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Appendix A: GeoPDF User Guide

Please tick the boxes next to the dataset titles in the map legend to display data. If data does not display, it means it is not present in that particular area.

Legend	Description	Reference
<u>Authority Information</u> <ul style="list-style-type: none"> Rugby Borough Boundary Watercourses 	<ul style="list-style-type: none"> Rugby Borough Boundary - the boundary of the Rugby Borough, the study area for this SFRA. Watercourses – the Environment Agency (EA) Detailed River Network representing the river network based on Ordnance Survey (OS) MasterMap for surface features and EA culvert surveys for underground features (where available). 	Section 1.5 SFRA study area Figure 1.1 Figure 1.4 Figure 1.5
<u>Historic</u> <ul style="list-style-type: none"> Historic Flood Map (EA) 	<ul style="list-style-type: none"> The EA Historic Flood Map shows areas of land that have been previously subject to fluvial flooding in the area. This includes flooding from rivers, the sea and groundwater springs but excludes surface water. <p>If an area is not covered by the Historic Flood Map, it does not mean that it has never flooded, only that currently there are no records of flooding in this area from the EA records. Other historic information is supplemented in the Level 1 report (section 5.1).</p>	Section 5.1 Historical Flooding Figure 5-1 Table 6.3 Appendix E
<u>Risk of Flooding from Surface Water (EA) (High Risk)</u> <ul style="list-style-type: none"> RoFSW 3.3% AEP RoFSW 1% AEP RoFSW 0.1% AEP 	<p>The EA’s Risk of Flooding from Surface Water (RoFfSW) flood maps give an indication of the broad areas likely to be at risk of surface water flooding. This includes flooding that takes place from the surface runoff generated by rainwater. The data includes the extent, velocity, depth and hazard mapping for each AEP event listed below.</p> <ul style="list-style-type: none"> 3.3% - each year the area has greater than a 1 in 30 chance of flooding 1% - each year the area has between a 1 in 100 and a 1 in 30 chance of flooding 0.1% - each year the area has greater than a 1 in 1000 chance of flooding 	Section 5.5 Surface water flood risk Appendix E
<u>Risk of Flooding from Rivers and Sea (EA)</u> <ul style="list-style-type: none"> Low Medium High 	<p>The Risk of Flooding from Rivers and Sea maps have been generated from the EA’s National Flood Risk Assessment (NaFRA) and National Receptor Dataset (NRD).</p> <ul style="list-style-type: none"> Low risk: each year there is a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) Medium risk: each year there is a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) High risk: each year there is a chance of flooding of greater than 1 in 30 (3.3%) 	Section 5.4 Fluvial flood risk Appendix E

Legend	Description	Reference
<p><u>Flood Zones</u></p> <ul style="list-style-type: none"> Flood Zone 3b Flood Zone 3a Flood Zone 2 	<p>The EA's Flood Map for Planning (FMFP) is an online mapping portal which shows the Flood Zones in England. They are formed from older national 2D generalised (broad-scale) modelling and updated periodically every year with detailed modelling outputs. In most places they should therefore reflect latest modelling where available. The Flood Zones are for use in development planning and flood risk assessments.</p> <ul style="list-style-type: none"> Flood Zone 3b – Functional Floodplain: This zone comprises land where water has to flow or be stored in times of flood. Flood Zone 3b is identified as land which would flood with an annual probability of 1 in 30 years (or 1 in 50, or 1 in 100 years), where detailed hydraulic modelling exists. Where the 1 in 30 year event is not available, the layer has been based on the larger, more conservative event outline. Flood Zone 3a – High probability: greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. (Excludes Flood Zone 3b, which is derived as part of the SFRA). Flood Zone 2 – Medium probability: between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year. This also includes the Historic Flood Map. 	<p>Section 3.2.1 Flood Zones – river risk</p> <p>Appendix B – for model details and relevant flood outlines</p>
<p><u>Climate Change Extent (Modelled)</u></p> <p>Fluvial:</p> <ul style="list-style-type: none"> Climate Change Central allowance <p>Surface Water</p> <ul style="list-style-type: none"> 3.3% AEP CC+25% 3.3% AEP CC+35% 1% AEP CC+25% 1% AEP CC+40% 	<p>These extents are from existing hydraulic models, where the 1% AEP (100-year flow) is upscaled by the EA's climate change allowances for the 2080s epoch for the relevant management catchment.</p> <p>Climate change modelled flood extents can be compared to the 100-year flood extent (Flood Zone 3a), and where no detailed modelling exists, compared against Flood Zone 2, for an indication of areas most sensitive to climate change. The models available for the Rivers within the Rugby area are within the Avon Warwickshire management catchment (see Table 4-1 of the main report for allowances). From the modelled outlines available, the following allowances have been included (note there are no modelled climate change outlines within the Higher Central and Upper End Categories).</p> <p>Central allowance:</p> <ul style="list-style-type: none"> River Swift 2019 – 1% AEP plus 20% CC River Avon 2010 – 1% AEP plus 20% CC <p>Surface Water Climate Change uplifts were modelled for this assessment for the following events and scenarios:</p> <ul style="list-style-type: none"> 3.3% AEP CC+25% 	<p>Section 4 Impact of Climate Change</p> <p>Appendix B</p>

Legend	Description	Reference
	<ul style="list-style-type: none"> 3.3% AEP CC+35% 1% AEP CC+25% 1% AEP CC+40% 	
<u>EA Flood Alert and Warning Areas</u> <ul style="list-style-type: none"> Flood Warning Flood Alert 	<ul style="list-style-type: none"> Flood Warnings are issued to designated Flood Warning Areas when a river level hits a certain threshold, heavy rainfall or high tides and strong winds are forecast. "Flooding is expected, immediate action is required". Flood Alerts are issued when there is water out of bank for the first time <i>anywhere in the catchment</i> and when forecasts indicate flooding may be possible. "Flooding is possible, be prepared". Both of these datasets are a polygon GIS shapefile where the above are issued; they are not flood extents. 	<p>Section 5.10 Flood Alert and Flood Warnings</p> <p>Appendix D Flood Alert and Flood Warnings</p>
<u>Groundwater Levels Emergence Mapping (JBA)</u> <ul style="list-style-type: none"> Less than 0.025m below surface Between 0.025-0.5m below surface Between 0.5-5m below surface At least 5m below surface No risk 	<p>JBA's Groundwater Flood emergence map shows the level of groundwater below the surface, at a resolution of 5m. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding, which may occur at sites other than those shown in the emergence mapping.</p>	<p>Section 5.7 Groundwater flooding</p> <p>Appendix E</p>
<u>Defences</u> <ul style="list-style-type: none"> Wall Embankment Natural High Ground Flood Gate 	<p>EA Asset Information Management System (AIMS) spatial Flood Defence dataset, shows flood defences currently owned, managed or inspected by the EA. A defence is any asset that provides flood defence or coastal protection functions.</p> <p>The main defences within the Rugby Borough Boundary are natural high ground, but there are also some embankments, walls and areas of engineered high ground.</p>	<p>Table 6-2 Locations shown in the 'EA AIMS' dataset</p> <p>Section 6.5 Existing and future flood alleviation schemes</p>

Appendix B - Data sources used in the SFRA

1 Historical Flooding

Warwickshire County Council provided records of flooding incidents in the area. These are presented in Table 5-1 of the Main Report. 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

The Environment Agency's Flood Map for Planning Flood Zones 2 and 3a shown in the Appendix A mapping.

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)

The following detailed models were available for use in this Level 1 SFRA:

- River Swift 2015 – 3.3% AEP (30 year)
- River Avon 2010 – 2% AEP (50 year)

Where detailed models were not available, a precautionary approach has been adopted for Flood Zone 3b with the conservative assumption that the extent of Flood Zone 3b is equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, 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

As there were no detailed models available for this Level 1 SFRA, Flood Zone 2 has been used as an indication of climate change.

Surface Water Climate Change uplifts were modelled for this assessment for the following events and scenarios:

- 3.3% AEP CC+25%
- 3.3% AEP CC+35%
- 1% AEP CC+25%
- 1% AEP CC+40%

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

4 Surface water flooding

Mapping of surface water flood risk in the study area has been taken primarily 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 1000 (0.1%) chance in any given year.
Low	Flooding occurring as a result of rainfall with a 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 site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to illustrate the flood risk more accurately at a site-specific scale. The 1 in 1000 surface water flood extent has been used to define surface water Zones "A" and "B" for the purpose of performing the Sequential Test.

5 Groundwater

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater Flooding 2010 (AStGWF) dataset and the JBA Groundwater Flood Risk map.

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.

The JBA Groundwater Flood Risk map shows groundwater flood risk on a 5m square grid. For each grid cell, a depth range is given for modelled groundwater levels in the 100-year return period flood event. It takes into account factors including topography, groundwater recharge volumes and spatial variations in aquifer storage and transmission properties.

Section 5.7 of the Main Report explains groundwater flooding.

6 Sewers

Severn Trent Water provided a list of recorded internal and external sewer flooding incidents from their Hydraulic Sewer Flooding Risk Register, last updated on the 5 September 2022.

This information is included in Table 5-2 of the Main Report.

7 Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within the Borough of Rugby has been mapped using the outlines produced as part of the National Reservoir Flood Mapping (RFM) study, and are shown online on the [Long-Term Risk of Flooding website](#) at the time of publication.

The Environment Agency provide two flooding scenarios for the reservoir flood maps: a 'dry-day' and a 'wet-day'. The 'dry-day' scenario shows the predicted flooding which would occur if the dam or reservoir fails when rivers are at normal levels. The 'wet-day' scenario shows the predicted worsening of the flooding which would be expected if a river is already experiencing an extreme natural flood.

Section 5.9 of the Main Report presents the reservoirs affecting the Rugby Borough.

8 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.

9 Overview of supplied data

Overview of supplied data for the Rugby 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	Environment Agency
	Historic flooding incident records	Warwickshire County Council,
Fluvial (including climate change)	Flood Map for Planning Flood Zones	Environment Agency
Surface Water	Risk of Flooding from Surface Water dataset	Environment Agency
Sewers	Internal and external historic drainage records	Severn Trent Water
Groundwater	Areas Susceptible to Groundwater Flooding dataset Bedrock geology/superficial deposits datasets (online dataset)	Environment Agency
	Groundwater Flood Risk Map	JBA
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	Warwick District Council Stratford on Avon District Council Coventry City Council Nuneaton and Bedworth Borough Council

<p>Other datasets</p>	<p>Partner Data Catalogue:</p> <ul style="list-style-type: none"> - Source Protection Zones - 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 	<p>Environment Agency (via Warwickshire County Council)</p>
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Source of Flooding	High Risk	Medium Risk	Low Risk	Present Day	Future
Fluvial	Greater than 1 in 100 year (FZ3)	Between 1 in 100 and 1 in 1000 year (FZ2)	Less than 1 in 1000 year	<p>EA's Flood Zones 1, 2 and 3 use a risk-based approach.</p> <p>Functional Floodplain (FZ3b) is displayed using the best available model data: 2015 River Swift ISIS-TUFLOW and 2010 River Avon ISIS-TUFLOW.</p> <p>Where model data is not available, Fluvial Floodzone 3a is used as a Proxy for FZ3b.</p>	<p>EA's Flood Zones 1, 2 and 3 use a risk-based approach.</p> <p>Climate change uplifts should be assessed as part of the screening process. Where significant parts of sites area's are shown to be at risk in the 1000 year (0.1%AEP), a review of whether the site is sequentially appropriate may be required following a Level 2 assessment. This may result in slightly larger numbers of sites requiring assessment at Level 2.</p> <p>Climate Change uplifts use the best available data:</p> <ul style="list-style-type: none"> - where climate change datasets are not available to define FZ3b, the 1% AEP event should be used. - where climate change datasets are not available to define FZ3a the 0.1% AEP event should be used. - No climate change datasets are available to define Low Risk into the future and the current 0.1% AEP event should be used, noting the comment above about re-screening following any Level 2 assessment.
Coastal	Greater than 1 in 200 year (FZ3)	Between 1 in 200 and 1 in 1000 year (FZ2)	Less than 1 in 1000 year	Not relevant for Warwickshire and Coventry Authorities.	Not relevant for Warwickshire and Coventry Authorities.
Surface Water	Greater than 1 in 1000 year (Zone A)		Less than 1 in 1000 year (Zone B)	<p>Different assumptions are used to derive surface water risk than is the case for fluvial and tidal flood zones. The RoFSW dataset potentially does not provide the confidence or certainty required to define areas of high medium and low flood risk that are comparable with the risk zones for river and sea flooding. Therefore, a precautionary approach should be taken so development is located in areas of low flood risk. This approach will require that sites where proposed development is located in a high risk surface water zone are assessed in more detail in the Level 2 SFRA.</p>	<p>Different assumptions are used to derive surface water risk than is the case for fluvial and tidal flood zones. The RoFSW dataset potentially does not provide the confidence or certainty required to define areas of high medium and low flood risk that are comparable with the risk zones for river and sea flooding. Therefore, a precautionary approach should be taken so development is located in areas of low flood risk. This approach will require that sites where proposed development is located in a high risk surface water zone are assessed in more detail in the Level 2 SFRA.</p> <p>Climate Change datasets exist for the following events and scenarios 3.3% AEP CC+25%; 3.3%AEP CC+35%; 1% AEP CC+25%; and 1% AEP CC+40%.</p> <p>Surface water flood risk into the future should be sequentially assessed using the maximum extent of either the existing 0.1% AEP dataset of the 1% AEP extent including 40% uplift for Climate Change.</p>

Source of Flooding	High Risk	Medium Risk	Low Risk	Present Day	Future
Groundwater	All sites assumed to be potentially susceptible to groundwater flooding			Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from groundwater. Therefore, a precautionary approach should be taken and all potential allocation sites will be assessed for groundwater flood risk in the Level 2 SFRA and the implications for sequential selection of alternative locations considered at this stage.	Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from groundwater. Therefore, a precautionary approach should be taken and all potential allocation sites will be assessed for groundwater flood risk in the Level 2 SFRA and the implications for sequential selection of alternative locations considered at this stage.
Sewer	All sites assumed to be at high risk of sewer flooding. Additional information required via the Level 2 assessment			Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from sewers. Therefore, a precautionary approach should be taken and all potential allocation sites will be assessed for sewer flood risk via the Level 2 SFRA where data is available and the implications for sequential selection of alternative locations considered at this stage.	Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from sewers. Therefore, a precautionary approach should be taken and all potential allocation sites will be assessed for sewer flood risk via the Level 2 SFRA where data is available and the implications for sequential selection of alternative locations considered at this stage.
Reservoir	Sites where reservoir flooding is predicted to make fluvial flooding worse for development in high hazard zone to be assessed in a Level 2 SFRA.			Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from reservoirs. In addition, the reservoir flood map identifies the consequence of a reservoir breach rather than risk, so applying high, medium and low 'risk' is not possible using this dataset. Therefore, a precautionary approach should be taken and sites where reservoir flooding is predicted to make fluvial flooding worse for development or where development is proposed in a high hazard zone will be assessed in Level 2 SFRA and the implications for sequential selection of alternative locations considered at that stage.	Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from reservoirs. In addition, the reservoir flood map identifies the consequence of a reservoir breach rather than risk, so applying high, medium and low 'risk' is not possible using this dataset. Therefore, a precautionary approach should be taken and sites where reservoir flooding is predicted to make fluvial flooding worse for development or where development is proposed in a high hazard zone will be assessed in Level 2 SFRA and the implications for sequential selection of alternative locations considered at that stage.

Appendix D - Flood Alert and Flood Warnings

1.1 Flood Alert Areas

Flood Alert Code	Flood Alert Name	Watercourse/s	Coverage
033WAF201	Upper Avon River Swift and Clay Coton Brook	River Avon, River Swift, Clay Coton Brook	Low-lying land and roads between Stanford and Rugby including Lilbourne and Clay Coton areas
033WAF202	River Sowe, River Sherbourne, Canley Brook and Finham Brook	River Sowe, Rivre Sherbourne, Canley Brook	Low-lying land and roads between Bedworth and Baginton on the River Sowe, between Allesley and Whitley on the River Sherbourne, between Tile Hill and Canley on the Canley Brook and the Finham Brook and its tributaries
033WAF203	River Leam and River Itchen	River Leam, River Itchen	Low-lying land and roads between Grandborough and Leamington, including Long Itchington
033WAF204	Middle Avon Rugby to Bidford	River Avon, St Johns Brook, Fishers Brook	Low-lying land and roads between Rugby and Bidford including caravan parks and farmland
033WAF307	River Anker and River Sence	River Anker, River Sence	Low-lying land and roads between Nuneaton and Tamworth on the River Anker and between Temple Mill and Ratcliffe Culey on the River Sence

1.2 Flood Warning Areas

Flood Warning Code	Flood Warning Name	Watercourse/s	Coverage
033WAF201	River Swift at Rugby	River Swift	River Swift at Rugby, including Brownsover Road, Swift Park and Leicester Road Retail Park
033WAF204	River Avon at Little Lawford and Newnham Grounds	River Avon	River Avon at Little Lawford and Newnham Grounds including Little Lawford Lane
033WAF204	River Avon at Marston and Wolston	River Avon	River Avon at Marston and Wolston including Priors Road in Marston and Hawthorne Close, St Margarets Avenue, Bluemells Drive and Main Street in Wolston
033WAF203	River Leam at Marton	River Leam	River Leam at Marton including Coventry Road, North Street and Birdingbury Road
033WAF201	River Avon at Rugby and Newbold on Avon	River Avon	River Avon at Rugby and Newbold on Avon including Aqua Place, Boughton Road and Kinman Way area, Junction One Retail Park area, Fosterd Road and Newbold Road in Rugby and Grange Road, Newbold Road, Main Street and Parkfield Road in Newbold on Avon
033WAF203	River Leam at Grandborough and Kites Hardwick	River Leam	River Leam at Grandborough and Kites Hardwick including Hill Road, Sawbridge Road and Main Street in Grandborough and Southam Road in Kites Hardwick
033WAF204	River Avon at Bretford	River Avon	River Avon at Bretford

Appendix E – Summary of flood risk in Rugby Borough

The table below summarises the areas where there are notable flood risks within Rugby Borough.

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25 %	>=25% <50%	>=50% <75%	>=75 %		
River Anker (Wolvey and Bramcote)	<p>The River Anker rises to the southeast of Wolvey and flows in a north westerly direction before leaving the area along the western boundary. It is joined by several tributaries within the area including Harrow Brook.</p> <p>The River Anker flows in a westerly direction through the north end of Wolvey where the flood risk is limited to Church/Temple Hill (B4109). The River Anker continues in a westerly direction towards Makin Fisheries, where it is joined by an unnamed tributary from the south. The floodplain of this unnamed watercourse is rural with flood risk limited to the B4109 where it crosses this road.</p> <p>The River Anker then continues in a north westerly direction, crossing the M69, the B4114 and the Ashby Canal. The River Anker then continues in a northerly direction along the western boundary of the study area, crossing Mill Lane where there are a small number of isolated buildings at flood risk. The area remains rural as the River Anker flows along the boundary with no further roads or properties at risk before it leaves the area.</p> <p>Harrow Brook flows in a southerly direction along the western boundary of the study area before joining the River Anker just outside the study area to the west. The floodplain of Harrow Brook remains rural with no roads or properties shown to be at flood risk within the area.</p> <p>Sketchley Brook enters the area in the northeast and flows in a south westerly direction towards its confluence with Harrow Brook. The floodplain of Sketchley Brook remains rural with no roads or properties shown to be at flood risk within the area.</p> <p>There is a small unnamed watercourse in the east of the area which rises to the north of Copston Magna and flows in a north easterly direction to leave the area. The floodplain of this watercourse is rural with no roads or properties shown to be at flood risk within the area.</p>	<p>The EA AIMS dataset shows the following defences:</p> <ul style="list-style-type: none"> • High ground along both sides of Harrow Brook along the west side of the study area. • High ground along both sides of Sketchley Brook from where it enters the study area until its confluence with Harrow Brook. • High ground along both sides of the River Anker where it flows along the boundary of the study area in the northwest of the area. 	<p>Surface water in the area follows the topography, predominantly flowing downhill from the higher areas in the south following the path of the River Anker and its tributaries and the roads in the area.</p> <p>The area is predominantly rural with relatively few assets at flood risk; however, there are also a small number of built-up areas where there is a flood risk to properties and infrastructure including:</p> <ul style="list-style-type: none"> • Burton Hastings – there is a low to high risk flow path along Burton Lane with a couple of properties impacted by the flood risk. There is also an area of low to medium ponding affecting a building in the west of the settlement. • Bramcote – there are several low to high risk flow paths following the roads through the settlement with a small number of properties at risk along Aldemey Close and Hereford Road. There are also a number of isolated areas of ponding affecting properties across the settlement. • Wolvey – there is a low to high risk flow path which flows through the north end of the settlement following the path of the River Anker with a few properties in the north end of the settlement shown to be at flood risk including along Hall Road, Wolvey Hall Farm Close and School Lane. • Wolvey Heath – there is low risk along Leicester Road with a couple of properties to the west of the road at flood risk. There are also a couple of areas of low to high risk ponding but these are not shown to affect any properties in the area. • Copston Magna – there is a low to high risk flow path which flows in a northerly direction through the settlement following the path of an unnamed watercourse with a small number of properties shown to be at flood risk. 	✓	✓	✓		<ul style="list-style-type: none"> • Makin Fisheries Lake No.1, located in the centre of the area to the west of Wolvey – the flood extent follows the path of the River Anker downstream until it leaves the area. It also extends slightly upstream along Harrow Brook from its confluence with the River Anker just outside the study area. In the ‘Wet Day’ scenario the flood outline is wider and extends further upstream along Harrow Brook and its tributary Sketchley Brook and also extends upstream a short way along the River Anker. 	The EA’s Recorded Flood Outlines Shapefile shows no records of flooding within the area.
Smite Brook (Monks Kirby and Stretton under Fosse)	<p>Smite Brook rises in the east of the area and then flows west to join Coombe Pool. It then continues west from Coombe Pool to leave the area under the A46. Smite Brook then joins the River Sowe to the west of the study area. There are also several unnamed watercourses which rise in the higher land in the north of the area and then flow</p>	<p>The EA AIMS dataset shows the following defences:</p> <ul style="list-style-type: none"> • High ground along both sides of the unnamed watercourse 	<p>Surface water in the area follows the topography, predominantly flowing downhill from the higher areas in the north and east following the path of Smite Brook and the other unnamed tributaries in the area.</p>	✓	✓	✓	✓	<ul style="list-style-type: none"> • Coombe Pool, located in the southwest of the area – the flood outline extends along the short stretch of Smite Brook downstream of Coombe Pool until it leaves the 	The EA’s Recorded Flood Outlines Shapefile shows no records of flooding within the area.

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25 %	>=25% <50%	>=50% <75%	>=75 %		
	<p>in a southerly/south westerly direction to leave the area.</p> <p>The floodplain of Smite Brook is rural until it flows to the south of Monks Kirby. Here there is an unnamed watercourse which flows in a southerly direction through the settlement to join Smite Brook and there are several properties at flood risk along Brockhurst Lane, Smite Close and Bell Lane.</p> <p>Smite Brook then flows in a southerly direction, crossing the B4428 and the M6 and flowing to the west of the Prison Service College Newbold Revel where there are a number of buildings on the western side of the site shown to be at flood risk.</p> <p>Smite Brook then continues in a westerly direction flowing to the north of Brinklow. Flood risk here is limited to local roads, isolated buildings and a sewage treatment works. Smite Brook then continues in a westerly direction, flowing through Coombe Country Park where it joins Coombe Pool. To the west of Coombe Pool, Smite Brook is joined by an unnamed watercourse from the south before flowing under the A46 to leave the study area. This area is relatively rural with flood risk restricted to a local road and the Country Park. Along the unnamed tributary, flood risk is limited to the B4428.</p> <p>To the north of Smite Brook there is an unnamed watercourse that originates in the fields to the northeast of Withybrook before flowing in a south westerly direction through the area. The floodplain of this watercourse is mainly rural with flood risk restricted to local roads and isolated properties but there are a number of properties at flood risk along Main Street, Bow Lane and All Saints Close where the watercourse flows through the south end of Withybrook.</p> <p>There is also a small area of flood risk affecting the A46 by its junction with the M6 and M69 where there is a second unnamed watercourse flowing in a southerly direction out of the area.</p> <p>In the east side of the area there is an additional unnamed watercourse which flows in an easterly direction out of the area to the north of Willey, however this is not shown to result in flood risk to any roads or properties in the area.</p>	<p>flowing west from the B4029 through to the A46 where it leaves the area.</p>	<p>The area is predominantly rural with relatively few assets at flood risk; however, there are also a small number of built-up areas where there is a flood risk to properties and infrastructure including:</p> <ul style="list-style-type: none"> Barnacle – there is a low to high risk flow path which flows in a north easterly direction through the east of the settlement with a couple of properties shown to be at flood risk. There are also a number of smaller flow paths and isolated areas of ponding affecting a small number of properties across the settlement. Shilton – there are areas of low to high risk affecting a number of properties along Hallway Drive in the northwest of the settlement. There are also a couple of low to high risk flow paths following the railway and main road through the settlement with a small number of properties shown to be at flood risk. Ansty – there is a low to high risk flow path flowing in a southerly direction to the west of the area with a couple of properties shown to be at a low risk of flooding. Ansty Park and Rolls Royce – there are several areas of low to high risk ponding across Ansty Park and the Rolls Royce site with a small number of buildings surrounded by flood risk. Withybrook – there is a low to high risk flow path flowing in a westerly direction through the south of the settlement following the path of an unnamed watercourse with several properties shown to be at flood risk along Main Street, All Saints Close and Bow Lane. There are also two flow paths which flow south along the main roads in the settlement to join this main flow path but these remain mainly confined to the roads. Wibtoft – there are some low to medium risk flow paths flowing in a north easterly direction through Wibtoft and out of the study area with a small number of properties at risk of flooding. Willey – there is a low to high risk flow path which flows in a northerly direction to the west of the settlement with a couple of properties in the northwest of the area shown to be at flood risk. Monks Kirby – there are two low to high risk flow paths following Smite Brook from the east and its unnamed tributary from the north which converge in the centre of the settlement with several properties at flood risk along Brockhurst Lane, Smite Close, Miller’s Lane and Belt Lane. Pailton – there is a low to high risk flow path which flows in a northerly direction through the settlement with several properties shown to be at flood risk along Lutterworth Road, St Denis View, Foxfield, Rugby Road and Home Farm Close. 				<p>area and also extends upstream along an unnamed tributary of Smite Brook to the south. The flood extent is much wider in the ‘Wet Day’ scenario, extends further upstream along the unnamed tributary and also affects the A46 where Smite Brook crosses it.</p>		

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25 %	>=25% <50%	>=50% <75%	>=75 %		
River Avon through Rugby Town	<p>The fluvial risk in Rugby comes from the River Avon, which flows in a westerly direction through the town, and its main tributaries, including the River Swift, Clifton Brook and Sow Brook.</p> <p>The River Avon enters the area in the east and flows in a westerly direction where it is joined by an unnamed watercourse from the north. Flood risk along this unnamed watercourse is restricted to local roads, the M6 and a couple of isolated properties. The flood extent around the confluence is wide reaching, particularly for the Flood Zone 2 extent, but flood risk is limited to local roads and isolated properties.</p> <p>To the west of this confluence, the River Avon flows along the southeast boundary of Brownsover. Flood Zone 2 extends further west than Flood Zone 3 with several properties at flood risk along the side roads coming off Staveley Way to the east. The River Avon then crosses the Oxford Canal where it is joined by Clifton Brook from the south.</p> <p>Clifton Brook enters the area in the east and is also joined by an unnamed watercourse from the south a short distance into the area. The flood extent is wide reaching at this confluence but the flood risk is limited to local roads and isolated buildings. Clifton Brook continues in a westerly direction and flows to the north end of Hillmorton where there are a couple of properties at flood risk. Clifton Brook then flows in a north westerly direction towards the River Avon. There is flood risk to the railway line, several roads and a number of properties along Clifton Road, Butler's Leap and Cottage Leap before Clifton Brook joins the River Avon.</p> <p>At the confluence of Clifton Brook and the River Avon the flood extent is far reaching, covering Boughton Road Recreation Ground to the south with several properties at flood risk both north and south of the watercourse.</p> <p>As the River Avon continues to flow in a westerly direction through Rugby there are a large number of roads and buildings at flood risk, both to the north and south of the River, particularly in Flood Zone 2 which shows a wider flood extent than Flood Zone 3 particularly in the centre of the town.</p> <p>To the north of the Junction One Retail Park is the confluence of the River Avon and the River Swift. The River Swift enters the area in the east and flows in a southerly direction to join the River Avon. The floodplain of the River Swift is mostly</p>	<p>The EA AIMS dataset shows the following defences:</p> <ul style="list-style-type: none"> • High ground along both sides of the River Swift from where it enters the area until it joins the River Avon. • An embankment along both sides of the River Swift between Brownsover Road and the Oxford Canal. • High ground along both sides of the River Avon. • High ground along both sides of Clifton Brook from where it enters the area until it joins the River Avon. • High ground and an embankment around the south end of Boughton Road Recreation Ground. • High ground along both sides of Sow Brook from where it passes under Overslade Lane until it joins the River Avon. • High ground along both sides of an unnamed tributary of the Sow Brook from where it passes under Barby Road until it joins Sow Brook. • A flood wall and embankment around the Sports Pavilion off Parkfield Road, Newbold on Avon. • A flood wall and embankment in Newbold on Avon along the south side of Main Street from Grange Road 	<p>Surface water in the area follows the topography, flowing downhill mainly following the path of the main watercourses and their tributaries and the roads in the area. The area is mostly urban, covering the town of Rugby and as such there are a number of roads and properties throughout the area that are at a risk of surface water flooding.</p> <p>In general, a lot of the areas of surface water risk correlate with those of fluvial risk, however, there are additional flow paths flowing downhill towards the main watercourses alongside flow paths following roads in the area and isolated areas of surface water ponding. Some key areas of additional flood risk affecting properties in the area include:</p> <ul style="list-style-type: none"> • Houlton – there is a low to high risk flow path which flows through the centre of Houlton towards Clifton Brook with flood risk to several properties including along St Gabriel's Way, Hughes Drive, Maxwell Road, Maine Street, Muirhead Rise, Wroughton Drive and Tolsford Road. • Hillmorton – there is a low to high risk flow path flowing in a north easterly direction through the west side of Hillmorton towards Clifton Brook with flood risk to a number of properties including along Tenant Close, Shenstone Avenue, Kingsley Avenue, Edgecote Close, Vere Road, Eden Road and Lower Hillmorton Road. There is also a low to high risk flow path flowing in a north easterly direction through the east side of Hillmorton, with a large area of surface water risk building up behind the railway line with properties at flood risk along Waverley Road, Pine Grove, Brindley Road, Gainsborough Crescent, Constable Road and School Street. • Clifton-upon-Dunsmore – there are a number of low to high risk flow paths throughout the settlement, mainly remaining confined to the roads but there is some flood risk to properties particularly along South Road, Lilbourne Road, Rugby Road and North Road. • Overslade – there are a number of low to high risk flow paths in the south of Overslade flowing in a northerly direction towards Sow Brook with flood risk to several properties including along Norton Leys, Sheridan Close, Dunchurch Road, Shakespeare Gardens, Boswell Road, Rupert Brooke Road, Edyvean Close, Bawnmore Road and Cordelia Way. • Long Lawford – there is a low to high risk flow path which flows in a northerly direction through the centre of Long Lawford towards the River Avon with several properties at flood risk including along Back Lane, Teeswater Close, Townsend Lane, Greenwood Close, Boyce Way, Round Avenue and Hirst Close. 	✓	✓	✓	✓	<ul style="list-style-type: none"> • Naseby Reservoir, located to the east of the study area – the flood extent follows the path of the River Avon along its entire length through the area. In the 'Wet Day' scenario the flood extent is wider and extends further upstream along several tributaries of the River Avon, including the River Swift and Clifton Brook. • Stanford Reservoir, located to the east of the study area - the flood extent follows the path of the River Avon along its entire length through the area. In the 'Wet Day' scenario the flood extent is wider and extends further upstream along several tributaries of the River Avon, including the River Swift and Clifton Brook. • Sulby Reservoir, located to the east of the study area - the flood extent follows the path of the River Avon along its entire length through the area. In the 'Wet Day' scenario the flood extent is wider and extends further upstream along several tributaries of the River Avon, including the River Swift and Clifton Brook. • Welford Reservoir, located to the east of the study area – the flood extent follows the path of the River Avon along its entire length through the area. In the 'Wet Day' scenario the flood extent is wider and extends upstream along several tributaries of the River Avon, including 	<p>From the EA's Recorded Flood Outlines:</p> <ul style="list-style-type: none"> • January 1985 – fluvial flooding due to channel capacity exceedance along both sides of the River Avon and along both sides of the River Swift from Church Street in the north through to Brownsover Road in the south. • September 1992 – fluvial flooding due to channel capacity exceedance along both sides of the River Avon from where it enters the area through to Newton Road, along sections of Clifton Brook between where it crosses Houlton Road and Clifton Road, along Clifton Brook just upstream of its confluence with the River Avon and along several sections of the River Swift. • April 1998 – fluvial flooding due to channel capacity exceedance along both sides of the River Avon from Newbold on

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25 %	>=25% <50%	>=50% <75%	>=75 %		
	<p>rural however there are a number of buildings in the east side of the Swift Valley Industrial Estate and the Glebe Farm Industrial Estate that are at flood risk before the River Swift crosses the Oxford Canal and joins the River Avon.</p> <p>To the west of the main urban area of Rugby, the River Avon is joined by Sow Brook from the south. Sow Brook emerges from a culvert by Overslade Lane and then flows in a northerly direction through Overslade and to the west of New Bilton to join the River Avon. There are several properties at flood risk along its course including along Deepmore Road, Lytham Road, May Lane, Gilbert Avenue, Addison Road, Keyes Drive and Lawford Road. There is also an unnamed tributary of Sow Brook which flows in a westerly direction from Barby Road to join Sow Brook by Bilton Road, with flood risk to several properties including along Hibbert Close, Westfield Road, Burnside, Bilton Road, Stourhead Road and Prior Park Road.</p> <p>The River Avon then continues in a westerly direction until it leaves the area with the floodplain being relatively rural in this area and the areas at flood risk are confined to local roads and a small number of properties to the south of Little Lawford. There are also a couple of unnamed tributaries which join the River Avon in this area. One watercourse flows in a northerly direction through the west side of Long Lawford to join the River Avon, with a few properties in the west of Long Lawford at flood risk along South View Road, Livingstone Avenue and Green Close. There is also an unnamed watercourse which flows south to join the River Avon but the flood risk along this watercourse is restricted to the B4412 and Little Lawford Road.</p>	<p>in the south to the Co-op supermarket in the north.</p>	<ul style="list-style-type: none"> Swift Valley Industrial Estate – there are several areas of low to high risk surrounding buildings throughout the industrial estate. Brownsover – there is a large low to high risk flow path flowing through the Brownsover area in a south easterly direction towards the River Avon with flood risk to several properties including along Cornflower Drive, Thistle Way, Maidenhair Drive, Orchid Way, Champion Way, Lavender Close, Brookline Drive and Grendon Drive. Central Rugby, south of the railway line – there are several low to high risk flow paths which flow in a northerly direction following the roads through the centre of Rugby to build up along the railway line. Most of these flows remain confined to the roads but there are some properties at flood risk including along Railway Terrace, Acacia Grove, Wood Street, The Sidings, Abbey Street, Hunter Street, Clifton Road, Cambridge Street and Winfield Street. 					<p>the River Swift and Clifton Brook.</p>	<p>Avon until it leaves the area.</p> <ul style="list-style-type: none"> January 2001 – fluvial flooding along several sections of the River Avon, particularly around its confluence with Clifton Brook and where it crosses Newton Road. Also, flooding due to drainage issues along Clifton Brook between its railway crossing and Clifton Road, by the River Swift at Swift Park and by the River Avon at Fosterd Road.
<p>River Avon downstream of Rugby Town (Bingley Woods, Wolston and Ryton-on-Dunsmore)</p>	<p>The main fluvial risk in this area comes from the River Avon which enters the area in the east, south of Little Lawford, and flows in a westerly direction through the area until it reaches Tolbar End where it then turns and flows south a short way along the western boundary before leaving the area. The River Avon is also joined by a number of tributaries throughout the area.</p> <p>Where the River Avon enters the area in the east there are a couple of properties located in Flood Zone 2 to the west of Little Lawford which extends further than Flood Zone 3 in this area. The River Avon then flows in a westerly direction with the floodplain remaining rural until it flows to the north of Church Lawford where Flood Zone 2 extends further south than Flood Zone 3 and encroaches on a couple of properties in the north end of the settlement. To the northwest of</p>	<p>The EA AIMS dataset shows the following defences:</p> <ul style="list-style-type: none"> High ground along both sides of the River Avon. High ground along both sides of the unnamed watercourse flowing in a northerly direction through Wolston from Brook Street in the south until it joins the River Avon in the north. 	<p>Surface water in the area follows the topography, predominantly flowing downhill from the higher areas in the north and southeast following the path of the River Avon and its tributaries and the roads in the area.</p> <p>The area is predominantly rural with relatively few assets at flood risk; however, there are also a small number of built-up areas where there is a flood risk to properties and infrastructure including:</p> <ul style="list-style-type: none"> Brinklow – there are low to medium risk flow paths along several roads in the south of the settlement with a small number of properties at flood risk along Heath Lane, Dun Cow Close and Rugby Road. Kings Newnham – there are two low to high risk flow paths flowing in a southerly direction through the settlement towards the River Avon 	✓	✓	✓	✓	<ul style="list-style-type: none"> Brinklow Marina, located in the northeast of the area – the flood extent flows from the Marina in a south westerly direction to join the River Avon between Church Lawford and Bretford. The flood extent then follows the path of the River upstream to the north of Church Lawford and downstream until it reaches the A423. In the 'Wet Day' scenario the flood outline is wider and extends upstream 	<p>From the EA's Recorded Flood Outlines Shapefile:</p> <ul style="list-style-type: none"> January 1985 – fluvial flooding due to channel capacity exceedance along both sides of the River Avon throughout the area. September 1992 – fluvial flooding due to channel capacity

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25 %	>=25% <50%	>=50% <75%	>=75 %		
	<p>Church Lawford the River Avon is joined by an unnamed watercourse from the north. The flood risk along this unnamed watercourse is confined to local roads.</p> <p>Following this confluence, the River Avon then continues to flow in a westerly direction towards Bretford where it is joined by a second unnamed watercourse from the north. As this watercourse flows south through Bretford there are a small number of properties at flood risk.</p> <p>As this unnamed watercourse joins the River Avon in the south of Bretford there are several properties located in Flood Zone 2 along the A428, where Flood Zone 2 extends further north than Flood Zone 3. To the west of Bretford the River Avon is joined by a further unnamed watercourse from the south, however the flood risk along this watercourse is limited to the B4455 and a local road.</p> <p>The River Avon then continues in a westerly direction through the north of Wolston where there are a small number of properties located in Flood Zone 3 and several further properties located in Flood Zone 2, which extends further south, including along Main Street, St Bluemels Drive, St Margaret's Avenue and Hawthorne Close.</p> <p>In the west side of Wolston, the River Avon is joined by an unnamed watercourse from the south. This watercourse rises in the south of the area and flows in a northerly direction with flood risk restricted to the B4455 until the watercourse reaches Wolston where there are several properties at flood risk including along Brook Street, Derry Close and Main Street before the watercourse joins the River Avon.</p> <p>To the west of Wolston, the River Avon continues to flow in a westerly direction. The Flood Zones show wide flood extents, but the floodplain remains mostly rural with flood risk limited to local roads, a golf course and a sewage treatment works. As the River Avon flows to the north of Ryton-on-Dunsmore, Flood Zone 2 extends slightly further south than Flood Zone 3 and encroaches on a couple of properties in the north of the settlement.</p> <p>The River Avon then continues in a westerly direction with flood risk limited to local roads, a couple of isolated properties and the A423/A45 until it reaches the western boundary of the study area. The River Avon then turns and flows in a southerly direction along the western boundary of</p>		<p>with a small number of buildings in the east of the settlement shown to be at flood risk.</p> <ul style="list-style-type: none"> • Church Lawford – there are a number of small flow paths and areas of ponding across the settlement. Most of the flood risk remains confined to the roads with only a small number of properties at flood risk. There is also a low to high risk flow path which flows to the west of the settlement in an northerly direction towards the River Avon. This flow path encroaches on a couple of properties along King's Newnham View in the north of the settlement. • Bretford – there are several flow paths which follow the roads in the area, generally flowing in a southerly direction towards the River Avon. These remain mainly confined to the roads but there are a couple of properties at flood risk along Fosse Way. There is also a large low to high risk flow path which flows in a southerly direction through the east of the settlement following the path of an unnamed watercourse, which encroaches on a property on King's Newnham Lane. • Wolston – there is a low to high risk flow path which flows in a westerly direction through the north of the settlement following the path of the River Avon. There are also several flow paths which flow in a northerly direction through the settlement towards the River Avon and additional isolated areas of ponding. There are several properties at flood risk across the settlement including along Manor Estate, Brook Street, Main Street, School Street, Meadow Road and Hawthorne Close. • Binley Woods – there is a low to high risk flow path flowing in a south westerly direction in the south of the area with several properties at flood risk along Ferndale Road, Saxon Close, Foxwood Drive, Craven Avenue, Court Leet and Woodlands Road. There is also a low to high risk flow path flowing in a westerly direction towards the Coventry Eastern Bypass (A46) with flood risk to several properties along Heather Road, Monks Road, Elm Close and Norman Ashman Coppice. There are also several further properties at flood risk from areas of ponding across the settlement. • Brandon – there is a low to high risk flow path flowing in a south westerly direction along Rugby Road and Avondale Road. This flow path mainly remains confined to the roads but there are a small number of properties at flood risk. • Ryton-on-Dunsmore – there is a low to high risk flow path which flows in a northerly direction through the east of the settlement towards the River Avon with several properties at flood risk including along Cedar Avenue, Holly Drive, Poplar Grove and Leamington Road. There are 				<p>as far as the east side of Church Lawford.</p> <ul style="list-style-type: none"> • Naseby Reservoir, located to the east of the study area – the flood extent follows the path of the River Avon along its entire length through the area, with a wider flood extent during the 'Wet Day' scenario. • Sulby Reservoir, located to the east of the study area - the flood extent follows the path of the River Avon along its entire length through the area, with a wider flood extent during the 'Wet Day' scenario. • Stanford Reservoir, located to the east of the study area - the flood extent follows the path of the River Avon along its entire length through the area, with a wider flood extent during the 'Wet Day' scenario. • Welford Reservoir, located to the east of the study area – the flood extent follows the path of the River Avon downstream as far as Bretford. In the 'Wet Day' scenario the flood extent is wider and follows the River Avon along its entire length through the area. 	<p>exceedance along the River Avon to the east of Church Lawford and to the south of Bretford.</p> <ul style="list-style-type: none"> • April 1998 - fluvial flooding due to channel capacity exceedance along both sides of the River Avon throughout the area. 	

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	the study area before leaving the area to the southeast of Coventry Airport. The floodplain remains rural in this area with only one isolated building by the A45 shown to be at flood risk.		also several further small flow paths and areas of ponding causing flood risk to further properties across the settlement.						
River Leam (Dunchurch, Thurlaston and Stretton, Dunsmore and Marton)	<p>The River Leam flows in a northerly direction along the eastern boundary of the study area before flowing in a westerly direction through the area. The River Leam has several tributaries within the area, including Rains Brook, Millholme Brook and the River Itchen.</p> <p>The floodplain of the River Leam is rural where it enters the study area in the east, and flood risk is limited to local roads and isolated farm buildings until it is joined by an unnamed watercourse between Sawbridge and Grandborough. This unnamed watercourse flows in a westerly direction through Willoughby before joining the River Leam, where there are several properties along Main Street, Lower Street, White Barn Close and College Road located at flood risk.</p> <p>Following its confluence with the unnamed watercourse, the River Leam continues in a westerly direction flowing through the northeast side of Grandborough where there are a small number of properties located in Flood Zone 3 and several further properties located in Flood Zone 2 which shows a greater extent to the south of the River Leam.</p> <p>To the north of Grandborough, the River Leam is joined by Rains Brook. The flood zones extend over a wide floodplain in this area, particularly to the west of the watercourse, but the floodplain is rural with no roads or properties shown to be at flood risk. Rains Brook enters the area in the east and flows in a south westerly direction to join the River Leam. The flood extent remains confined to a relatively narrow floodplain along Rains Brook and the area is mostly rural, with flood risk limited to local roads and small sections of the M45 and A45 where the watercourse crosses these roads.</p> <p>From its confluence with Rains Brook, the River Leam continues in a westerly direction and flows through Kites Hardwick where there are a small number of properties located in Flood Zone 3 and considerably more properties located in Flood Zone 2 which shows a much greater flood extent to the south of the watercourse. To the east of Kites Hardwick the River Leam is joined by Millholme Brook from the south.</p> <p>Millholme Brook enters the area in the south and flows in a north westerly direction to join the River Leam. It is joined by a couple of small unnamed tributaries from the west. The floodplains of</p>	<p>The EA AIMS dataset shows the following defences:</p> <ul style="list-style-type: none"> • High ground along the south side of the River Leam from Grandborough through to Kites Hardwick. • High ground along both sides of the River Leam from Kites Hardwick through to where the watercourse leaves the study area north of Eathorpe. • High ground along both sides of Millholme Brook from where it crosses Grandborough Fields Road through to its confluence with the River Leam. • High ground along both sides of the unnamed watercourse which flows from the south of Birdingbury until its confluence with the River Leam. • High ground along the River Itchen where it flows along the western boundary of the study area. 	<p>Surface water in the area follows the topography, predominantly flowing downhill from the higher areas in the north and east mainly following the path of the River Leam and its tributaries and the roads in the area.</p> <p>The area is predominantly rural with relatively few assets at flood risk; however, there are also a number of built-up areas where there is a flood risk to properties and infrastructure including:</p> <ul style="list-style-type: none"> • Stretton on Dunsmore – there are several low to high risk flow paths following the main roads through the settlement towards the unnamed tributary of the River Leam which flows to the south. There are several properties at flood risk particularly around the junction of Plott Lane and Brookside. • Princethorpe – there is a low to high risk flow path which flows in a southerly direction through the west of the settlement following the path of an unnamed tributary of the River Leam with several properties along Leamington Road located at flood risk. There are further flow paths which flow in a westerly direction through the settlement to join the main flow path, with additional properties shown to be at risk. • Marton – there is a low to high risk flow path which follows the A423 in a northerly direction through the settlement towards the River Leam and a low to high risk flow path which flows west along North Street towards the River Itchen. The flood risk is shown to be mainly confined to the roads within this settlement. • Birdingbury – there are several low to high risk flow paths which flow in a north easterly direction towards the River Leam with several properties at flood risk particularly along Main Street and Back Lane. • Draycote – there are several low to high risk flow paths which flow through Draycote before converging to the south of the settlement, with several properties at flood risk. • Leamington Hastings – there is a low to high risk flow path flowing in a northerly direction to the east of the settlement towards the River Leam with flood risk along Birdingbury Road. There are also a few properties at a low risk of flooding in the north of the settlement. • Dunchurch – there is a low to high risk flow path which flows in a southerly direction through the west side of the settlement before pooling to the north of the M45 with several properties at flood risk including along Brook View, Done Cerce Close, Sandford Way and 	✓	✓	✓	✓	<ul style="list-style-type: none"> • Daventry Reservoir, east of the study area – only impacts the area during the 'Wet Day' scenario where the flood outline extends along a small section of the eastern boundary of the study area following the path of the River Leam. • Draycote Water, in the centre of the area – the flood extents show similar outlines for both the 'Dry Day' and 'Wet Day' scenarios following the path of the River Leam and its tributaries Millholme Brook and Rains Brook upstream and following the path of the River Leam downstream, extending upstream along its main tributaries. There are also large areas of risk in the immediate vicinity of the reservoir, impacting the settlement of Draycote to the west. • Drayton Reservoir, east of the study area – the flood outline extends along a small section of the eastern boundary of the study area following the path of the River Leam. • Napton Reservoir, south of the study area – there is a small area of flood risk along the southern boundary of the area north of where the reservoir lies just outside the study area boundary with this flood risk only impacting Calcutt Marina. The flood extent also follows the 	<p>From the EA's Recorded Flood Outlines Shapefile:</p> <ul style="list-style-type: none"> • March 1981 – fluvial flooding along the River Leam to the north of Marton and along the boundary of the study area to the north of Eathorpe. • January 1985 – fluvial flooding due to channel capacity exceedance along both sides of the River Leam from Grandborough until the watercourse leaves the study area north of Eathorpe and along the River Itchen where it flows along the western boundary of the study area. • April 1998 – fluvial flooding due to channel capacity exceedance in Willoughby, Princethorpe and Draycote.

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25 %	>=25% <50%	>=50% <75%	>=75 %		
	<p>Millholme Brook and its tributaries are rural and flood risk is limited to local roads, the A426 and an isolated building.</p> <p>The River Leam continues in a westerly direction and the floodplain remains rural until it reaches Birdingbury, where the flood extent reaches the northeast side of the settlement, but no properties are shown to be at flood risk. To the east of Birdingbury there is an unnamed watercourse which joins the River Leam from the south but flood risk from this watercourse is limited to a small section of Birdingbury Road.</p> <p>To the north of Birdingbury there is an unnamed watercourse which flows in a south westerly direction from Draycote Water to join the River Leam. This watercourse flows through the settlement of Draycote where there are a small number of properties located in Flood Zone 3 with several further properties located in Flood Zone 2 which extends considerably further.</p> <p>To the west of Birdingbury the flood risk from the River Leam is confined to local roads until it reaches the settlement of Marton. There are a small number of properties located in Flood Zone 3 in the north of the settlement with a considerable number of additional properties located in Flood Zone 2 which extends further south.</p> <p>The River Itchen flows in a northerly direction along the western boundary of the study area to join the River Leam at Marton. The path of the River Itchen is rural in this area with no properties or roads at flood risk until the watercourse reaches Marton. The River Leam then flows in a north westerly direction along the boundary before leaving the study area. This area is rural with flood risk limited to a small section of the B4455 where the watercourse crosses this road.</p> <p>As the River Leam leaves the study area it is joined by an unnamed watercourse from the north. This watercourse rises in Lemon's Wood in the north of the area and flows in a westerly direction to the south of Stretton on Dunsmore before flowing in a southerly direction through Princethorpe to join the River Leam. Flood Zones 2 and 3 show the same extent through Princethorpe with several properties at risk along Leamington Road.</p>		<p>Ferrieres Close. There are also further properties at flood risk across the settlement from areas of surface water ponding.</p> <ul style="list-style-type: none"> Broadwell – there is a low to high risk flow path flowing in an easterly direction towards an unnamed tributary of Millholme Brook with several properties at flood risk including along The Green, Croftlands and Hayway Lane. Grandborough – there is a low to high risk flow path which flows in a northerly direction through the settlement towards the River Leam with several properties at flood risk including along Sawbridge Road, The Steeples, Hill Road and Main Street. Willoughby – there are two low to high risk flow paths which flow in a westerly direction into the settlement, one following the Main Street and one following the path of the unnamed watercourse, converging along Main Street through the centre of the settlement. A large number of properties throughout the settlement are shown to be at flood risk. Flecknoe – there is a low to high risk flow path flowing in an anticlockwise direction through the settlement with a small number of properties at flood risk across the settlement. 				<p>path of the River Itchen along the western boundary of the study area. The 'Wet Day' scenario shows a wider extent than the 'Dry Day' scenario, but no settlements are shown to be at risk.</p> <ul style="list-style-type: none"> Ventnor Marina Sunrise Basin, in the south of the area – the flood extent follows the path of an unnamed watercourse downstream until it joins Millholme Brook and then continues downstream along the path of Millholme Brook and then downstream along the River Leam as far as Birdingbury and slightly upstream along the River Leam from its confluence with Millholme Brook. In the 'Wet Day' scenario the flood extent is wider and follows the path of the River Leam downstream until it leaves the area, and also extends slightly upstream along the River Itchen from its confluence with the River Leam. 		

Appendix F – Cumulative Impact Assessment

This section provides a summary of the catchments where the level of flood risk and development pressures mean they could be affected by cumulative impacts and identifies recommendations for local planning policy for Rugby Borough Council so the impacts are addressed.

1 Background

1.1 Introduction

The cumulative impact of development should be considered at both the Local Plan making and the planning application and development design stages. Appropriate mitigation measures should be implemented so flood risk is not exacerbated, and where possible the development should be used to reduce existing flood risk issues.

To understand the impact of future development on flood risk in Warwickshire and Coventry, catchments were identified where cumulative development may have the greatest potential effect on flood risk, and where further assessment would be required within a Level 2 Strategic Flood Risk Assessment (SFRA) or site-specific Flood Risk Assessment (FRA). The potential change in developed area within each catchment and communities sensitive to increased risk of surface water flooding, alongside evidence of historic flooding incidents have been considered to identify catchments at the highest risk. Where catchments have been identified as sensitive to the cumulative impact of development, the assessment concludes with recommended strategic planning policy suggestions to manage the risk.

1.2 Strategic flood risk solutions

Rugby Borough Council (RBC) have a vision set forth in their Local Plan for the future management of flood risk and drainage in the region. The plans consider flood risk management, alongside wider environmental and water quality enhancements. Strategic solutions may include upstream flood storage, integrated major infrastructure/ Flood Risk Management (FRM) schemes, new defences, and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for natural flood management and retrofitting sustainable drainage systems. The **Warwickshire Local Flood Risk Management Strategy** (as LLFA), **Severn River Basin Flood Risk Management Plan** (RBMP) and **River Severn Catchment Flood Management Plan** (CFMP) set out specific actions for the authority region.

Section 2 sets out the strategic plans that exist for the authority region. The following list summarises the key outcomes these strategies are seeking to achieve. It is anticipated that this vision will be delivered by new development alongside retrofitting and enhancing green infrastructure and flood defence schemes in the existing developed area.

The strategic policy vision from the Catchment Flood Management Plan (CFMP) and the River Basin Management Plan (RBMP) focus on re-naturalising watercourses, safeguarding the floodplains and encouraging collaboration and creating new partnerships to reduce the risk of flooding and to enhance the natural environment. Within Rugby Borough, strategic solutions encourage development that:

- Prevents deterioration of the status of surface water and groundwater;
- Aims to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological status and good surface water chemical status;
- Reverses any significant and sustained upward trends in pollutant concentrations in groundwater;
- Reduces discharges, emissions and losses of priority hazardous substances into surface waters;
- Progressively reduces the pollution of groundwater and prevent or limit the entry of pollutants;
- Reduces risk to people, economic damage and community disruption;
- Uses sustainable flood storage and mitigation schemes to store water and manage surface water runoff in locations that provide overall flood risk reduction as well as environmental benefits;
- Engages with a variety of stakeholders across the region to develop plans and seize opportunities for collaborative partnership working;
- Provides a greater role for communities in managing flood risk;
- Improves knowledge and understanding of flood risk and management responsibilities, and of watercourse networks and drainage infrastructure;
- Promotes sustainable and appropriate development;
- Delivers flood risk management measures that have social, economic and environmental benefits;
- Identifies opportunities to use areas of the floodplain to store water during high flows and reduce long term dependence on engineered flood defences;
- Uses SFRA's to inform future development and minimise flood risk from all sources;
- Implements upstream catchment management e.g. slow the flow and flood storage schemes could be implemented in upper catchments to reduce flooding downstream and across neighbouring authority boundaries; and
- Promotes and considers Sustainable Drainage Systems (SuDS) at the earliest stage of site development.

In some locations, the Environment Agency (EA) have committed to assist Local Planning Authorities (LPAs) in identifying areas which may be most affected by increased flood risk due to development and/or climate change. However, this work is stated to likely fall short of extensive hydraulic modelling

and detailed mapping of theoretical flood extents. The headline message is therefore:

Flood risk is increasing, perhaps substantially, so Planners, Emergency Planners, Asset Managers and others will need to mitigate this through a mix of collaborative working, planning policies, use of 'worst case' scenarios, development of contingency plans and some detailed analysis.

1.2.1 Opportunities and projects in/ affecting Rugby Borough

There are currently no known plans for future flood defence or alleviation within Rugby Borough. Severn Trent Water recently announced its intention to improve 500km of Rivers across Warwickshire as part of their **Green Recovery Plan**, and there are likely to be opportunities to reduce flood risk alongside these plans.

Despite limited large scale plans, there are likely to be many smaller opportunities to deliver benefits through the retrofitting of SUDS in urban areas and natural flood management in upper catchment areas. Additionally, development presents opportunity to provide benefits beyond the site boundaries, for example through the provision of oversized SUDS or post-development reductions in runoff rates.

Specific recommendations and areas likely to benefit are included as part of the policy recommendations in Section 2 of this assessment.

Rugby Borough is already included within the **Warwickshire, Coventry and Solihull Local Nature Partnership (LNP)**. The following are other stakeholders and project delivery schemes affecting the Borough.

Warwickshire Avon Catchment Partnership:

The **Warwickshire Avon Catchment Partnership** is the associated Catchment Based Approach (CaBA) catchment partnership for the 'Warwickshire Avon' catchment. The partnership focuses on 7 priority areas:

1. Coventry Brooks and Rivers
2. River Stour catchment including tributaries
3. River Alne Source to Confluence with Preston Bagot Brook
4. River Arrow
5. Upper River Avon, Rains Brook and Upper River Leam
6. Forest of Feckenham
7. Carrant Brook

The Warwickshire Avon Partnership is a collaboration between relevant partners to deliver projects that will improve the health of the area's rivers and wetland environments.

Their key priorities are:

- To co-ordinate action through liaison with a range of partners;
- To endorse priority projects identified in the Delivery Action Chart which are delivering multiple benefits including enhancing ecological condition, addressing flood issues, and promoting involvement and education on catchment priorities;
- To communicate the Catchment Plan and projects to key audiences e.g. liaise with landowners to engage their active support with practical projects, and to facilitate the creation of more feasibility studies for larger scale flood risk reduction or river enhancement schemes;
- To inform stakeholders and the public of priorities, planned actions and achievements;
- To deliver practical improvements at a minimum of two priority sites per year across the catchment and priority areas and use these as demonstration sites to encourage further action;
- To secure funds and resources to deliver projects on the ground; and
- To engage with major stakeholders and developers to deliver enhancements; and
- To monitor and report on results achieved and progress across the catchment.

Warwickshire, Coventry and Solihull Sub-Regional Green Infrastructure Strategy

The Warwickshire, Coventry and Solihull Sub-Regional Green Infrastructure Strategy is a Strategy that aims to provide evidence for the preparation of plans, policies and strategies relating to Green Infrastructure (GI) at a sub-regional level and local level. The strategy also details how landholders and partners can help with the delivery of GI. The desired outcome is a comprehensive, interactive and highly flexible evidence base, which can be used for a range of purposes:

- A framework for the sustainable land management of the area;
- A tool for predicting the implications of change on the natural environment;
- Informing the sustainable management of the historic environment and the conservation and enhancement of heritage assets;
- An accurate picture of the green infrastructure of an area – essential in making planning decisions, informing developments and strategies;
- A tool for delivering the natural environmental contribution to identified priorities in the
- fields of health, economy and quality of life;

- A structured plan for delivering environmental change;
- Attracting funding by demonstrating researched needs and outcomes;
- Attracting inward investment; and
- Assisting priority setting for neighbouring authorities in areas of common interest.

Habitat Biodiversity Audit (HBA)

The Habitat Biodiversity Audit (HBA) is a partnership project established in 1995. It is managed by Warwickshire Wildlife Trust and funded by local authorities. The project is based in Warwickshire County Council's Ecological Services offices in Warwick and provides both up to date accurate records of habitats and a record of changes in land use over time. The European Committee of Regions (2006) described the HBA as the "only recognised best practice model for monitoring and auditing biodiversity". The HBA is updated annually with surveying ongoing.

The **Wildlife Sites Project** is part of the HBA Partnership. This project began 1999 and aims to develop and maintain a formal local wildlife sites system for Warwickshire as part of a wider initiative with Coventry and Solihull. The Warwickshire Wildlife Sites data can be found [here](#).

Warwickshire Wildlife Trust Nature Reserves

Warwickshire Wildlife Trust manage 8 Nature Reserves within the Rugby Borough. These are:

- Draycote Meadows
- Stockton Cutting and Tasker's Meadow
- Ashlawn Cutting
- Cock Robin Wood
- Windmill Spinney
- Newbold Quarry
- Swift Valley Nature Reserve
- Ryton Wood (SSSI)

These sites are home to various important and protected habitats and species, including:

- Muntjac deer
- Grass snakes
- Badgers
- Grassland
- Woodland
- Wetland
- Greater butterfly-orchid
- Small red-eyed damselfly
- Soldier beetle
- Longhorn beetle
- Green woodpecker
- Wild cherry
- Meadowsweet
- Fieldfare
- Purple hairstreak
- Silver-washed fritillary

Natural Flood Management techniques could be encouraged at some of the reserves to aid flood storage and improve natural habitats.

1.3 Assessment of Cross-Boundary Issues

This assessment has been undertaken covering six Local Authority areas; Rugby, Warwick, Stratford-on-Avon, Nuneaton and Bedworth, Coventry, and North Warwickshire Districts (referred to collectively as the Warwickshire Authorities in this report). Additionally, catchments covering Rugby Borough also cross into the following neighbouring Authorities (see Figure 1-1 in the main report for the Local Authority boundaries):

- Hinckley and Bosworth Borough
- Nuneaton and Bedworth Borough
- City of Coventry
- Harborough District
- Stratford-on-Avon District
- Warwick District
- West Northamptonshire
- Blaby District

The Rugby Borough is predominantly a lowland area with some areas of relatively higher ground in the north of the Borough, near Stretton-under-Fosse with topography of approximately 110m AOD. The large rivers of the Avon, Leam, Anker and Swift dominate the topography of the area which slopes down towards the rivers and their tributaries.

The River Avon enters Rugby Borough from the east where it marks the boundary of Harborough District and Daventry District. The Avon leaves the District to the west and enters Warwick District. The River Anker originates in Rugby Borough and flows north west into Nuneaton and Bedworth Borough. The River Itchen briefly flows along the Rugby Borough and Warwick District boundary. The River Leam flows north along the Daventry District and Rugby Borough border before entering Rugby where it flows west before entering the Warwick District. The River Swift flows south into Rugby Borough from Harborough Borough. It then joins the River Avon at Brownsover.

See Section 1.5 of the main report for further details on the study area.

As such, future development, both within and outside of Rugby Borough can have the potential to affect flood risk to existing development and surrounding areas, depending on the effectiveness of SuDS and drainage implementation.

Development control should address the potential impact on receiving watercourses from development in the Borough. If considered appropriately during the planning stage and appropriate development management decisions taken there should be no adverse impacts on flood risk or water quality. All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments near watercourses in neighbouring authorities comply with the latest guidance and legislation relating to flood risk and sustainable drainage, they should not normally result in an increase in flood risk within the Borough. The neighbouring authorities were contacted for information on their site allocations, to determine where development in neighbouring authorities may have an impact on.

The **Rugby Borough Council Local Plan 2011-2031** was adopted in 2019.

The following Local Plans have been adopted by neighbouring local authorities and include policies relevant to flood risk and drainage:

- **Hinckley and Bosworth Borough Council's Local Plan** (2011 – 2028)
- **Blaby District Council's Local Plan** (currently under review, due end unknown)
- **Harborough District Council's Local Plan** (2011 – 2031)
- **Coventry City Council's Local Plan** (2011 – 2031)
- **Stratford-on-Avon District Council Core Strategy** (2016-2031, currently under review, due end unknown)
- **West Northamptonshire Council's Joint Core Strategy** (2008 – 2029)
- **Warwick District Council's Local Plan** (due to be replaced by South Warwickshire Local Plan, due end unknown)
- **North Warwickshire Borough Council's Local Plan** (2021 – 2033)
- **Nuneaton and Bedworth Borough Council's Local Plan** (currently under review, due end unknown)

For the CIA, Rugby Borough was assessed at a sub-catchment level (see Figure F-1).

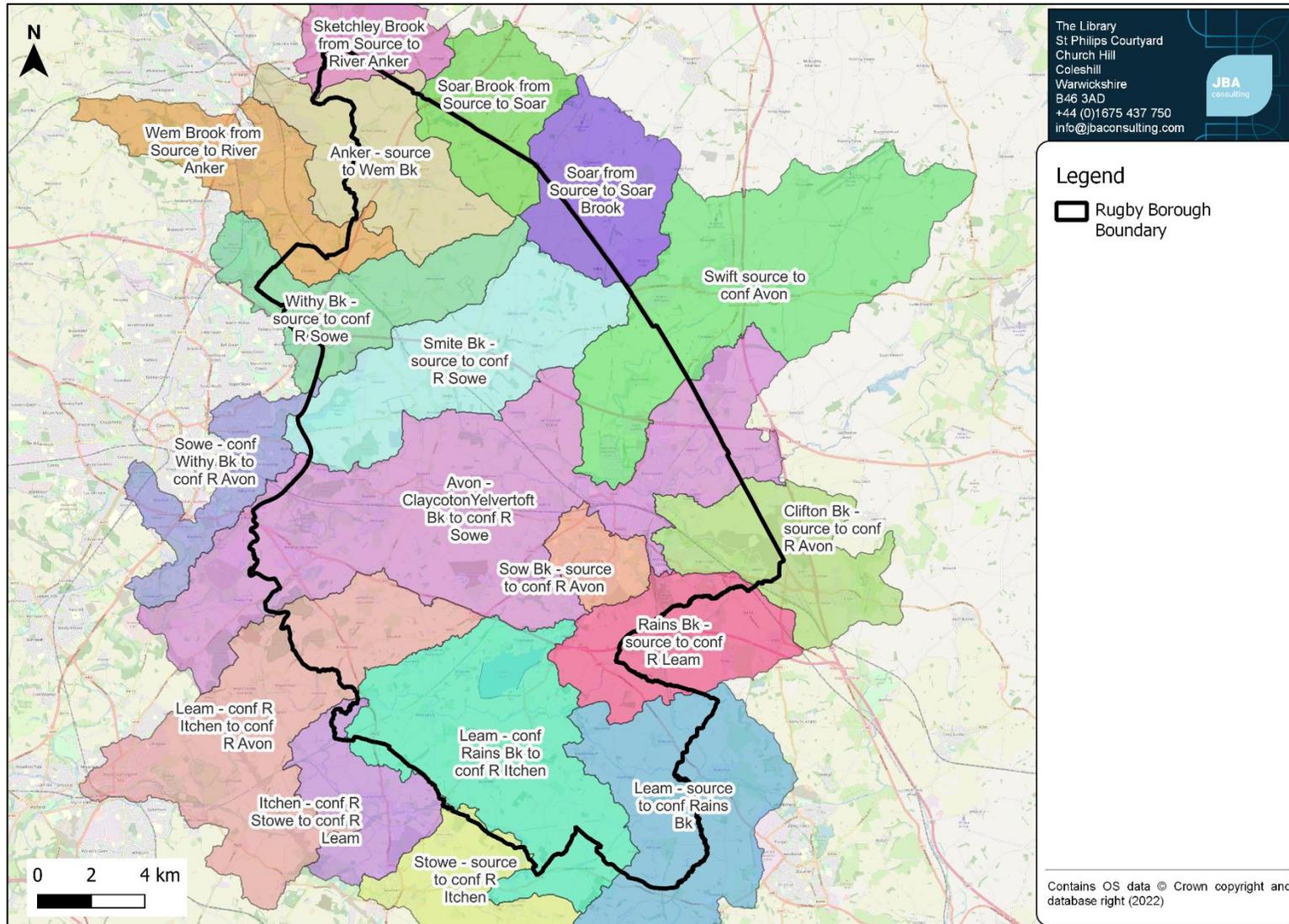


Figure F-1: Catchments within Rugby Borough.

1.4 Cumulative Impact Assessment Methodology

This broadscale assessment determines where the potential cumulative impact of developments may have the greatest effect on flood risk across the study area. Catchments at the highest risk are taken forward to a catchment-level analysis. Potential change in developed areas within each catchment from neighbouring authorities was also considered. In this instance, historic records of flooding events were not available, however some baseline records were derived from recent Section 19 reports and a supplied asset register. The recorded incidents from these provide a general overview but were included in the assessment. Analysis of this data facilitated the identification of catchments at the greatest risk of cumulative impacts of an increase in impermeable area within the catchment.

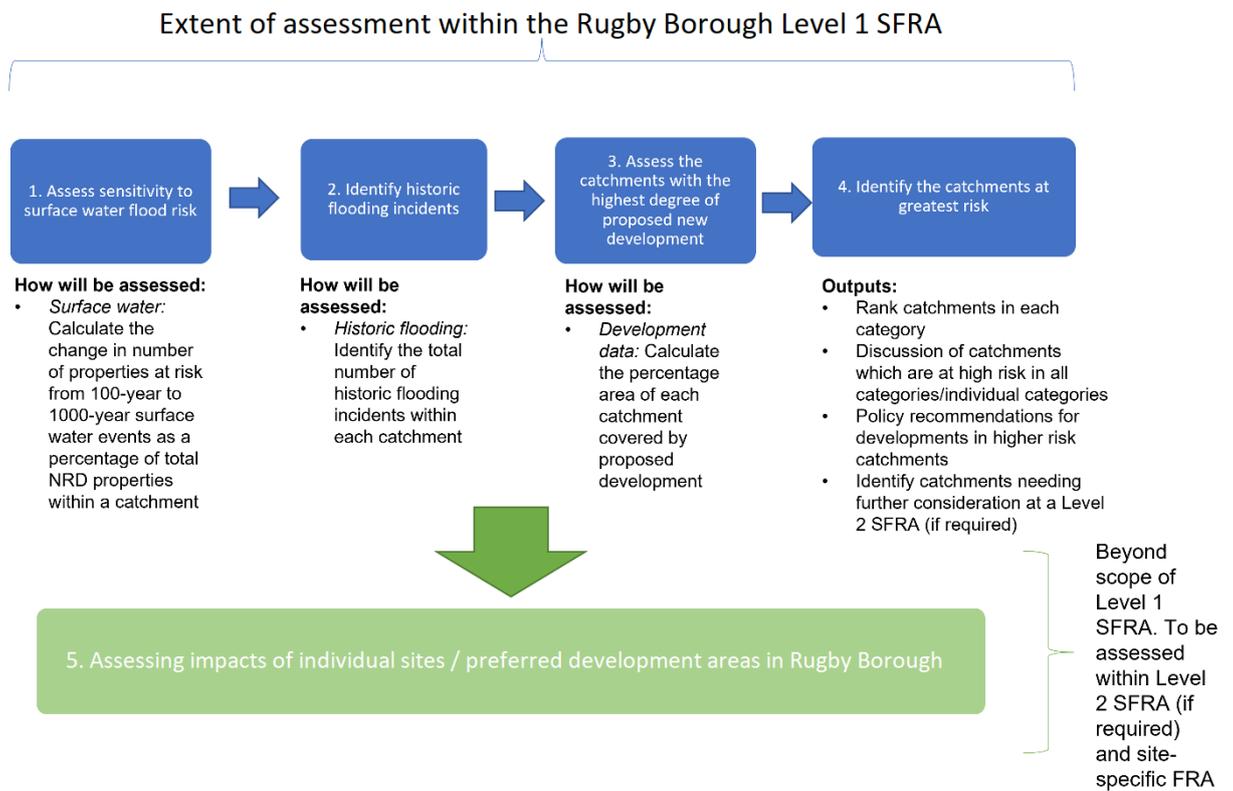


Figure F-2: Overview of the method used within the Cumulative Impact Assessment

Figure F-2 shows the methodology used and Table F-1-1 summarises the datasets used within the Warwickshire cumulative development scenario.

Future development sites within the study area were provided by the Warwickshire Authorities. Catchments within the study area were initially ranked using the following five metrics: sensitivity to increased fluvial flood risk; prevalence of recorded historic flood incidents (limited by the data available); prevalence of historic sewer flooding instances; sensitivity to increased risk of surface water flooding; and area of new development proposed within the catchment.

The final results of this assessment gave a cumulative impact rating of low, medium, or high for each metric, for each catchment within the study area, the boundaries of which were derived from WFD. The rating of each catchment in each of these assessments was combined to give an overall ranking.

1.4.1 Sensitivity to increases in surface water flooding

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

The National Receptor Database (NRD) dataset 2021 was used to identify all properties within the study area.

This data was analysed for the 1,000-year and 100-year surface water flood extents respectively to determine the number of properties in each catchment, in each surface water flood extent. The difference between the two values was then taken as a percentage of the total number of properties within the catchment to allow comparison between catchments of different sizes.

1.4.2 Sensitivity to increases in fluvial flooding

For the purpose of the CIA this is the measure of the increase in the number of properties at risk of fluvial flooding from a 1 in 100-year event to a 1 in 1,000-year event. It is an indicator of where local topography makes an area more sensitive to increases in flood risk that may be due to any number of reasons, including climate change, new development etc. It is not an absolute figure or prediction of the impact that new development will have on flood risk, but rather an indicator of the sensitivity of receptors to cumulative effects.

The National Receptor Database (NRD) dataset 2021 was used to identify all properties within the study area.

This data was analysed using Flood Zone 2 (1,000-year event) and Flood Zone 3 (100-year event) to determine the number of properties in each catchment, in each Flood Zone. The difference between the two values was then taken as a percentage of the total number of properties within the catchment to allow comparison between catchments of different sizes.

1.4.3 Growth in the area

Development within authorities has the potential to affect flood risk in neighbouring authorities, especially if there are existing flood risk issues. Rugby Borough is predominantly a lowland area. The large rivers of the Avon, Anker and Leam dominate the topography of the area. The topography slopes downhill towards Morton to Grandborough, and other areas such as Ryton-on-Dunsmore, Church Lawford and Wolvey. The east of the Borough generally has higher topography than the west. Rugby itself lies at around 120m AOD. The River Avon enters Rugby Borough from the east as it leaves Harborough

District. The Avon travels west through Rugby Borough and enters Warwick District. The River Anker rises in Rugby Borough at Wolvey, it flows west to enter Nuneaton and Bedworth Borough. The River Leam follows the border of Rugby Borough and West Northamptonshire before flowing west through the south of Rugby Borough and then entering Warwick District.

Areas for future proposed development were received from the Warwickshire Authorities and were assessed as part of this CIA. The area of potential new development within each catchment was expressed as a percentage of the total catchment area to determine the potential for increase in flood risk as a result of new development.

1.4.4 Historic flood risk

Recorded flooding events data for fluvial or surface water flooding within the study area was provided by Warwickshire County Council and Coventry City Councils as LLFAs. Data was filtered to only include incidences where properties were affected. Details of historic flood events can be found in Section 5.1 of the main SFRA report. Each point represents a location where it is known there has been at least one flood event (however, the nature and scale of these flood events varies significantly).

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

1.4.5 Historic sewer flooding incidences

Recorded sewer flooding events data was provided by Severn Trent Water. Data was filtered to only include incidences where property was affected (as opposed to highways flooding). Each point represents a location where it is known there has been at least one flood event (however, the nature and scale of these flood events varies significantly).

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

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

Table F-1-1 Summary of datasets used within the Broadscale Cumulative Impact Assessment

Dataset	Coverage	Source of Data	Use of Data
Catchment Boundaries	Warwickshire Study Area	Water Framework Directive Catchments	Assessment of susceptibility to cumulative impacts of development by catchment.
National Receptor Dataset (2021)	Warwickshire Study Area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment.

Dataset	Coverage	Source of Data	Use of Data
Risk of Flooding from Surface Water	Warwickshire Study Area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment.
Fluvial Flood Zones 2 and 3	Warwickshire Study Area	Environment Agency	Assessing the number of properties at risk of fluvial flooding within each catchment
Future development areas (recently built out sites/sites under construction/sites with planning permission/previously allocated sites/currently allocated sites)	Warwickshire Study Area	Rugby Borough Council, Warwick District Council, Stratford-on-Avon District Council, Nuneaton and Bedworth Borough Council, Coventry City Council, and North Warwickshire District Council.	Assessing the impact of proposed future development on risk of flooding.
Historic Flooding Incidents and Sewer Flooding Incidents	Warwickshire Study Area	Warwickshire County Council, Coventry City Council, Severn Trent Water	Assessing incidences of historic flooding within the study area.

1.4.6 Ranking the results

The ranking results were combined from all five metrics to give an overall High, Medium and Low ranking for all catchments within the study area. The results for each assessment were ranked into High, Medium and Low risk as shown in Table F-1-2. Ranking delineations were given at natural breaks in the results.

Table F-1-2: Ranking assessment criteria

Flood risk ranking	% of properties at increased risk of fluvial flooding	% of properties at increased risk of SW flooding	No. of Recorded Historic Flooding Incidents	No. of Recorded Sewer Flooding Incidents	% Area of Catchment Covered by new development
Low	<3%	<3%	0	<5	<4%
Medium	3 to 5 %	3 to 5 %	1-5	6-10	4 to 10%
High	>5%	>5%	>5	>10	>10

1.4.7 Assumptions

The assumptions made when conducting the cumulative impact assessment are shown in Table F-1-3.

Policy recommendations with regards to managing the cumulative impact of development are described in Section 2.2 of the CIA. Appropriate policies will address the issue of incremental increase due to cumulative effects in flood risk both within and downstream of Rugby Borough.

Table F-1-3: Assumptions of the cumulative impact assessment

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Surface water flood risk; Flood Zone 2 and 3	Total number of properties flooded	Assumption that all properties have been included in the 2021 NRD dataset. It may not include all new build properties.	This was the most up to date and best data available.
Historic Flooding incidents	Total number of historic events and severity of flooding	Only flooding incidents recorded that could be georeferenced with XY coordinates to produce GIS files. Each point represents a location where it is known there has been at least one flood incident. The severity of the historic flooding event relating to the point has not been considered, just the total number of points within each catchment where there has been a flood incident.	GIS data sourced provided the best available results for the location of historic flooding incidents in the study area.

1.5 Cumulative Impact Assessment

1.5.1 Sensitivity to fluvial flooding

The number of properties within Flood Zone 2 not presently within Flood Zone 3 was taken, as a percentage of the total properties in the catchment. These properties are considered sensitive to increased flood risk as a result of climate change.

Catchments with greater than 5% properties at increased risk were considered high risk.

Table F-1-4 Warwickshire and Coventry catchments considered highly sensitive to increased fluvial flood risk in future

Catchment	% properties sensitive to increased fluvial flood risk	Rank
Arrow - Sperrall Hall Farm, Studley to confluence with River Alne	11.9%	1
Alne- confluence with Preston Bagot Brook to confluence with Claverdon Brook	7.9%	2
Alne - source to confluence with Preston Bagot Brook	7.8%	3
Arrow – confluence with River Alne to confluence with River Avon	7.7%	4
Knee Brook - source to confluence with Blockley Brook	7.6%	5
Leam – confluence with River Itchen to confluence with River Avon	6.2%	6

Catchment	% properties sensitive to increased fluvial flood risk	Rank
Avon (Warks) – confluence with River Sowe to confluence with River Leam	5.9%	7

1.5.2 Sensitivity to surface water flooding

The number of properties within the 1000-year surface water extent not presently within the 100-year extent was taken, as a percentage of the total properties in the catchment. These properties are considered sensitive to increased flood risk as a result of climate change.

Catchments with greater than 5% properties at increased risk were considered high risk.

Table F-1-5 Warwickshire and Coventry catchments considered highly sensitive to increased surface water flood risk in future

Catchment	% properties sensitive to increased surface water flood risk	Rank
Marchfont Bk - source to conf R Avon	11.7%	1
Knee Bk - source to conf Blockley Bk	8.3%	2
Knee Bk - conf Blockley Bk to conf R Stour	6.4%	3
Dene - Butlers Marston to conf R Avon	6.0%	4
Itchen - source to conf with R Stowe	5.9%	5
Tadmarton Stream (Source to Sor Brook)	5.9%	6
Dene - source to Butlers Marston	5.5%	7
Alne conf Preston Bagot Bk to conf Claverdon Bk	5.4%	8
Leam - source to conf Rains Bk	5.4%	9
Stour (Warks) - source to conf Nethercote Bk	5.2%	10
Nethercote Bk - source to conf R Stour	5.1%	11
Alne - conf Claverdon Bk to conf R Arrow	5.1%	12

1.5.3 Prevalence of historic flooding incidents

Historic flood incidents data for fluvial or surface water was available for this assessment from Warwickshire County Council and Coventry City Council. Data was filtered to include only flooding that affected properties. While this will not provide a detailed scope of historic flooding incidents across the region, the number of flood incidents in each catchment from the data available were identified to provide a broadscale understanding of flood risk. Catchments with more than 5 recorded incidents were considered high risk.

Table F-1-6 Warwickshire and Coventry catchments with the highest number of recorded historic flood incidents

Catchment	Number of recorded incidents	Rank
Avon (Wark) conf R Leam to Tramway Br, Stratford	20	1
Leam - conf R Itchen to conf R Avon	16	2
Arrow - Sperrall Hall Fm, Studley to conf R Alne	16	2
Avon- Tramway Br Stratford to Workman Br Evesham	7	4
Preston Bagot Bk - source to conf R Alne	7	4
Leam - conf Rains Bk to conf R Itchen	6	6
Tame from R Blythe to River Anker	6	6

1.5.4 Prevalence of sewer flooding incidents

Records of sewer flooding incidents were available for this assessment from Severn Trent Water Data was filtered to include only flooding that affected properties. Catchments with more than 10 recorded incidents were considered high risk.

Table F-1-7 Warwickshire and Coventry catchments with the highest number of recorded historic flood incidents

Catchment	Number of recorded incidents	Rank
Leam - conf R Itchen to conf R Avon	49	1
Avon (Wark) conf R Leam to Tramway Br, Stratford	39	2
Anker from Wem Brook to River Sence	32	3
Stour - conf Nethercote Bk to conf Back Bk	30	4
Avon - ClaycotonYelvertoft Bk to conf R Sowe	29	5
Avon- Tramway Br Stratford to Workman Br Evesham	28	6
Anker from River Sence to River Tame	28	6
Finham Bk - source to conf Canley Bk	25	8
Sow Bk - source to conf R Avon	25	8
Avon (Warks) - conf R Sowe to conf R Leam	21	10
Stowe - source to conf R Itchen	21	10
Clifton Bk - source to conf R Avon	21	10

Catchment	Number of recorded incidents	Rank
Tame from R Blythe to River Anker	20	13
Sherbourne - source to conf R Sowe	20	13
Cole from Hatchford-Kingshurst Brook to R Blythe	20	13
Wem Brook from Source to River Anker	16	16
Canley Bk - source to conf with Finham Bk	14	17
Withy Bk - source to conf R Sowe	13	18
Dene - source to Butlers Marston	13	18
Sowe - conf Withy Bk to conf R Avon	13	18

1.5.5 Area of proposed development

The Warwickshire authorities provided a list of likely new development sites and the total area of new development in each catchment was measured, as a percentage of catchment area. Catchments with more than 10% of their area earmarked for development were considered high risk.

Table F-1-8 Warwickshire and Coventry catchments with the highest percentage cover of proposed development

Catchment	Area of proposed development (ha)	Area of proposed development (%)	Rank
Finham Bk - conf Canley Bk to conf R Sowe	266.6	40.9%	1
Tach Bk - source to conf R Avon	441.8	16.6%	2
Radford Bk - source to conf R Leam	190.2	12.1%	3
Sowe - conf Breach Bk to conf Withy Bk	303.4	11.5%	4
Marchfont Bk - source to conf R Avon	373.0	11.3%	5
Clifton Bk - source to conf R Avon	330.5	10.11%	6

1.6 Overall rankings

As can be seen from the above tables and Figure F-2, there are catchments that are at high risk in multiple categories. Rankings from each assessment have been combined to give an overall ranking. A Red-Amber-Green (RAG) rating was then applied to the catchments, with red being high risk, amber being medium risk and green being low risk (Figure F-3). The catchments with a combined ranking score of less than 30 were deemed high risk.

The catchments rated as high-risk in the broadscale assessment, which lie within Rugby Borough, are shown in F-1-9.

Table F-1-9: High Risk catchments within Rugby Borough, as shown in Figure F-3

Waterbody Name
Leam - conf R Itchen to conf R Avon
Leam - conf Rains Bk to conf R Itchen
Clifton Bk - source to conf R Avon

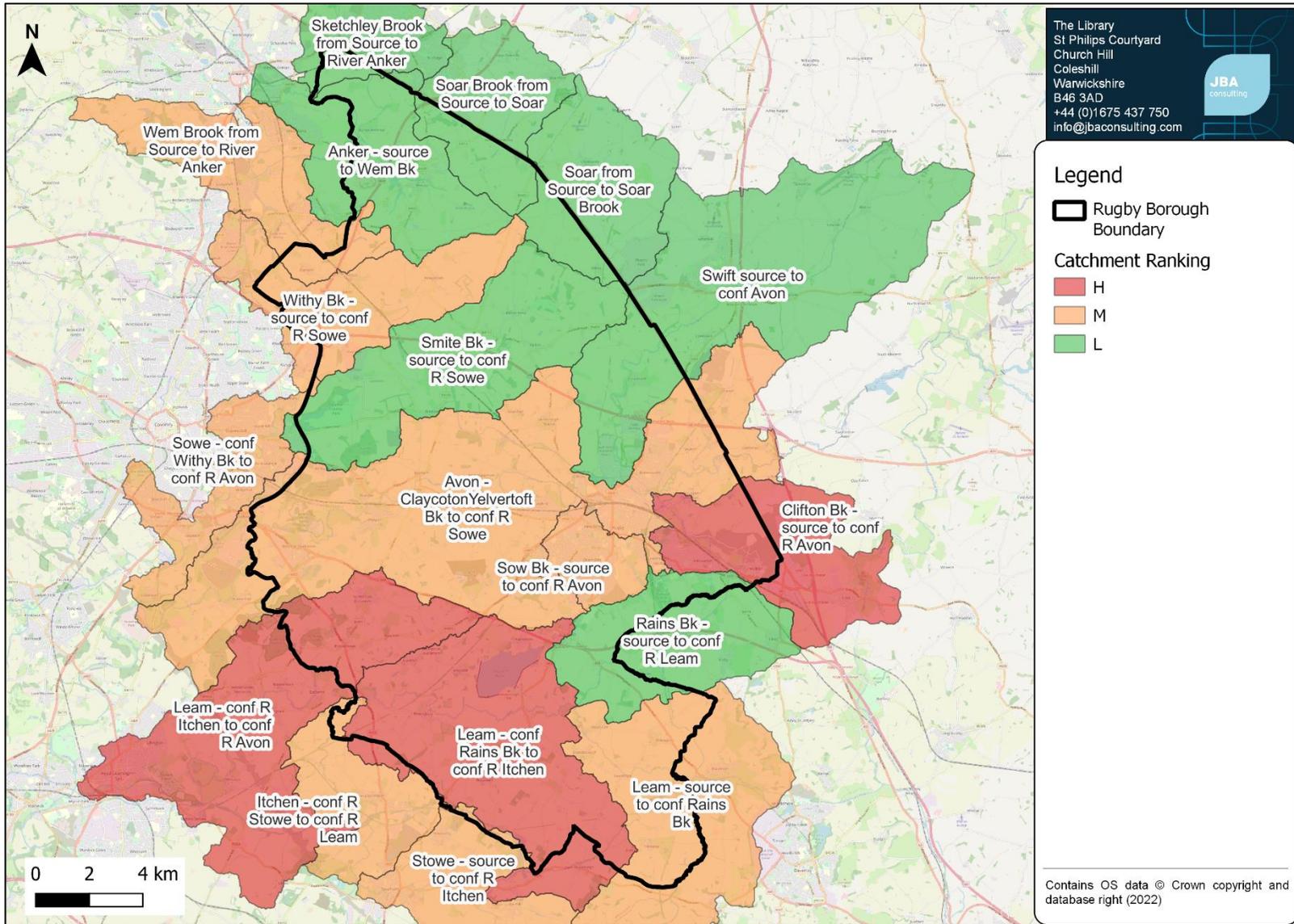


Figure F-3: Final catchment rankings of susceptibility to the impacts of cumulative impacts within Rugby Borough.

2 Policy Recommendations

2.1 Broadscale Recommendations

The broadscale cumulative impact assessment for Rugby Borough has highlighted that the potential for development to have a cumulative impact on flood risk is moderately low across the area. Catchments have been identified as high, medium or low risk.

New development can potentially increase flood risk and thus the need for incremental action and betterment in flood risk terms across all of Rugby Borough is appropriate.

The following policy recommendations therefore apply to all catchments within the study area:

- The Warwickshire Authorities should work closely with each other and neighbouring local authorities to develop complementary Local Planning Policies for catchments that drain into and out of the City to other local authorities in order to minimise cross boundary issues of cumulative impacts of development.
- Developers should incorporate SuDS and provide details of adoption, ongoing maintenance and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the districts where practicable. Developers should refer to the relevant LLFA guidance (Warwickshire County Council) for the requirements for SuDS in Rugby Borough, including Technical and Development Type-specific Guidance for Developers.
 - **Warwickshire Flood Risk & Sustainable Drainage Local Guidance for Developers**

Further guidance on SuDS can be found in Section 9 of the main SFRA report.

- Warwickshire County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. These should take into account all sources of flooding so that future development is resilient to flood risk and does not increase flood risk elsewhere.
- Where appropriate, that the opportunity for Natural Flood Management in rural areas, SuDS retrofit in urban areas and river restoration should be maximised. Culverting should be opposed, and day-lighting existing culverts promoted through new developments.
- Runoff rates from all development sites must be limited to greenfield rates (including brownfield sites) for all sites unless it can be demonstrated that this is not practicable. If it is demonstrated that greenfield rates are not practicable then the runoff rates should be restricted to the closest rate that is practicable. Developers should refer to the relevant LLFA guidance for the requirements for SuDS in Rugby Borough.

- Rugby Borough Council should consider requiring developers to contribute to community flood defences outside of their red line boundary to provide wider benefit and help offset the cumulative impact of development. There are proposed and ongoing Flood Alleviation Schemes which may help to reduce fluvial risk in the town centre, and there may be opportunities for development to support the funding/delivery of these schemes.

Section 8.3 of the main SFRA report details the local requirements for mitigation measures. Catchment-specific recommendations are made for high-risk catchments below.

2.2 Recommendations for medium and high-risk catchments

Medium Risk catchments are detailed in Table 2-1 below. High risk catchments are detailed in Table F-1-9. From analysing the results produced above, high-level recommendations to manage the risks of the cumulative impacts of development have been proposed for the medium and high-risk catchments. These recommendations include policy recommendations for the Local Authority and considerations for developers as part of site-specific proposals.

Table 2-1 Medium Risk Catchments with the Rugby Borough Study Area

Medium Risk catchments within Rugby Borough
Withy Bk - source to conf R Sowe
Itchen - conf R Stowe to conf R Leam
Avon – Claycoton Yelvertoft Bk to conf R Sowe
Stowe - source to conf R Itchen
Wem Brook from Source to River Anker
Sowe - conf Withy Bk to conf R Avon
Leam - source to conf Rains Bk
Sow Bk - source to conf R Avon

- Rugby Borough Council should work closely with the EA and the LLFA to identify any areas of land that should be safeguarded for any future flood alleviation schemes and natural flood management features, including land which may lie outside their boundaries.
- Rugby Borough Council should explore the potential for development in High-Risk catchments to contribute towards works to reduce flood risk and enable regeneration as well as contributing to the wider provision of green infrastructure.
- Rugby Borough Council, in discussion with Warwickshire County Council as LLFA should consider requiring additional betterment for runoff rates from brownfield sites, beyond those currently set. Currently, the Warwickshire Local Guidance for Developers states that greenfield sites should limit runoff to greenfield rates whilst brownfield sites should reduce runoff to greenfield rates or achieve a minimum 50% reduction in runoff where it can be proved greenfield rates are not possible. More

detailed modelling must be undertaken by the developer to ascertain the true storage needs and potential at each site at the planning application stage.

- For any sites where an FRA is required, developers should explore, through the site-specific FRA, opportunities to provide wider community flood risk & water resource benefits as part of new development and justify where such measures are not included. Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered, with a focus on slowing the flow of water downstream, particularly in the upper catchment. This could include the provision of additional storage e.g. oversized SuDS and/or Partnership Funding contributions towards wider community schemes.
- Rugby Borough Council should consult with Local Non-For-Profit organisations such as wildlife trusts, rivers trusts and catchment partnerships to understand ongoing and upcoming projects where NFM, flood storage and attenuation, and environmental betterment may be possible alongside developments and aid in reducing flood risk.

2.2.1 Recommendations for Developments in High-Risk Catchments

Catchments that have been scored an overall ranking of high, should also consider the following recommendations:

- That a Level 2 SFRA or detailed local area Strategic Drainage Study considers further how the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. Such studies could be used to justify greater restrictions/ enforce through Local Planning Policy development site runoff rates and volumes specific to each catchment that are over and above those required by National and Local SuDS Standards. They could also identify where there are opportunities with allocated sites to provide off-site betterment e.g. online/ offline flood storage and where land should be safeguarded within proposed site allocations to fulfil this purpose.
- All development proposals should undertake a site-specific Flood Risk Assessment. Site-specific FRAs should explore opportunities to provide wider community flood risk benefit through new developments. Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered. This may be either by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques, green infrastructure and green-blue corridors, and/ or by providing a Partnership Funding contribution towards any flood alleviation schemes.
- That a Surface Water Drainage Strategy be required for all developments, regardless of development size. Developers should also include a construction surface water management plan to support the Construction Drainage Phasing Plan. This should provide information to the EA, the LLFA and the LPA regarding the proposed management approach during the construction phase to address surface water management during storm events.

- That Rugby Borough Council consider requiring developers to contribute to community flood defences both within and outside of their red line boundary in these catchments to provide wider benefits and help offset the cumulative impact of development.