Appendix K - Data sources used in the SFRA

1 Historical Flooding

Devon County Council and East Devon District provided records of flooding in the area. These are presented in Appendix A. The Environment Agency's Historic Flood Map is also presented in Appendix A.

Section 5.1 documents historic flooding records obtained, including those from South West Water and from the Devon & Somerset Fire & Rescue Service.

2 Fluvial and tidal flooding

2.1.1 Technical assessment of flood hazards

Flood risk within the East Devon District has been assessed using results from hydraulic models supplied by the Environment Agency and existing Environment Agency Flood Zone mapping. The following models inform the flood risk information within the district:

Environment Agency fluvial (river) and coastal models:

- Clyst St Mary 2019 (currently being updated)
- Exe Estuary 2011
- River Axe 2014
- River Sid 2014
- Stoke Canon 2016
- Seaton Coastal 2018
- Budleigh Salterton 2021
- Sidmouth Coastal 2021

2.2 Flood Zones 2 and 3a

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

Flood Zone 1: Comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1% AEP).

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

Flood Zone 3a: This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding (>1.0% AEP) or a greater than 1 in 200 annual probability of flooding from the sea (>0.5% AEP) in any year.

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.

The Environment Agency regularly reviews its hydrology, hydraulic modelling and flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA.

2.3 Flood Zone 3b (the Functional Floodplain)

Flood Zone 3b: This zone comprises land where water has to flow or be stored in times of flood (the functional flood plain). The SFRA identified this Flood Zone as land which would flood with an annual probability of 1 in 30 years (3.3% AEP), where detailed modelling exists.

The Environment Agency provided the models mentioned in Section 2.1.1 for use in the SFRA and these have been used to identify Flood Zone 3b. Where the 3.3% AEP defended (30-year) extent was available, this was used to define Flood Zone 3b. Where the 3.3% AEP was not available for the defended 2% AEP event has been used as a proxy as this adopts a conservative approach.

The following layers from provided model outputs were used to define Flood Zone 3b:

Model	Event	Run used
Clyst St Mary 2019 (currently being updated)	2% tidal (with 100% AEP fluvial boundary) Defended 2% fluvial (with MHWS tidal boundary)	F1_Tide_50_BaseLine_ClystSM_012_g005_MaxExtent F50_Tide_MHWS_DoSomething_ClystSM_002_g005_MaxExtent
Exe Estuary 2011	Defended 3.3% tidal (with 100% AEP fluvial boundary) Defended 2% fluvial (with MHWS tidal boundary)	EXE_T0030F0002D_SWL_EXTENT EXE_TMHWSF0050D_SWL_EXTENT
River Axe 2014	Fluvial 3.3% AEP defended	River_Axe_30yr_sd13h_def_Outline
River Sid 2014	Fluvial 3.3% AEP defended	sid_f0030_t0005_def_v01_extent_area_filled_region
Stoke Canon 2016	Fluvial 2% AEP	StokeCanon_Q50_DraftFinal_region
Seaton Coastal 2018	Tidal 3.3% AEP defended	Results_outlines Seaton_T30_Def_outline
Budleigh Salterton 2021	Tidal 3.3% AEP defended	Budleigh_Def_T30_102_outline

Sidmouth Coastal 2021	Tidal 3.3% AEP defended	Sidmouth_Def_T30_103_outline

The modelled layers have been merged together to create a Flood Zone 3b layer from detailed modelling.

In Exmouth, a number of areas in the town were shown to be in Flood Zone 3b from the Exe Estuary model. As the Environment Agency has recently constructed flood defences with a standard of protection of 0.5% AEP, then these areas have been manually removed from the Flood Zone 3b layer.

There are a few areas, notably along the Withycombe Brook in Exmouth, around Castle Hill in Axminster, and along a tributary of the River Sid in Cotmaton, where the detailed modelling extent used for Flood Zone 3b is larger than the Environment Agency Flood Zone 3. It has been agreed with the Environment Agency that the modelled outputs would be used to define Flood Zone 3b in these areas. Developers should consult with the Environment Agency to confirm the appropriate data is being used as part of a Flood Risk Assessment.

Where detailed modelling was not available, then Flood Zone 3a has been used to define Flood Zone 3b. An additional layer has been created, Flood Zone 3b as a proxy from Flood Zone 3a. The Environment Agency's Flood Zone 3 layer has been used, and areas where detailed modelling are available have been cut out of the layer, so that the detailed modelling can be used to represent Flood Zone 3b.

Please note there are a number of urban areas (Rockbeare, Woodbury, Exmouth, Budleigh, Otterton and Ottery for example) where the functional floodplain covers the urban area), technically this would not be considered to be functional where there are buildings as they would not provide flood storage. These have been kept in the Flood Zone 3b layer given this is a fairly high level approach.

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.

3 Fluvial and Tidal Climate change

The existing hydraulic models were re-run using the latest climate change allowances, to provide extents for Flood Zone 3b, Flood Zone 3a and Flood Zone 2 in the future. The following models and runs were done:

Model	Events available to assess Climate Change
Clyst St Mary 2019	Fluvial dominant events: • 2% AEP + 46% CC UKCP18 tidal Higher Central MHWS • 2% AEP + 61% CC + UKCP18 tidal Higher Central MHWS • 1% AEP + 46% CC UKCP18 tidal Higher Central MHWS • 1% AEP + 61% CC + UKCP18 tidal Higher Central MHWS • 0.1% AEP + 46% CC UKCP18 tidal Higher Central MHWS • 0.1% AEP + 61% CC + UKCP18 tidal Higher Central MHWS

Model	Events available to assess Climate Change
	Tidal dominant events: • Defended 2% AEP tidal UKCP18 Higher Central fluvial 100% AEP + 61% CC • Defended 2% AEP tidal UKCP18 Upper End fluvial 100% AEP + 61% CC • Undefended 0.5% AEP tidal UKCP18 Higher Central fluvial 100% AEP + 61% CC • Undefended 0.5% AEP tidal UKCP18 Upper End fluvial 100% AEP + 61% CC • Undefended 0.1% AEP tidal UKCP18 Higher Central fluvial 100% AEP + 61% CC • Undefended 0.1% AEP tidal UKCP18 Upper End fluvial 100% AEP + 61% CC
Exe Estuary 2011	Fluvial dominant events: • Defended 2% AEP + 46% CC UKCP18 tidal Higher Central MHWS • Defended 2% AEP + 61% CC + UKCP18 tidal Higher Central MHWS • Undefended 1% AEP + 46% CC UKCP18 tidal Higher Central MHWS • Undefended 1% AEP + 61% CC + UKCP18 tidal Higher Central MHWS • Undefended 0. 1% AEP + 46% CC UKCP18 tidal Higher Central MHWS • Undefended 0. 1% AEP + 61% CC + UKCP18 tidal Higher Central MHWS Tidal dominant events: • 2% AEP tidal UKCP18 HC fluvial 50% AEP + 46% CC • 2% AEP tidal UKCP18 UE fluvial 50% AEP + 61% CC • 0.5% AEP tidal UKCP18 HC fluvial 50% AEP + 46% CC • 0.5% AEP tidal UKCP18 UE fluvial 50% AEP + 61% CC • 0.1% AEP tidal UKCP18 HC fluvial 50% AEP + 46% CC 0.1% AEP tidal UKCP18 UE fluvial 50% AEP + 61% CC
River Axe 2014	3.3% AEP defended fluvial + 46% CC 3.3% AEP defended fluvial + 61% CC 1% AEP undefended fluvial + 46% CC 1% AEP undefended fluvial + 61% CC 0.1% AEP undefended fluvial + 46% CC 0.1% AEP undefended fluvial + 61% CC

Model	Events available to assess Climate Change
River Sid 2014	3.3% AEP defended fluvial + 46% CC (20% AEP tidal boundary) 3.3% AEP defended fluvial + 61% CC (20% AEP tidal boundary) 1% AEP undefended fluvial + 46% CC (20% AEP tidal boundary) 1% AEP undefended fluvial + 61% CC (20% AEP tidal boundary) 0.1% AEP undefended fluvial + 46% CC (20% AEP tidal boundary) 0.1% AEP undefended fluvial + 61% CC (20% AEP tidal boundary) Tidal dominant climate change runs were not done on this model as the Seaton Coastal model is available.
Seaton Coastal 2018	3.3% AEP defended tidal Higher Central (P70) 2122 3.3% AEP defended tidal Upper End (P95) 2122 0.5 % AEP undefended tidal Higher Central (P70) 2122 0.5 % AEP undefended tidal Upper End (P95) 2122 0.1 % AEP undefended tidal Higher Central (P70) 2122 0.1 % AEP undefended tidal Upper End (P95) 2122
Budleigh Salterton 2021	3.3% AEP defended tidal Higher Central (P70) 2122 3.3% AEP defended tidal Upper End (P95) 2122 0.5 % AEP undefended tidal Higher Central (P70) 2120 0.5 % AEP undefended tidal Upper End (P95) 2120 0.1 % AEP undefended tidal Higher Central (P70) 2122 0.1 % AEP undefended tidal Upper End (P95) 2122
Sidmouth Coastal 2021	3.3% AEP defended tidal Higher Central (P70) 2122 3.3% AEP defended tidal Upper End (P95) 2122 0.5 % AEP undefended tidal Higher Central (P70) 2120 0.5 % AEP undefended tidal Upper End (P95) 2120 0.1 % AEP undefended tidal Higher Central (P70) 2122 0.1 % AEP undefended tidal Upper End (P95) 2122

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

Although the RoFfSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to 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 Zone "B" for the purpose of performing the Sequential Test.

Environment Agency surface water (rainfall) models:

- Risk of Flooding from Surface Water (2013)
- Risk of Flooding from Surface Water climate change (2021)

Devon County Council provided surface water (rainfall) models for Ottery St Mary and Sidmouth which have been used in the SFRA. The Environment Agency also have a surface water model of Lympstone.

5 Groundwater

Mapping of groundwater flood risk has been based on the JBA Groundwater Flood Risk map.

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

Historical incidents of flooding are detailed by South West Water. This database records incidents of flooding relating to hydraulic overload. The database covers reported incidents of sewer flooding in the last 10 years.

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

The South West Water Drainage and Wastewater Management Plan (DWMP) has also been assessed. Section 5.8 of the Main Report explains sewer flooding.

7 Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within East Devon District 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 5.11 of the Main Report presents the reservoirs affecting East Devon District.

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 Reduction in Risk of Flooding from Rivers and Sea due to 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 Milton Keynes 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
	Flood incident records	Devon County Council
	Flood incident records	South West Water
	Flood incident records	Devon & Somerset Fire & Rescue Service
Fluvial and tidal (including climate change)	Flood Map for Planning Flood Zones	Environment Agency
	Hydraulic Models: Clyst St Mary 2019 Exe Estuary 2011 River Axe 2014 River Sid 2014 Stoke Canon 2016 Seaton Coastal 2018 Budleigh Salterton 2021 Sidmouth Coastal 2021	Environment Agency
Surface Water	Risk of Flooding from Surface Water dataset Sidmouth, Ottery Mary, Lympstone Surface Water models	Environment Agency Devon County Council
Sewers	Internal and external historic drainage records DWMP	South West Water
Groundwater	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 (AIMS dataset)	Environment Agency
Cross-boundary impacts	Neighbouring authority sites and Local Plan information, to help assess cross-boundary impacts and the cumulative impact assessment	Exeter City Council Mid Devon District Council Teignbridge District Council Dorset County Council
Other datasets	Partner Data Catalogue: - 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	Environment Agency (via East Devon District Council)