Oxfordshire County Council Minerals and Waste Strategic Flood Risk Assessment

Addendum Report

Oxfordshire County Council

March 2019

AECOM Project No. 60600440

Quality information

Prepared by	Checked by	Approved by
Hannah Booth Graduate Water Consultant	Sarah Littlewood Senior Flood Risk Consultant	Emily Craven Associate

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	27/03/2019	Draft for client comment	EC	Emily Craven	Associate

Prepared for:

Oxfordshire County Council

Prepared by:

AECOM Infrastructure & Environment UK Limited
Midpoint, Alencon Link
Basingstoke
Hampshire RG21 7PP
United Kingdom

T: +44(0)1256 310200
aecom.com

Table of Contents

Tables

1. Introduction

1.1 Background

AECOM has been commissioned to prepare an Addendum to the Minerals and Waste Level 1 Strategic Flood Risk Assessment (SFRA) for Oxfordshire County Council (OCC). AECOM previously prepared a Level 1 SFRA in 2015 which still remains largely valid for the purposes of supporting OCC Minerals and Waste Local Plan (MWLP) Site Assessments. However, to support both the initial and detailed technical assessment of sites, a number of elements of the Level 1 SFRA have been updated.

This SFRA Addendum has been prepared in accordance with the National Planning Policy Framework[1] (NPPF) and supporting Planning Practice Guidance[2] (PPG).

1.2 Aims and Objectives

The purpose of the SFRA Addendum is to collate and present flood risk information that has been updated since the preparation of the original Level 1 SFRA in 2015, for use by OCC to facilitate the assessment of potential minerals and waste development sites.

In order to achieve this, the SFRA Addendum will provide the following updates to the original Level 1 SFRA:

- Update the fluvial flood risk mapping including the Environment Agency Flood Zones 2 and 3, Flood Zone 3b derived from hydraulic modelling outputs, and modelled flood outlines including allowances for climate change.
- Update mapping to include any further historic flooding records that have occurred since the original Level 1 SFRA was published.

This SFRA Addendum will enable OCC to complete the initial site assessments and apply a sequential approach to the selection of sites.

[1] https://www.gov.uk/government/publications/national-planning-policy-framework--2 19 February 2019
[2] https://www.gov.uk/government/collections/planning-practice-guidance

2. Updated datasets

2.1 Flood Zones

The Environment Agency's Flood Map for Planning (Rivers and Sea)[3] assesses the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in **Error! Reference source not found.**.

The latest Environment Agency Flood Zones 2 and 3 outlines have been obtained from the Environment Agency Data Catalogue and are presented in Figures 1A to 1E included in Appendix A.

Table 2-1 Fluvial Flood Zones (extracted from the PPG[4] 2014)

Flood Zone	Flood Zone Definition for River Flooding	Probability of Flooding
Flood Zone 1	Land having a less than 1 in 1,000 chance of river flooding each year (<0.1% annual exceedance probability (AEP)). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1 in 100 and 1 in 1,000 chance of river flooding each year (between 1% and 0.1% AEP).	Medium
Flood Zone 3a	Land having a 1 in 100 or greater chance of river flooding each year (greater than 1% AEP).	High
Flood Zone 3b	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Environment Agency Flood Map).	Functional Floodplain

A large proportion of the County is located in areas that have a Medium and High probability of flooding from rivers (i.e. Flood Zones 2 and 3). The flood maps in Figure 1 and 1A-1E show the extent of flooding from the main rivers in the County. The floodplain of the River Thames poses the greatest risk of flooding, affecting the western and central part of the County. The River Ock flows from west to east through the district of the Vale of White Horse. The floodplains associated with the River Ock affects the towns of Abington and Marcham. A significant area of Flood Zone 2 and 3 is also present along the River Ray, to the south of Bicester.

As defined in the original Level 1 SFRA (2015), Flood Zone 3b Functional Floodplain is defined as:

> Land where water has to flow or be stored in times of flood based on flood modelling of a 5% AEP event (1 in 20 chance of flooding in any one year) or greater, or land purposely designed to be flooded in an extreme flood event (0.1% AEP). Where detailed modelling is not available, it is assumed that the extent of Flood Zone 3b is equal to Flood Zone 3a.

For the modelled watercourses in the County (further described in Section 2.2 and Appendix B), the 5% AEP (1 in 20 year) outputs have been used to delineate Flood Zone 3b Functional Floodplain within the maps in Appendix A Figure 1 and Figures 1A-1E.

2.2 Flood Modelling Studies

The Environment Agency's 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling (JFLOW) and is routinely updated and revised using results from the Environment Agency's ongoing programme of more detailed river catchment studies. The studies can include topographic

[3] https://flood-map-for-planning.service.gov.uk/
[4] https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

surveys and hydrological and/or hydraulic modelling as well as incorporating information from recorded flood events.

A large number of hydraulic modelling studies have been undertaken across Oxfordshire. Appendix B provides a summary of the hydraulic modelling studies that have been undertaken for the Main Rivers in Oxfordshire and used to inform the Environment Agency's Flood Map for Planning (Rivers and Sea).

The outputs from the modelling studies have been used to define the areas of Functional Floodplain (Flood Zone 3b) within the County and areas at risk of flooding due to climate change.

The scope of these modelling studies typically covers flooding associated with Main Rivers, and therefore Ordinary Watercourses that form tributaries to the Main Rivers may not always be included in the model. Modelling of Ordinary Watercourses available on the Flood Map for Planning (Rivers and Sea) may be the result of the national generalised JFLOW modelling carried out by the Environment Agency and may need to be refined when determining the probability of flooding for an individual site and preparing a site-specific FRA. The outputs of any available ordinary watercourse modelling have also been provided by the Environment Agency for use in this study.

2.3 Climate Change

The NPPF and supporting PPG sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. This includes demonstrating how flood risk will be managed now and over the lifetime of development, taking climate change into account.

In SFRAs and site specific Flood Risk Assessments published pre 2016, an allowance of 20% was added to the 1 in 100 year (1% AEP) return period to account for increases in flood risk due to climate change. In February 2016, the Environment Agency published revised guidance on climate change allowances[5] including predictions of anticipated change for:

- Peak river flow by river basin district;
- Peak rainfall intensity;
- Sea level rise;
- Offshore wind speed and extreme height.

The guidance reflects an assessment completed by the Environment Agency between 2013 and 2015 using United Kingdom Climate Projections 2009 (UKCP09) data to produce more representative climate change allowances across England. The full guidance can be found using the following link to the .gov.uk website and is discussed further below. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

Climate change allowances applicable to the Oxfordshire County (Thames River Basin District) are set out in Table 2-2**Error! Reference source not found.**.

Table 2-2 Peak River Flow Allowances for Thames River Basin District

River Basin District	Allowance Category	Total potential change anticipated for the '2020's (2015 to 2039)	Total potential change anticipated for the '2050's (2040 to 2069))	Total potential change anticipated for the '2080's (2070 to 2115)
Thames	Upper End	25%	35%	70%
	Higher Central	15%	25%	35%
	Central	10%	15%	25%

**'Allowances' in this context is the amount as a % that is added to estimated peak river flows to account for climate change increases.*

[5] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

2.3.1 Strategic planning

For the purposes of strategic planning and completion of the Sequential Test, OCC are advised to use the '2070 to 2115' 100 year development lifetime outlined in Table 2-3. This correlates to a climate change range of impacts of between + 25% and + 70% on the modelled 1 in 100 year flood extent (1% AEP).

Hydraulic models that have been developed since 2016 have applied these revised climate change allowances. However, for modelling studies that have not yet been updated, only the 1% AEP including 20% climate change allowance is available. In the absence of updated hydraulic modelling for the 1% + 70% Climate change (Flood Zone 3 + CC), the extent of Flood Zone 2 presented in Figures 1A – 1E should be used as a proxy.

Table 2-3**Error! Reference source not found.** identifies which climate change allowances are available for each of the modelled watercourses in Oxfordshire. These have been mapped in Appendix A Figure 2 and 2A-2E.

Table 2-3 Climate Change allowances for each modelled watercourse

Modelled Watercourse	Climate Change allowances applied
Thames Eysham to Sandford	1% AEP +25%, 35%, and 70% climate change event.
Ock East Hanney to Thames Confluence	
Ginge Brook	
Thames Sandford to Mapledurham	
River Windrush, Worsham to Witney (A40)	
Windrush	1% AEP +20% climate change event.
Letcombe Brook	
Moor Ditch to Thames Confluence	
Thames MLR to St Johns	
Thames (Shifford to Eynsham and Windrush), Thames St John's to Shifford	
Stert A40 to Thames Confluence	
Assendon Stream	
Mill and Bradfords Brook	
Chalgrove Brook	
River Cherwell, Thrupp Bridge to Thames Confluence	
Chill Brook	
Clanfield Brook	
Moor Ditch and the Ladygrove Brook	
Moor Ditch, Ladygrove Brook and the Hakkas	
Bledington Brook	
River Evenlode and the Littlestock Brook	
Langford Brook, Pingle Stream, Bure Brook (Town Brook) and Back Brook.	
Boundary Brook	
Northfields and Littlemore Brooks	
Wendlebury Brook	
River Windrush	
Hailey Road Drain	

2.3.2 Site Specific Flood Risk Assessments

When considering which climate change allowance should be applied for a specific development site, consideration should be made of the flood zone in which the site is located, the vulnerability classification of the proposed development, and the lifetime of the proposed development.

Table 2 in the PPG[6] sets out the flood risk vulnerability classifications for proposed uses. Those that could be of relevance to minerals and waste management sites have been extracted and presented in Table 2-4.

Table 2-4 Flood risk vulnerability classifications for minerals and waste uses

Vulnerability classification	Description
Essential Infrastructure	Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
Highly Vulnerable	Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More Vulnerable	Landfill* and sites used for waste management facilities for hazardous waste.
Less Vulnerable	Waste treatment (except landfill* and hazardous waste facilities). Minerals working and processing (except for sand and gravel working). Water treatment works which do not need to remain operational during times of flood. Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water Compatible	Sewage transmission infrastructure and pumping stations. Sand and gravel working.

** Landfill is as defined in Schedule 10 of the Environmental Permitting (England and Wales) Regulations 2010.*

The range of climate change allowances that should be considered as part of a site specific FRA for a proposed development is shown in Table 2-5.

Table 2-5 Using peak river flow allowances for flood risk assessments

Vulnerability classification	Flood Zone	Climate change allowance *(refer to Error! Reference source not found. and select allowance in accordance with the lifetime of the proposed development)*
Essential Infrastructure	2	Higher central and upper end
	3a	Upper end
	3b	Upper end
Highly Vulnerable	2	Higher central and upper end
	3a	Development should not be permitted.
	3b	Development should not be permitted.
More Vulnerable	2	Central and higher central
	3a	Higher central and upper end
	3b	Development should not be permitted.
Less Vulnerable	2	Central
	3a	Central and higher central
	3b	Development should not be permitted.
Water Compatible	2	None
	3a	Central
	3b	Central

2.4 Historic Flooding

The Environment Agency has provided their 'Historic Flood Map' which shows the maximum extent of all individual recorded flood outlines (from rivers, the sea and groundwater springs) and shows areas of land that have previously been subject to flooding in England. This data has been mapped in Appendix A Figure 3.

[6] https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-2-Flood-Risk-Vulnerability-Classification

Locations where flood defences are present are mapped in Appendix A Figure 3. Existing flood defences offer varying levels of protection and any proposed development within areas shown to have a flood history should investigate this risk further as part of a site specific flood risk assessment.

AECOM Position Statement – March 2019

AECOM are currently awaiting any historic flooding data from the Lead Local Flood Authority (Oxfordshire County Council). This section will be updated on receipt of this data.

2.5 Mineral and Waste Sites

OCC have provided the following GIS layers showing the minerals and waste sites under consideration:

- Soft Sand sites
- Crushed Rock sites
- Sharp Sand and Gravel sites
- Waste sites

The site boundaries are included in the mapping in Appendix A to enable the application of the Sequential Test by OCC.

The majority of sites are likely to be for Less Vulnerable or Water Compatible uses and will therefore be considered appropriate in accordance with the NPPF. Table 2-6 from the PPG sets out where the Exception Test and further consideration of flood risk issues may be required.

Table 2-6 Flood risk vulnerability and flood zone compatibility (PPG 2014)

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test Required	✓	✓
	3a	Exception Test Required	✓	×	Exception Test Required	✓
	3b	Exception Test Required	✓	×	×	×

3. Summary

The latest Flood Zones 2 and 3 outlines have been obtained from the Environment Agency and mapped in Appendix A Figure 1.

Hydraulic modelling outputs have been obtained from the Environment Agency for all available watercourses and used to map Flood Zone 3b Functional Floodplain in Appendix A Figure 1.

Hydraulic modelling outputs have been obtained from the Environment Agency for all available watercourses and used to map the risk of flooding including allowances for climate change in Appendix A Figure 2. A variety of outputs are available. Where climate change allowances are not available, the extent of Flood Zone 2 (available in Appendix A Figure 1) should be used as a conservative estimate of the impact of climate change until more modelling is undertaken or becomes available.

The latest Historic Flood Map has been obtained from the Environment Agency and mapped in Appendix A Figure 3.

The minerals and waste sites have been overlaid on the mapping to enable the application of the Sequential Test by OCC. Further assessment of these sites may be required to inform the application of the Exception Test, where required.

Appendix A Maps

Figure Number	Title
1, (1A – 1E)	Flooding from Rivers
2 (2A – 2E)	Flooding from Rivers, including climate change allowances
3	Historic Flood Map

Appendix B Flood Modelling Studies

B.1 Flood modelling studies that have informed the mapping included in Appendix A

Watercourse	Model area	Modelling Study
Thames Eysham to Sandford	The model area covers approximately 19km of the River Thames from its confluence with the River Evenlode to downstream of Sandford Lock and the River Cherwell from the A40 to its confluence with the River Thames.	CH2M, 2018, Oxford Baseline Hydraulic Modelling Report Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +25, 35, and 70% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Ock East Hanney to Thames Confluence	The model area covers 60km of the River Ock from a number of upstream tributaries to its confluence with the River Thames, just downstream of Abingdon.	CH2M, 2017, Abingdon Flood Schemes - River Ock Modelling Report Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +25, 35, and 70% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
River Cherwell and the Oxford Canal	The model area encompasses the River Cherwell from upstream of Cropredy to Kings Sutton, covering a distance of approximately 15km. Tributaries of the River Cherwell from Chacombe Stream, Hanwell Brook, Moorfield Drain and Farthinghoe Stream have been represented. The Oxford Canal, running north to south almost parallel to the River Cherwell and passing through Banbury, has also been considered in this study.	Mott MacDonald, 2015, Banbury Flood Alleviation Scheme Model Update Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Ginge Brook	The Ginge Brook is a small tributary of the River Thames, with a catchment area of approximately 40km^2. The watercourse rises at East Ginge, to the south-east of Wantage, before flowing in a northerly direction into the River Thames just upstream of Culham Weirs.	JBA, 2018, Ginge Brook, Steventon Modelling Study Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +25, 35, and 70% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Thames Sandford to Mapledurham	The model area covers 58km of the River Thames from the railway upstream of Sandford Lock to Reading Bridge.	CH2M, 2017, Abingdon Flood Schemes - River Thames Modelling Report Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +25, 35, and 70% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
River Windrush, Worsham to Witney (A40)	The model area extends from the Worsham gauging station to the downstream of the A40. The model area also includes the new Woodford Mill Fish Bypass channel in Witney.	CH2M Hill, 2014, Post 2007 ABD – Windrush: Worsham to Witney (A40) Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +25, 35, and 70% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline). The model extents provided are from the undefended scenario.
Windrush	The model area extends from the Worsham gauging station to the A40 downstream of Witney.	CH2M, 2014, Post 2007 ABD – Windrush: Worsham to Witney (A40) Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event.

		Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline). The model extents provided are from the undefended scenario.
Letcombe Brook	The Letcombe Brook has been modelled from its upstream limits at Letcombe Bassett, to its downstream limit at Halls Lane, East Hanney. The Humber Ditch tributary is also modelled from its source to the west of Charlton Village Road to the confluence with Letcombe Brook.	Faber Maunsell Limited, 2009, Letcombe Brook SFRM Hydraulic Modelling Report Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Moor Ditch to Thames Confluence	The model area includes the Moor Ditch which flows from Milton in an easterly direction, through Milton Park and Didcot Power Station, before turning north to flow to the Thames at Long Wittenham. A number of tributaries flow into the Moor Ditch including the Ladygrove Brook and the Hakkas Brook. These have been modelled as part of the study.	HR Wallingford, 2007, Letcombe Brook SFRM Hydraulic Modelling Report Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Thames MLR to St Johns	The modelled area considers the Upper Thames, from its source to Buscot weir. The flood model also covers 27 named watercourses that are tributaries to the River Thames.	Halcrow, 2013, Draft Modelling Report Thames Main River Limit to St John's Modelling and Mapping. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Thames (Shifford to Eynsham and Windrush), Thames St John's to Shifford	The modelled area includes the length of the River Windrush and a number of small tributaries.	Halcrow, 2010, Thames: St Johns to Evenlode Confluence Flood Risk Mapping Study (TH001). Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Stert A40 to Thames Confluence	The model extent of the River Stert starts upstream of the A34 to its confluence with the River Thames.	Black and Veach, 2011, Technical Memorandum Abingdon FAS modelling. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Assendon Stream	The modelled area extends from the upstream side of Middle Assendon to its confluence with the River Thames at Phyllis Court, Henley-on-Thames.	JBA, 2014, Assendon Stream - Modelling, Mapping and Hydrology. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Mill and Bradfords Brook	The model area extent for the Mill and Bradford's Brook extends from upstream of Hithercroft Road crossing to its confluence with River Thames.	JBA, n.d, Mill and Bradfords Brook- Hydrology Report. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Chalgrove Brook	The model extends from upstream of the three watercourses that pass through Watlington (Willow ponds, Horse pond and south of the school and college) the downstream of Watlington close to Watlington Mill.	Environment Agency, 2014, Initial Assessment Watlington Flood Alleviation. Note for the purposes of mapping, Appendix A map 4 illustrates

		the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
River Cherwell, Thrupp Bridge to Thames Confluence	The model area extends from Thrupp railway bridge in Thrupp to the River Thames confluence at Oxford.	Peter Brett Associates, 2005, Lower Cherwell Flood Risk Mapping. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Chill Brook	The model area for the Chill Brook extends from south of the A42 (SP416101) to the confluence with Warf Stream at Oxford Road (to the south of Eynsham).	CH2M Hill, 2014, Post 2007 ABD – Chill Brook. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Clanfield Brook	The modelled area of the Clanfield Brook covers the watercourse from upstream of the village of Clanfield to the confluence with Broadwell Brook.	JBA Consulting, 2007, Clanfield Flood Risk Mapping Study. Note for the purposes of mapping, updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Moor Ditch and the Ladygrove Brook	The modelled location is for a site to the north of Didcot which extends from the north of the A4130 to the south of the B4016.	Glanville, 2014, Hydraulic Modelling Report Land at North East Didcot. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Moor Ditch, Ladygrove Brook and the Hakkas	The modelled area for this watercourse includes two areas, the Moor Ditch catchment and the Hakkas Brook catchment. The Moor Ditch flows from Milton in an easterly direction, through Milton Park and Didcot Power Station, before turning north to flow to the Thames at Long Wittenham. A number of tributaries to the Moor Ditch have also been included within the model area. The Hakkas Brook catchment, which rises to the west of West Hagbourne, and runs in an easterly direction to join the Mill Brook near South Moreton.	HR Wallingford, 2007, Strategic Flood Risk Assessment for Didcot- Hydraulic Modelling Report. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Bledington Brook	The Bledington Brook modelled area is from its source along the eastern edge of the village of Bledington down to its confluence with the River Evenlode.	JBA Consulting, 2012, Bledington Brook Flood Risk Mapping Study. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
River Evenlode and the Littlestock Brook	The modelled area includes the River Evenlode and the Littlestock Brook. The River Evenlode flows from the north-west through the village of Shipton-under Wychwood. It then changes course and flows in a north easterly direction through Ascott – under Wychwood towards Charlbury. The Littlestock Brook is a tributary of the River Evenlode and flows from the west of the study area, through Milton under Wychwood to its confluence with the Evenlode at the edge of Shipton under Wychwood. Another tributary of the River Evenlode, Coldwell Brook flows from the south, joining the Evenlode at Ascott – under – Wychwood.	Halcrow, 2012, Wychwood Flood Risk Mapping. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).

Langford Brook, Pingle Stream, Bure Brook (Town Brook) and Back Brook.	The watercourses included within the model study area are the Langford Brook, Pingle Stream, Bure Brook (Town Brook) and Back Brook. The modelled area extends from the source of these watercourses to the confluence with the River Ray.	Peter Brett Associates, 2009, Bicester Flood Risk Mapping Study. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Boundary Brook	The modelled area of the Boundary Brook covers the watercourse from its source, south of Girdleston Lane and Old Road to the confluence with the River Thames.	Monson, 2009, Boundary Brook Flood Mapping Report. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Northfields and Littlemore Brooks	The modelled areas included within the study are the Langford Brook, Pingle Stream, Bure Brook (Town Brook) and Back Brook. These watercourses have been modelled from their source to the confluence with the River Ray.	Halcrow, 2011, Littlemore and Northfield Brooks Flood Risk Mapping Update. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Wendlebury Brook	The modelled watercourses within the study include the Wendlebury Brook and the Gagle Brook. The Wendlebury Brook rises due west of Chesterton and flows in south-eastern direction before its confluence with the River Ray. The modelled area of these watercourses is the village of Wendlebury.	JBA Consulting, 2013, Wendlebury Brook Flood Risk Mapping Study. Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
River Windrush	The modelled area of the River Windrush extends along the western edge of the village of Boughton on the Water. The upstream inflow is located south of the A429 (to the north of Boughton on the Water). The downstream boundary is located at the confluence between the River Windrush and the River Dickler.	CH2M Hill, 2014, Post 2007 ABD – Bourton on the Water Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline).
Hailey Road Drain	The modelled area of the Hailey Road Drain extends from the upstream inflows to the north east of Eastfield Road and through a number of manholes on Hailey Road. The downstream boundary is located at Bridge street at the confluence with the River Windrush.	CH2M Hill, 2014, Post 2007 ABD – Hailey Road Drain Note for the purposes of mapping, Appendix A map 4 illustrates the 1% AEP +20% climate change event. Updated modelling is also used to delineate Flood Zone 3b (1 in 20 year (5%) flood outline). The model extents provided are from the undefended scenario.

aecom.com