Milton Keynes City Council – Level 1 Strategic Flood Risk Assessment

Final Report

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Milton Keynes City Council

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Contract

This report describes work commissioned by Milton Keynes City Council, in an email dated 08 July 2022. Milton Keynes City Council's representatives for the contract was Sabina Kupczyk. Lucy Archer-Lock, Erica Skinner and Jon Wilson of JBA Consulting carried out this work.

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Purpose

This document has been prepared as a Final Report for Milton Keynes City Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Milton Keynes City Council.

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JBA would like to acknowledge Milton Keynes City Council, the Environment Agency, Bedford Group of Drainage Boards, planners at the neighbouring authorities and Anglian Water for their assistance in producing this SFRA.

Carbon footprint

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Executive summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the preparation of the new Local Plan - New City Plan and associated Planning Policy documents using the best available information. This Level 1 Strategic Flood Risk Assessment (SFRA) can be used to inform the Local Plan on the location of future development and the preparation of sustainable policies for the long-term management of flood risk, provided the potential implications of the recent changes to the Planning Practice Guidance (PPG) are understood.

Introduction

To support the preparation of a new Local Plan for Milton Keynes City Council, the key objectives of the assessment are:

- To provide an up-to-date SFRA that will be used in the decision making process for future development proposals in Milton Keynes administrative area.
- To collate and analyse the latest available information and data for current and future (i.e. climate change) flood risk from all sources, and how these may be mitigated.
- To inform decisions in the emerging New City Plan, including the selection of development sites and planning policies.
- To provide evidence to support the application of the Sequential Test for the allocation of new development sites, to support Milton Keynes City Council's preparation of the new Local Plan.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the emerging Local Plan.
- To provide advice for applicants carrying out site-specific Flood Risk Assessments and outline specific measures or objectives that are required to manage flood risk.

Summary of flood risk in Milton Keynes administrative area

Parts of the Milton Keynes administrative area are at risk of flooding from the following sources: fluvial, surface water, groundwater, sewers, reservoir inundation and canal overtopping/breaches. This study has shown that the most significant sources of flood risk in Milton Keynes administrative area are fluvial and surface water.

- *Fluvial flood risk:* The primary fluvial flood risk in Milton Keynes administrative area is along the River Great Ouse and its tributaries, including the River Ouzel and River Tove. Areas where there are properties at risk from Main River flooding include Newport Pagnell, New Bradwell, Bletchley and Water Eaton and Stony Stratford. Key areas at risk of flooding from ordinary watercourses include Bletchley, Lavendon, Stoke Goldington, Tathall End and Walton Park.
- *Surface water flood risk:* The Risk of Flooding from Surface Water map shows a number of prominent overland flow routes; these predominantly follow topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas. There are also considerable flow routes following the roads through the main urban areas of Milton Keynes administrative area which alongside isolated areas of ponding affect many properties across these settlements. Within Milton Keynes administrative area Bletchley is designated as a Flood Risk Area within the 2018 Environment Agency Preliminary Flood Risk Assessment due to surface water flooding.

- *Sewer flood risk*: The 2,342 Anglian Water sewer historic flooding data points provided are shown to be dispersed across Milton Keynes administrative area. These are mostly from foul sewer, but there are also combined sewer and surface sewer records. Within the administrative area the majority of points are located within the southern half of the boundary in the town centre, with smaller clusters in the north in Castlethorpe, Hanslope, Ravenstone, Olney and Sherington.
- *Groundwater flood risk:* JBA's Groundwater Flood Risk map shows the areas with the highest risk of groundwater emergence generally follow the flow paths of the major watercourses in Milton Keynes administrative area, particularly along the River Great Ouse and its tributaries such as the River Ouzel, and areas of low-lying topography. Across the majority of the administrative area of Milton Keynes, the risk of groundwater flooding is considered to be low due to the nature of the local geological deposits.
- *Canal flood risk*: The Grand Union Canal flows through Milton Keynes administrative area. This has the potential to interact with other watercourses and become flow paths during flood events or in a breach scenario. There have been 2 recorded incidents of breach and 2 of overtopping on the Grand Union Canal.
- *Reservoir flood risk:* There is a potential risk of flooding from reservoirs both within the administrative area and those outside. The level and standard of inspection and maintenance required under the Reservoirs Act (1975) means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant).

Defences

The Flood Map for Planning was updated in December 2022 to remove the 'Areas Benefiting from Defences' (ABD). This has been superseded by a dataset called 'Reduction in Risk of Flooding from Rivers and Sea due to Defences'. This shows areas where there is a reduction in flood risk due to defences, taking into account the condition the defences are in. This shows areas of reduced risk not removed risk. This means there are areas within the risk reduction extent that may still flood in a design event. Areas within the administrative area of Milton Keynes shown in the dataset are located in Newport Pagnell, Willen, Woolstone and at Caldecotte Lake.

The Environment Agency 'AIMS' spatial flood defence dataset gives further information on all flood defence assets within the administrative area. Mapping showing the condition and design standards of existing flood defences in Milton Keynes administrative area can be found in Appendix I; this information is derived from the Environment Agency's Spatial Flood Defences dataset. Other than natural high ground, there are few defences within the administrative area of Milton Keynes contained in the AIMS flood defence layer. There is a section of embankment on the east bank of Willen Lake and along the River Ouzel just to its south in Walton. In Newport Pagnell, there are some embankments, walls and bridge abutments along the River Ouzel.

Surface water and foul sewer networks were incorporated into the original design of Milton Keynes administrative area to drain the urban area in the south. Surface water sewers drain the highways infrastructure and residential and commercial areas through a strategic sewer and balancing lake network. These play an important role in managing surface water and main river flood risk. The balancing lakes, which act as flood storage areas, are maintained by Anglian Water. The linear parks that link the network of balancing lakes are owned by Milton Keynes City Council but leased to the Parks Trust on a 999 year lease.

The Anglian River Basin District FRMP also mentions that flood defences have been constructed in Stoke Goldington and Tathall End, and Anglian Water have installed a larger sewer on Wolverton Road, Newport Pagnell to reduce flooding in this area.

Development and flood risk

The Sequential and Exception Test procedures that should be used in Local Plans and Flood Risk Assessments have been documented, along with guidance for planners and developers. Links have been provided for various guidance documents and policies published by other Flood Risk Management Authorities such as the Lead Local Flood Authority and the Environment Agency.

When necessary, development and redevelopment within Milton Keynes administrative area will require a Flood Risk Assessment appropriate to the scale of the development and to the scope as agreed with the Lead Local Flood Authority and/or Environment Agency. Flood Risk Assessments should consider flood risk from all sources including residual risk, along with promotion of Sustainable Drainage Systems to create a conceptual drainage strategy and safe access/egress at the development in the event of a flood. Latest climate change guidance (last updated in May 2022) should also be taken into account, for the lifetime of developments. Planners and developers must ensure that modelling in line with the most up to date Environment Agency climate change guidance has been run.

How to use this report

Planners

This Level 1 SFRA 2024 replaces the 2015 document published as part of the evidence base for the preparation of Plan:MK. The 2024 SFRA informs the preparation of the New City Plan being developed. The report has updated the content that was included in the previous SFRA to provide appropriate supporting evidence for the resubmission of the Local Plan. This includes how the cumulative impact of development should be considered.

It provides the latest flood risk data and guidance to inform the Sequential Test and provides guidance on how to apply the Exception Test. The Council can use this information to apply the Sequential Test to strategic allocations and identify where the Exception Test will also be needed. The SFRA will inform the development of local plan policies and it provides mapping of flood zones, including the functional floodplain.

Developers

The SFRA provides guidance for developers, which can be used by development management staff to assess whether site-specific Flood Risk Assessments meet the required quality standard.

For sites that are not strategic allocations, developers will need to use this SFRA to help apply the Sequential Test. For the following sites, whether strategic allocations or windfall sites, developers will need to apply the Exception Test and use information in a site-specific Flood Risk Assessment to inform this test at planning application stage:

- Highly vulnerable and in Flood Zone 2
- Essential infrastructure in Flood Zone 3a or 3b
- More vulnerable in Flood Zone 3a

This is a strategic assessment and does not replace the need for site-specific Flood Risk Assessments (FRA). A Flood Risk Assessment is needed for developments:

- in Flood Zones 2 or 3

- more than 1 hectare in Flood Zone 1
- less than 1 hectare in Flood Zone 1, including a change of use in development type to a more vulnerable class, where they could be affected by sources of flooding other than rivers and sea (for example surface water or reservoir flooding)
- all sites highlighted as being at high risk from surface water flooding, or which are located within a Critical Drainage Catchment (CDC), which represent areas or catchments across the administrative area of Milton Keynes at greatest risk of surface water flooding, as identified in the Milton Keynes Surface Water Management Plan. In this case the FRA will be required to demonstrate that the development will not increase the flood risk to the CDC and where possible will provide an improvement to the existing situation. Also it is noted that an FRA is required at Critical Drainage Areas (CDAs), as defined under the Development Management Procedure Order (2015), although at the time of preparation of the SFRA it is understood that there are no such designations in the Milton Keynes administrative area.
- land identified in an SFRA as being at increased risk in the future

Plan:MK Policy Fr1 Managing Flood Risk sets out that all new development must incorporate a surface water drainage system with acceptable flood control and demonstrate that water supply, foul sewerage and sewage treatment capacity is available or can be made available in time to serve the development. Suitable access is safeguarded for the maintenance of water supply and drainage infrastructure.

Developers can use the information in this SFRA, alongside site-specific research to help scope out what additional work will be needed in a detailed FRA. To do this, they should refer to Chapter 4, Chapter 6 and the attached Appendices (PDF mapping). At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances, last updated in May 2022), inform masterplanning and demonstrate, if required, that the Exception Test is satisfied. As part of the Environment Agency's updated guidance on climate change, which must be considered for all new developments and planning applications, developers will need to undertake a detailed assessment of climate change as part of the planning application process when preparing FRAs.

Developers need to ensure that new development does not increase surface water runoff from a site or contribute to cumulative effects at sensitive locations, see Section 7. Section 9 provides information on the surface water drainage requirements of the Lead Local Flood Authority (LLFA). Sustainable Drainage Systems should be considered at the earliest stages that a site is developed which will help to minimise costs and overcome any site-specific constraints.

Site-specific Flood Risk Assessments will need to identify how flood risk will be mitigated to ensure the development is safe from flooding. In high-risk areas, the site-specific Flood Risk Assessment will also need to consider emergency arrangements, including how there will be safe access and escape routes from the site. The PPG indicates that safe access considerations should include the voluntary and free movement of people during a 'design flood', as well as the potential for evacuation before a more extreme flood, considering the effects of climate change for the lifetime of the development.

Residual risk is the risk that remains after mitigation measures are considered. The residual risk includes the consideration of flood events that exceed the design thresholds of the flood defences or circumstances where there is a failure of the defences, e.g. flood banks collapse. Residual risks should be considered as part of site-specific Flood Risk Assessments.

Any developments where the risk of flooding from rivers (and sea) is potentially reduced by flood risk management measures and where the standard of protection is not of the required standard (either now or in the future) should be identified and the use of developer contributions considered to fund improvements.

Neighbourhood plans

The SFRA provides:

- Information on the sources of flooding and the variation in the risk across the administrative area .
- Identification of organisations that are involved in flood risk management and their latest strategic plans and plans for major flood defences.
- The requirements for detailed Flood Risk Assessments and to inform the site selection process.

Neighbourhood planning groups can use this information to assess the risk of flooding to sites within their community, using Section 4, the sources of flooding in the Milton Keynes administrative area and the flood mapping in the appendices. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas. Similarly, all known available recorded historical flood events for the administrative area are listed in Section 4.1.1 and this can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing flood alleviation schemes are outlined in Section 6 and Section 8.3 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

Cumulative Impact Assessment

A cumulative impact assessment has been carried out and has identified which catchments within Milton Keynes administrative area are more sensitive to the cumulative impact of development and where more stringent policy regarding flood risk is recommended. Any development in these areas should seek to contribute to work that reduces wider flood risk in those catchments.

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Abbreviations and Glossary of Terms

Term	Definition
1D model	One-dimensional hydraulic model
2D model	Two-dimensional hydraulic model
ABD	Areas Benefitting from Defences. This dataset has now been retired and is superseded by a new dataset called: Reduction in Risk of Flooding from Rivers and Sea due to Defences.
AEP	Annual Exceedance Probability – The probability (expressed as a percentage) of a flood event occurring in any given year.
AStGWf	Areas Susceptible to Groundwater flooding
Blue Infrastructure	Blue infrastructure includes green roofs and walls, sustainable drainage systems (SuDS). It includes rivers, streams, canals, and other water bodies encapsulating the wider hydrological aspects of physical geography within the environment.
Brownfield	Previously developed land is that which is or was occupied by a permanent structure (excluding agricultural or forestry buildings) and associated fixed-surface infrastructure.
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CDA	Critical Drainage Area - A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure. These locations are formally identified and defined by the Environment Agency under the Development Management Procedure Order (2015).
CDC	Critical Drainage Catchments - Milton Keynes Surface Water Management Plan (2016) identified 13 critical drainage catchments (CDCs), through an initial risk assessment, which represent areas or catchments across the administrative area of Milton Keynes at greatest risk of surface water flooding.
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Cumecs	The cumec is a measure of flow rate. One cumec is shorthand for cubic metre per second; also m^3/s.
Defra	Department for Environment, Food and Rural Affairs
Design flood	This is a flood event of a given annual flood probability, which is generally taken as: • river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or • tidal flooding with a 0.5% annual probability (1 in 200 chance each year); or

Term	Definition
	• surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), plus an appropriate allowance for climate change. **Paragraph**: 002 Reference ID: 7-002-20220825
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
Exception Test	The Exception Test requires two additional elements to be satisfied (as set out in paragraph 164 of the National Planning Policy Framework) before allowing development to be allocated or permitted in situations where suitable sites at lower risk of flooding are not available following application of the sequential test. It should be demonstrated that: • development that has to be in a flood risk area will provide wider sustainability benefits to the community that outweigh flood risk; and • the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
FAA	Flood Alert Area
FAS	Flood Alleviation Scheme
FCERM	Flood and Coastal Erosion Risk Management
FFL	Finished Floor Level
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Map for Planning	The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Flood and Water Management Act (2010)	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
FWA	Flood Warning Area
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a river

Term	Definition
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWMA	Flood and Water Management Act
FWS	Flood Warning System
GI	Green Infrastructure – GI is a network of multi-functional green space and other green features, urban and rural, which can deliver quality of life and environmental benefits for communities. It includes parks, open spaces, playing fields, woodlands and other semi-natural features such as street trees, allotments, private gardens.
Greenfield	parcel of land not previously developed
Ha	Hectare
Indicative Flood Risk Area	Nationally identified flood risk areas based on the definition of 'significant' flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
LFRMS	Local Food Risk Management Strategy
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
m AOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has permissive powers but not a duty, to carry out maintenance, improvement or construction work on designated main rivers. Landowners are responsible for maintenance.
Milton Keynes Administrative Area	The study area has been referred to throughout the document as Milton Keynes administrative area. The administrative area comprises of 19 wards, covering an area of approximately 300 km^2.
MKCC	Milton Keynes City Council. Milton Keynes gained city status in 2022, and the council therefore changed its name from Milton Keynes Council to Milton Keynes City Council. The Council is referred to as Milton Keynes City Council throughout the document, including for documents which were published before 2022.
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NRD	National Receptor Database
NRIM	National Reservoir Inundation Mapping
NVZs	Nitrate Vulnerability Zones
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.

Term	Definition
PFRA	Preliminary Flood Risk Assessment
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.
RBMP	River Basin Management Plan
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
Riparian owner	A riparian landowner, in a water context, owns or is responsible for land or property, next to a river, stream or ditch. It is assumed, unless explicitly stated in the deeds, that riparian owners will own the watercourse up to the mid-point
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authority (RMA)	Operating authorities who's remit and responsibilities concern flood and/or coastal risk management. These are: Environment Agency, Lead Local Flood Authorities, District and Borough Councils, Coast protection authorities, Water and sewerage companies, Internal Drainage Boards and Highways authorities.
RoFfSW	Risk of Flooding from Surface Water (formerly known as the Updated Flood Map for Surface Water (uFMfSW))
Sequential Test	Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event AEP. For example, a flood embankment could be described as providing a 1% AEP standard of protection.
SPD	Supplementary Planning Document
SPZ	(Groundwater) Source Protection Zone
Stakeholder	A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - A mixture of built and nature-based techniques to mimic natural drainage as closely as possible.

Term	Definition
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan (2016) - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
WFD	Water Framework Directive – Under the WFD, all waterbodies have a target to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP) by a set deadline. River Basin Management Plans (RBMPs) set out the ecological objectives for each water body and give deadlines by when objectives need to be met.

Section guide for users

Section	How to use
Executive Summary	Summarises the Level 1 findings.
1. Introduction	For general information and context.
2. Flood risk policy and strategy	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	Users should use this section to understand and follow the steps required for the Sequential and Exception Tests.
4. Understanding flood risk in Milton Keynes administrative area	This section should be used to understand all sources of flood risk in the administrative area, including where has flooded historically. This section may also help identify any data gaps, in conjunction with Appendices.
5. Impact of climate change	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
6. Flood alleviation schemes and assets	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site-specific stage.
7. Cumulative impact of development and strategic solutions	This section should be used to understand the cumulative impact of development. Planners should use this section to help develop policy recommendations for the cumulative impact of development.
8. Flood risk management for developers	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed, as well as mitigation options.
9. Surface water management and Sustainable Drainage Systems	Developers should use this section to understand what national, regional and local SuDS standards are applicable.
10. Strategic Flood Risk Measures	Developers should use this section to understand strategic flood risk solutions.
11. Level 1 summary assessment of potential development locations	This section should be used to understand flood risk to potential development locations.
12. Summary	Developers and planners should use this as a summary of the SFRA.
13. Recommendations	Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.
Appendices	Users should use this section to understand all sources of flood risk in the administrative area. Planners should use these appendices to understand what data has been used in the SFRA, to inform the application of the Sequential and Exception Tests, as relevant, and to use these maps and tabulated summaries of flood risk to understand the nature and location of flood risk.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

> ***"Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.".***
>
> (National Planning Policy Framework, paragraph 166)

This Level 1 Strategic Flood Risk Assessment (SFRA) 2024 replaces updates the 2015 document, published as part of the evidence base for Plan:MK. The report has updated the content that was included in the previous SFRA and to provide appropriate supporting evidence for preparation of the New City Plan.

The 2024 SFRA update will be used in decision making, to inform the process for location of land for future development and the preparation of sustainable policies for the long-term management of flood risk.

The key objectives of the review performed during the preparation of the 2024 SFRA are:

1. To take into account the latest flood risk policy including the updated PPG.
2. Take into account the latest flood risk information and available data.
3. To provide specific flood risk analyses for sites identified by the Council as part of their Local Plan preparation.
4. To provide comprehensive mapping to support the Local Plan.

1.2 Levels of SFRA

The **Planning Practice Guidance** (PPG) identifies the following two levels of SFRA:

- **Level 1**: All local planning authorities need to produce a Level 1 SFRA. This needs to include enough detail to identify all flood risk areas. The assessment should be of sufficient detail to enable application of the Sequential Test. The Level 1 should be used to attempt to allocate sites in areas of lowest overall flood risk both now and in the future (including other sources of flood risk).
- **Level 2**: where allocations are proposed in flood risk areas (i.e. from any source now and in the future), or where future windfall pressures in flood risk areas are expected. The Level 2 SFRA should be detailed enough to identify which development sites have the least risk of flooding and the application of the Exception Test, if relevant. The above text suggests that the Level 2 SFRA will only be used to assess whether the Exception Test can be passed, and not the Sequential Test.

1.3 SFRA objectives

This Level 1 SFRA is intended to aid the Council in applying the Sequential Test for their site allocations and identifying where the application of the Exception Test may be required as part of a Level 2 SFRA.

The Level 1 assessment will form a key part of the evidence base for the Local Plan and will be compliant with the latest guidance, including the National Planning Policy Framework (NPPF), August 2022 updates to PPG, and Association of Directors of Environment, Economy, Planning & Transport (ADEPT) SFRA guidance[1], and incorporate the best available data at the time of production.

The SFRA will help various parties consider flood risk when making planning decisions about the design and location of any development and flood risk management features and structures.

The objectives of the Level 1 SFRA are to help the Local Planning Authority (LPA) make decisions about:

- the local plan or spatial development strategy
- individual planning applications
- the potential implications of adapting to climate change
- future flood and coastal risk management
- emergency planning (the resources needed to make development safe)
- site masterplans and local design guidance or codes
- infrastructure planning
- community infrastructure levy and planning obligations

It will also support the LPA to:

- carry out the sequential test for the local plan or spatial development strategy
- carry out the sequential test for individual planning applications
- do the exception test for the local plan, when proposing to allocate land for development in flood risk areas
- establish if a development can be made safe without increasing flood risk elsewhere
- decide when a flood risk assessment will be needed for individual planning applications
- identify if proposed development is in functional floodplain
- identify and safeguard from development, land likely to be needed for future flood risk management features and structures
- do the sustainability appraisal of the local plan or spatial development strategy

1 Association of Directors of Environment, Economy, Planning & Transport (2021) Strategic Flood Risk Assessment good practice guide. Available at: Strategic flood risk assessment good practice guide | ADEPT (adeptnet.org.uk)

1.4 SFRA outputs

To meet the objectives, the following outputs have been prepared:

- Identification of policy and technical updates
- Identification of any strategic flooding issues or cumulative effects which may have cross boundary implications
- Appraisal of all potential sources of flooding, including main river, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals
- Review of historic flooding incidents
- Reporting on the standard of protection provided by existing flood risk management infrastructure
- Available mapping showing distribution of flood risk across all Flood Zones from all sources of flooding including climate change allowances
- Assessment of the potential increase in flood risk due to climate change
- Flood Risk Assessment guidance for developers
- Assessment of surface water management issues, how these can be addressed through development management policies and the application of Sustainable Drainage Systems
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk
- Assessment of strategic flood risk solutions that can be implemented to reduce risks

Section 1.8 outlines the structure of the report and who should use which section.

1.5 SFRA study area

Milton Keynes administrative area is located approximately 80 km north-west of London. The administrative area covers an area of approximately 300 km^2 and had an estimated population of approximately 270,000 in 2020[2]. There are 19 wards in the administrative area, the largest of which is Broughton with a population of approximately 18,000[3]. Milton Keynes administrative area was designated as a New Town in 1967, incorporating the existing towns of Stony Stratford, Wolverton, Bletchley and Fenny Stratford. When designated New Town had a population of 40,000 with an intended population of 250,000. By 2031 Milton Keynes will have an approximate population of 345,000.

Milton Keynes has a very high proportion of parks and open space, including linear parks, balancing lakes and detention ponds as part of the strategic drainage network for the design of the city. These measures were incorporated into the original design of the Milton Keynes administrative area, to prevent the development from exacerbating the flood risk in Newport Pagnell and areas downstream. Outside of the city of Milton Keynes, the surrounding area is rural with villages and small towns.

2 Office for National Statistics (November 2021) Ward-level population estimates (Experimental Statistics) (Mid 2020)

3 Office for National Statistics (November 2021) Ward-level population estimates (Experimental Statistics) (Mid 2020)

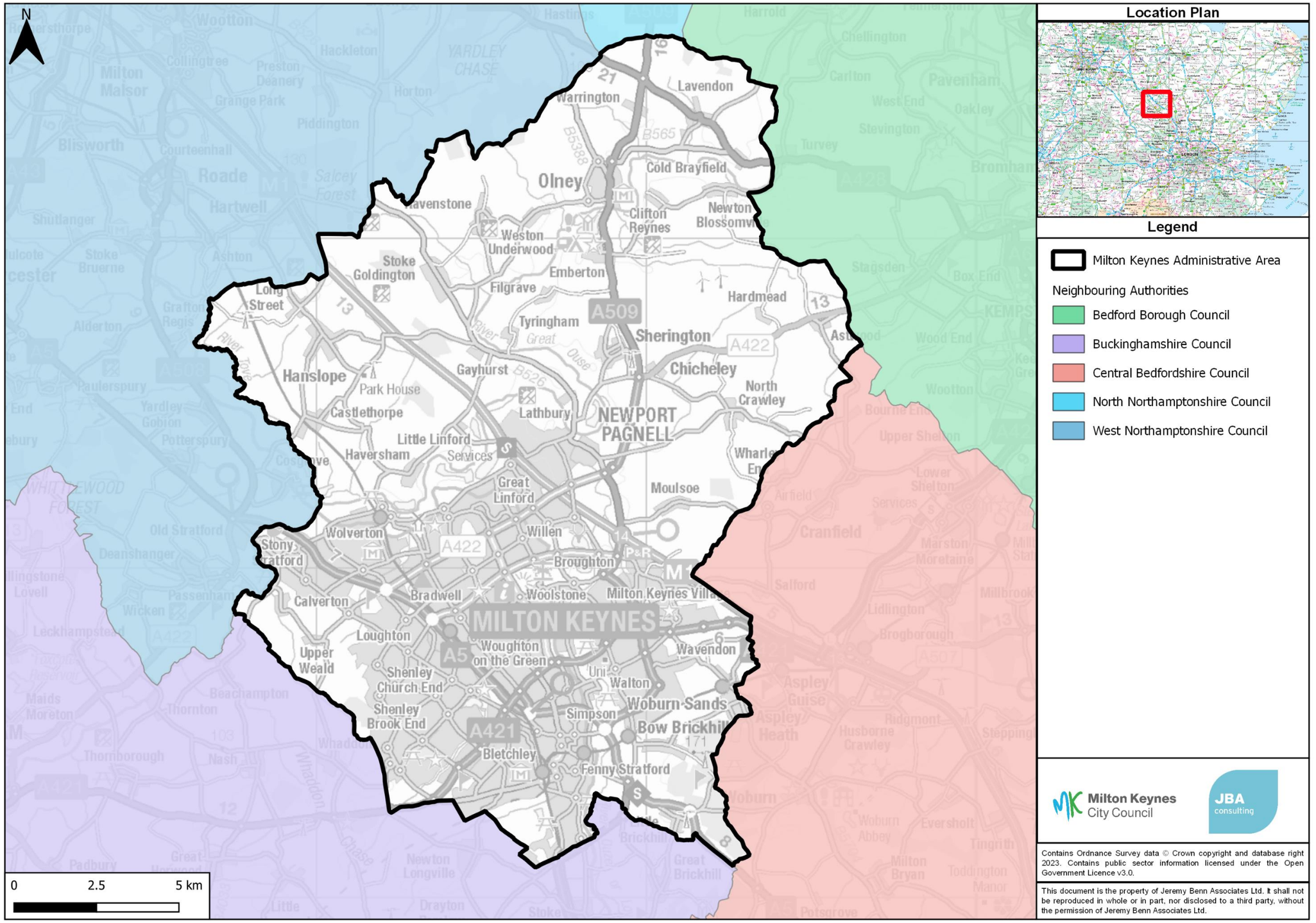

Figure 1-1: Milton Keynes City Council's administrative area and neighbouring authorities

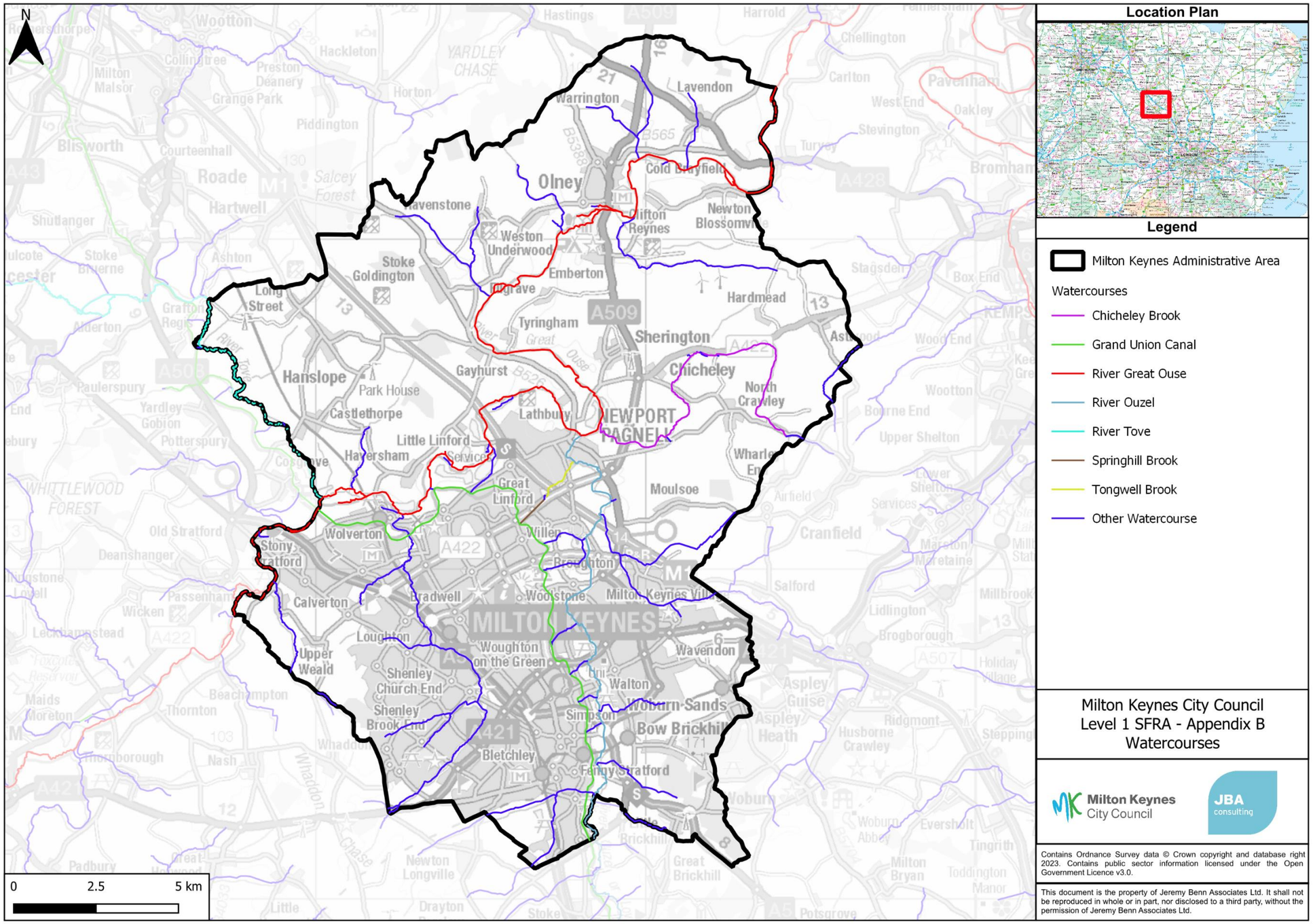

Figure 1-2: Watercourses within the administrative area of Milton Keynes

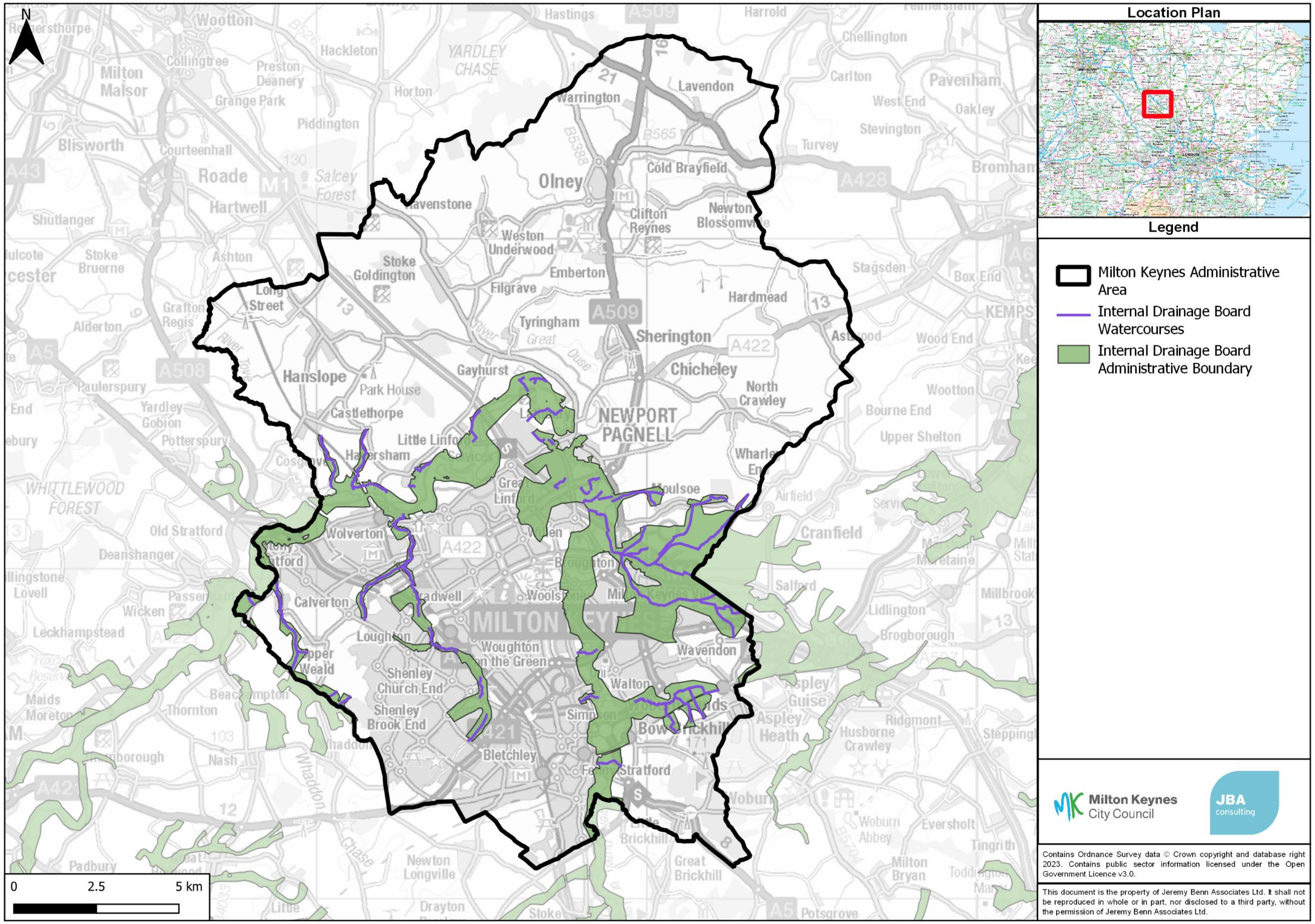

Figure 1-3: The Bedford Group of Drainage Board and key water assets

1.6 Consultation

The following parties (external to Milton Keynes City Council) have been consulted during the preparation of this version of the SFRA:

- Environment Agency
- Milton Keynes City Council (as Local Planning Authority, Lead Local Flood Authority)
- Anglian Water
- Neighbouring authorities (Bedford Borough Council, Buckinghamshire Council, Central Bedfordshire Council, North Northamptonshire Council, West Northamptonshire Council).
- IDB (The Bedford Group of Drainage Boards)
- Buckinghamshire Fire and Rescue Service
- The Parks Trust
- Canal and River Trust

The following engagements took place in production of the Level 1 SFRA:

- Inception Meeting (August 2022)
- Stakeholder Meeting (July 2023)
- Collaboration/ Data requests with the parties listed above.

1.7 Use of SFRA data

Level 1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. The primary purpose is to provide an evidence base to inform the preparation of Local Plans and any future flood risk policies.

Developers will still be required to undertake site-specific Flood Risk Assessments to support Planning Applications. Developers will be able to use the information in the SFRA to scope out the sources of flood risk that will need to be explored in more detail at site level.

Appendix L presents a **SFRA User Guide,** further explaining how SFRA data should be used, including reference to relevant sections of the SFRA, how to consider different sources of flood risk and recommendations and advice for Sequential and Exception Tests.

Advice to users has been highlighted in **amber boxes** throughout the document.

Key reference material such as external guidance documents/ websites are provided in **green** throughout the SFRA.

On the date of publication, the SFRA contains the latest available flood risk information. Over time, new information will become available to inform planning decisions, such as updated hydraulic models (which then update the Flood Map for Planning), updated information on other sources of flood risk or evidence showing future flood risks, new flood event information, new defence schemes and updates to policy, legislation and

guidance. Developers should check the online **Flood Map for Planning** in the first instance to identify any major changes to the Flood Zones. In conjunction with using this SFRA, developers should confirm the latest modelling available with the Environment Agency. If new accepted modelling is available since the SFRA was completed, then this would supersede the SFRA data.

1.8 Structure of this report

The contents of the report are set out according to the following structure:

Section	Contents	How to use
Executive Summary	Focuses on how the SFRA can be used by planners, developers and neighbourhood planners.	Summarises the Level 1 findings.
1. Introduction	Provides a background to the study, the Local Plan stage the SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA. Provides a short introduction to how flood risk is assessed and the importance of considering all sources. Includes this table of the contents of the SFRA.	For general information and context.
2. Flood risk policy and strategy	Sets out the relevant legislation, policy and strategy for flood risk management at a national, regional and local level.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	Provides an overview of both national and existing Local Plan policy on flood risk management. This includes the Flood Zones, application of the Sequential Approach and Sequential/Exception Test process. Provides guidance for Milton Keynes City Council and Developers on the application of the Sequential and Exception Test for both allocations and windfall sites, at allocation and planning application stages.	Users should use this section to understand and follow the steps required for the Sequential and Exception Tests.
4. Understanding flood risk in	Provides an overview of the characteristics of flooding affecting the	This section should be used to understand all sources of

Section	Contents	How to use
Milton Keynes administrative area	study area and key risks including historical flooding incidents, flood risk from all sources and flood warning arrangements.	flood risk in the administrative area, including where has flooded historically. This section may also help identify any data gaps, in conjunction with Appendix A.
5. Impact of climate change	Outlines the latest climate change guidance published by the Environment Agency and how this was applied to the SFRA. Sets out how developers should apply the guidance to inform site-specific Flood Risk Assessments.	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
6. Flood alleviation schemes and assets	Provides a summary of current flood defences and asset management and future planned schemes. Introduces actual and residual flood risk.	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site-specific stage.
7. Cumulative impact of development and strategic solutions	This section provides an introduction to the cumulative impact assessment (CIA).	Planners should use this section to help develop policy recommendations for the cumulative impact of development.
8. Flood risk management for developers	Guidance for developers on Flood Risk Assessments, considering flood risk from all sources.	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed, as well as mitigation options.
9. Surface water management and Sustainable Drainage Systems	An overview of Sustainable Drainage Systems (SuDS), Guidance for developers on Surface Water Drainage Strategies, considering any specific local standards and guidance for SuDS from the Lead Local Flood Authority.	Developers should use this section to understand what national, regional and local SuDS standards are applicable. Hyperlinks are provided.
10. Strategic Flood Risk Measures	Outlines different options which could be considered for strategic flood risk solutions.	Developers should use this section to understand strategic flood risk solutions.

Section	Contents	How to use
11. Level 1 summary assessment of potential development locations	Summarises the flood risk to potential development locations.	This section should be used to understand flood risk to potential development locations.
12. Summary	Summarises sources of flood risk in the study area	Developers and planners should use this as a summary of the SFRA.
13. Recommendations	Outlines planning policy recommendations	Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.
Appendices	Appendix A: Historic flooding Appendix B: Watercourses Appendix C: Flood Zones Appendix D: Fluvial climate change Appendix E: Risk of Surface Water flooding Appendix F: Risk of Surface Water Flooding with climate change Appendix G: Groundwater flooding Appendix H: Reservoir flooding Appendix I: Flood defence Appendix J: Flood warning and alerts Appendix K: Data sources used in the SFRA Appendix L: SFRA user guide Appendix M: Summary of flood risk across the administrative area Appendix N: Site screening Appendix O: Sequential Test recommendation Appendix P: Critical Drainage Catchments Appendix Q: Surface Water Flood Zones	Planners should use these appendices to understand what data has been used in the SFRA, to inform the application of the Sequential and Exception Tests, as relevant, and to use these maps and tabulated summaries of flood risk to understand the nature and location of flood risk.

1.9 Understanding flood risk

The following content provides useful background information on how flooding arises and how flood risk is determined.

1.9.1 Sources of flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and in many different ways. Major sources of flooding include:

- Fluvial (rivers) - inundation of floodplains from rivers and smaller watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- Surface water - surface water flooding is a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network (public sewers, highway drains, etc) or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
- Groundwater - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- Infrastructure failure – the failure or exceedance of a constructed system like reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. Interactions can also occur between different types of flooding. This was evident in the December 2020 flooding that occurred in Milton Keynes administrative area, where the flood event was a combination of river, surface water and groundwater sources. With climate change, the frequency, pattern and severity of flooding are expected to change and become more frequent and more damaging.

1.10 Likelihood and consequence of flood risk

Flood risk is a combination of the likelihood of flooding and the potential consequences arising.

1.10.1 Likelihood

Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates the flood level that is expected to be reached on average once in a hundred years, i.e. it has a 1% chance of occurring in any one year, not that it will occur at least once every hundred years.

Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring.

1.10.2 Consequence

The consequences of flooding include fatalities, property damage, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the characteristics caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding.

Even low level flooding can have significant impacts to people and business and can have long term consequences.

The **Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal** provides a manual of assessment techniques of flood risk management benefits, indirect benefits and coastal erosion risk management benefits. This includes depth damage curves indicating how damages to residential or non-residential vary with flood depth.

1.10.3 Risk

Flood risk is not static and it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above. Low probability events can have significant impacts and therefore have a medium/high risk.

1.10.4 Resilience

Resilience to flood risk describes the capacity of people and places to plan for, better protect, respond to and recover from flooding and coastal change. It includes making the best land use and development choices, protecting people and places, responding to and recovering from flooding and coastal change whilst also adapting to and planning for climate changes we are likely to see over the next 100 years.

Flood risk is constantly changing, and in the context of climate change we are likely to see flooding in areas which have not flooded historically. Approaches to managing flood risk must therefore be able to adapt to changes in our understanding, for example the introduction of non-stationarity fluvial flood frequency estimation into guidance for funding future flood risk reduction projects.

2 Flood Risk policy and strategy

This section sets out the flood risk management roles and responsibilities for different organisations and relevant legislation, policy and strategy.

2.1 Overview of flood risk planning policy in England

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is taken into account at every stage of the planning process. This section of the SFRA provides an overview of the planning framework, flood risk policy and flood risk responsibilities. In preparing the subsequent sections of this SFRA, appropriate planning and policy amendments have been acknowledged and taken into account. A diagram showing strategic planning links and key documents for flood risk can be found in Figure 2-1. It should be noted that the Flood Risk Regulations (2009) that transposed the EU Floods Directive into English Law were revoked as of December 2023.

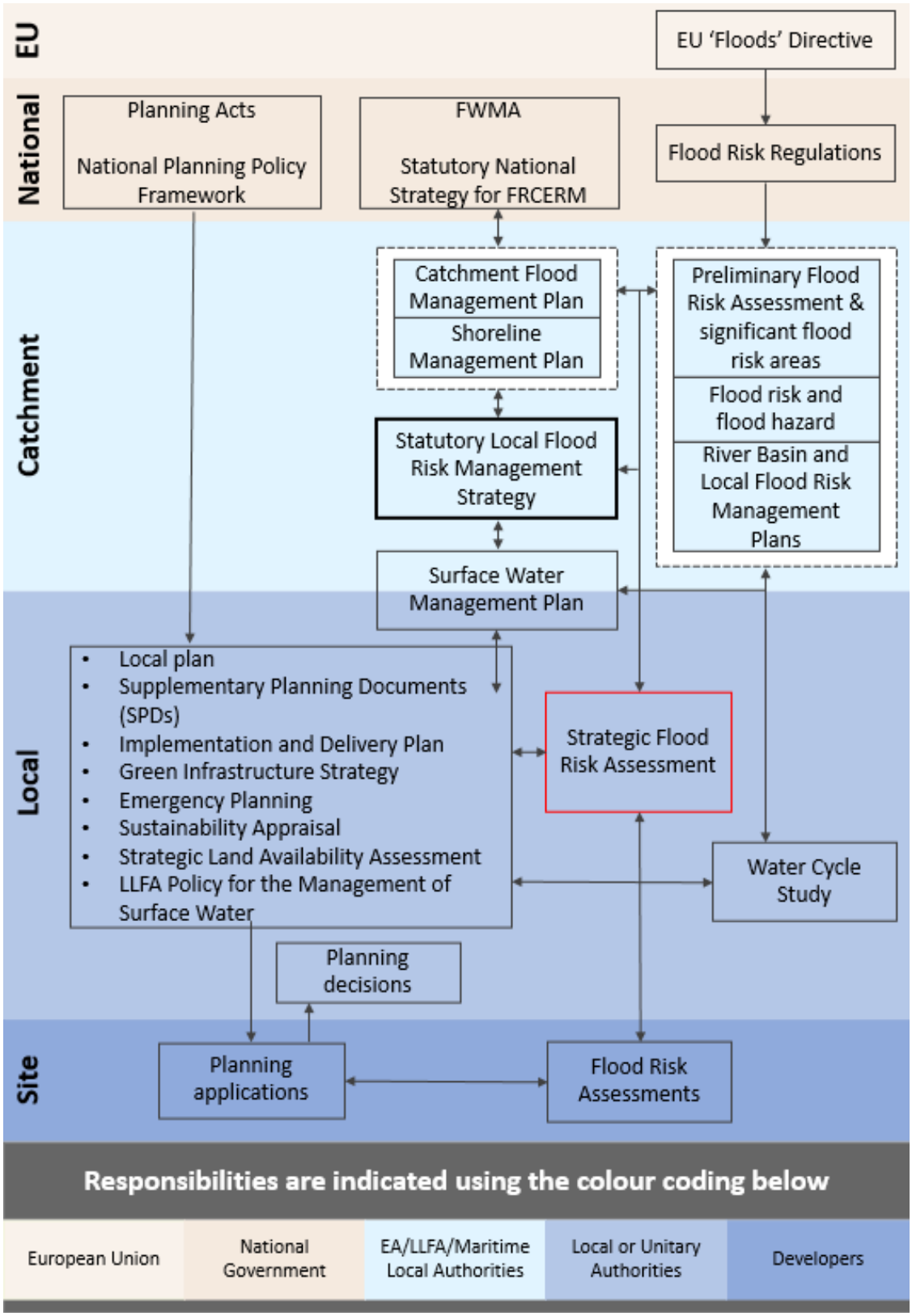

Figure 2-1: Strategic planning links and key documents for managing flood risk

2.2 Roles and responsibilities for flood risk management in Milton Keynes administrative area

There are different organisations within Milton Keynes administrative area that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are shown in Table 2-1, with a summary of their responsibilities.

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties. Property owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species and allowing the flow of water to pass without obstruction. More information can be found in the Environment Agency publication **Owning a watercourse** (2018).

When it comes to undertaking works to reduce flood risk, the Environment Agency and Milton Keynes City Council as LLFA do have powers but their limited resources must be prioritised and targeted to where they can have the greatest effect. Permissive powers mean that Risk Management Authorities are permitted to undertake works on watercourses but are not obliged.

Table 2-1 Roles and responsibilities for Risk Management Authorities

Information taken from National Flood and Coastal Erosion Risk Management Strategy Annex A[4].

Risk Management Authority	Roles and responsibilities in relation to flood and coastal risk management activities
Environment Agency	The Environment Agency is the strategic risk management authority at a national level and manages the risk of flooding by: • carrying out works to manage flood risk from main rivers and the sea (Water Resources Act 1991) • carrying out works to manage coastal change (Coast Protection Act 1949) • regulating the operation of large raised reservoirs (Reservoirs Act 1975) setting the direction for managing the risks through the national

4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/917641/15482_Environment_agency_digital_AnnexA_PDFA.pdf#:~:text=2%20%28FWMA%2C%202010%29%20%E2%80%94%20preparing%20preliminary%20flood%20risk,Country%20Planning%20%28Development%20Management%20Procedure%29%20%28England%29%20Order%202015%29

Risk Management Authority	Roles and responsibilities in relation to flood and coastal risk management activities
	flood and coastal erosion risk management strategy for England (FWMA (Flood Water Management Act), 2010) • preparing preliminary flood risk assessments and flood risk management plans for flooding from main rivers, reservoirs and the sea (Flood Risk Regulations 2009) • warning and informing (Ministerial Direction to the National Rivers Authority, 1996) • regulating activities that may affect the risk of flooding from main rivers (Environmental Permitting Regulations (England and Wales) Regulations 2016) • Carrying out surveys and mapping (Flood Risk Regulations 2009, Water Resources Act 1991) • reporting to the minister on flood and coastal erosion risk and how the national and local strategies are being applied by all of the authorities involved (FWMA, 2010) • acting as a statutory consultee for planning authorities providing advice on planning applications, local plans and environmental assessments regarding flood risk from main rivers and the sea (Town and Country Planning (Development Management Procedure) (England) Order 2015
Milton Keynes City Council as Lead Local Flood Authority (LLFA)	Milton Keynes City councils are the lead local flood authority for their area, and manage the risk of flooding by: • developing, maintaining and applying a strategy for local flood risk (surface runoff, groundwater and ordinary watercourses) management in their areas (FWMA, 2010) • preparing preliminary flood risk assessments and flood risk management plans for sources of flooding other than main rivers, reservoirs and the sea (Flood Risk Regulations 2009) • carrying out works to manage flood risk from surface water and groundwater (Land Drainage Act 1991) • maintaining a register of flood defences infrastructure in its area (FWMA, 2010) • consenting to certain structural changes on ordinary watercourses (Land Drainage Act 1991) • investigating flooding in its area (FWMA, 2010) • acting as a statutory consultee for planning authorities and respond to the drainage design for major planning applications (Town and Country Planning (Development Management Procedure) (England) Order 2015
Milton Keynes City Council as Local Planning Authority	• Carry out works to manage flood risk from ordinary watercourses and the sea, and undertake those functions of an IDB where there is no IDB in place (Land Drainage Act 1991). • As Planning authority, responsible for developing the local plan, which must have regard to national planning policy. They work with lead local

Risk Management Authority	Roles and responsibilities in relation to flood and coastal risk management activities
	flood authorities and others to ensure decisions on development in their area effectively manage the risks from flooding.
Anglian Water	Anglian Water are responsible for public water supply and, in some cases, for providing public sewers. All water companies are risk management authorities. Under the Water Industry Act 1991 and Water Resources Act 1991 they are required (amongst other things) to maintain a water supply system, prepare and review water resource management plans and provide drought plans. Water companies responsible for public sewers must also ensure those sewers effectually drain the areas they serve (this includes drainage of surface water). Water companies manage the risk of flooding from their water main and sewer networks. Every 5 years the Government issues strategic policy direction to the Water Services Regulation Authority (Ofwat).
Highways Authorities *National Highways (motorways and trunk roads)* *Milton Keynes City Council (for non-trunk roads)*	Highway authorities include county and unitary authorities, plus Highways England. They are risk management authorities responsible for providing and managing highway drainages and some roadside ditches. They must ensure that road projects do not increase flood risks. They can carry out drainage works on highways or adjoining land (Highways Act 1980).
Bedford Group of Internal Drainage Boards	Internal drainage boards are risk management authorities responsible for managing water levels within their internal district. They have (amongst others) the following functions to manage the risk of flooding. • carrying out works to manage flood risk from ordinary watercourses and the sea and to manage water levels within their internal drainage district (Land Drainage Act 1991) • consenting to certain structural changes on ordinary watercourses (Land Drainage Act 1991).
The Parks Trust	Riparian Owner of watercourses through the linear parks in Milton Keynes administrative area. The trust is responsible for maintaining land around the balancing lakes, but not for flood risk management.

2.3 Relevant legislation

The following legislation is relevant to development and flood risk in the Milton Keynes administrative area:

- **Flood Risk Regulations (2009)** - these transpose the European Floods Directive (2000) into law and require the Environment Agency and LLFAs to produce Preliminary Flood Risk Assessments and identify where there are nationally significant Flood Risk Areas. For the Flood Risk Areas, detailed flood maps and a Flood Risk Management Plan is produced; this is done in a six-year cycle. As of 31 December 2023 the Flood Risk Regulations (2009) have been revoked from UK Law as part of a review into retained EU legislation. This was done as the Flood Risk Regulations duplicate existing domestic legislation, namely the Flood and Water Management Act 2010. The Government expects to see the continued implementation of Flood Risk Management Plans 2021-2027, with funding for this still in place over the 6-year period.
- **Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991), Environment Act (2021), Flood and Water Management Act (2010)** – as amended and implanted via secondary legislation. These set out the roles and responsibilities for organisations that have a role in FRM.
- **Land Drainage Act (1991, as amended) and Environmental Permitting Regulations (2018)** also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an ordinary watercourse or Main River.
- **Water Environment Regulations (2017)** – these transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produce River Basin Management Plans (RBMPs). These aim to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reaches 'good' status.
- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014) and Strategic Environmental Assessment Directive (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

2.4 Relevant flood risk policy and strategy documents

Table 2-2 summarises relevant national, regional and local flood risk policy and strategy documents and how these apply to development and flood risk. Hyperlinks are provided to external documents. These documents may:

- Provide useful and specific local information to inform Flood Risk Assessments within the local area.
- Set the strategic policy and direction for Flood Risk Management (FRM) and drainage – they may contain policies and action plans that set out what future flood mitigation and climate change adaptation plans may affect a development site. A developer should seek to contribute in all instances to the strategic vision for FRM and drainage in the administrative area.

- Provide guidance and/or standards that informs how a developer should assess flood risk and/or design flood mitigation and SuDS.

Table 2-2: National, regional and local flood risk policy and strategy documents

	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
National	**Flood and Coastal Management Strategy** (Environment Agency) 2020	No	Yes	No	Due to be reviewed in 2026
	National Planning Policy Framework and Guidance (MHCLG) updated 2023 and PPG updated in 2022	No	No	Yes	
	Building Regulations Part H (MHCLG) 2010	No	No	Yes	-
	The Climate Crisis: a guide for Local Authorities on Planning for Climate Change (TCPA) 2023	N/A	Yes	Yes	No
	Climate change guidance for development and flood risk (Environment Agency) 2022	N/A	No	No	
Regional	**Anglian River Basin District River Basin Management Plan** (Environment Agency) 2016	WFD (Section 2.2.2)	No	Yes	
	Anglian River Basin District Flood Risk Management Plan (Environment Agency) 2022	Flood Risk Regulations (section 2.2)	No	Yes	2027
	Great Ouse Catchment Flood Management Plan (Environment Agency) 2011	N/A	Yes	Yes	-
	Anglian Water Draft Drainage and Wastewater Management Plan (DWMP) (Anglian Water, 2023)	Yes	Yes	No	
Local	**Milton Keynes Local Flood Risk Management Strategy 2016 - 2020** (Milton Keynes Council) 2016	FWMA	Yes	No	

	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
	Milton Keynes Drainage Strategy (Milton Keynes City Council)	N/A	Yes	No	
	Flood and Coastal Management Strategy (Environment Agency) 2020	No	Yes	No	Due to be reviewed in 2026

Other relevant guidance documents are mentioned in the appropriate section in the SFRA document.

2.5 Key legislation for flood and water management

2.5.1 Flood Risk Regulations (2009)

The **Flood Risk Regulations (2009)** translate the EU Floods Directive into UK law. The EU requires Member States to complete an assessment of flood risk (known as a Preliminary Flood Risk Assessment (PFRA)) and then use this information to identify areas where there is a significant risk of flooding. For these Flood Risk Areas, Member States must then undertake Flood Risk and Hazard Mapping and produce Flood Risk Management Plans. Although the UK has now left the EU, the requirements of the Flood Risk Regulations were transposed into English Law although these will be revoked on the 31 December 2023.

The Flood Risk Regulations direct the Environment Agency to do this work for river, sea and reservoir flooding. LLFAs must do this work for surface water, ordinary watercourse and groundwater flooding. This is a six-year cycle of work and the second cycle started in 2017.

The **Upper River Great Ouse PFRA**[5]**(2011) and the Milton Keynes PFRA Addendum**[6] **(2017)** provided information on significant past and future flood risk from localised flooding in the Bedford Group of Internal Drainage Boards' area, including Milton Keynes administrative area.

The **Environment Agency PFRA (2018)** for river, sea and reservoir flooding identifies nationally significant Flood Risk Areas for these sources. Milton Keynes administrative area is identified as a Flood Risk Area for surface water flood risk.

As of 31 December 2023 the Flood Risk Regulations (2009) have been revoked from UK Law as part of a review into retained EU legislation. This was done as the Flood Risk Regulations duplicate existing domestic legislation, namely the Flood and Water Management Act 2010. The Government expects to see the continued implementation of Flood Risk Management Plans 2021-2027, with funding for this still in place over the 6-year period.

5 Upper River Great Ouse PFRA. (2011) https://bbcdevwebfiles.blob.core.windows.net/webfiles/Files/PFRA.pdf

6 Milton Keynes PFRA Addendum (2017)

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/698240/PFRA_Milton_Keynes_Council_2017.pdf

2.5.2 Flood and Water Management Act (2010)

The Flood and Water Management Act (FWMA) was passed in April 2010. It aims to improve both flood risk management and the way water resources are managed.

The FWMA has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for LAs, as LLFAs, designed to manage local flood risk (from surface water, ground water and ordinary watercourses) and to provide a strategic overview role of all flood risk for the EA.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by LAs and other key partners. The integration and synergy of strategies and plans at national, regional, and local scales, is increasingly important to protect vulnerable communities and deliver sustainable regeneration and growth.

Below is a summary of some of the work Milton Keynes City Council has undertaken to date as a LLFA.

- **Milton Keynes City Council's Local Flood Risk Management Strategy** was published in 2016.
- Register of Flood Risk Features: LLFAs must establish and maintain a register of structures or features which, in their opinion are likely to have a significant effect on flood risk in the LLFA area. The LLFA is currently in the process of compiling the Asset register and reviewing which structures or features in their opinion have significant effect on flood risk.

Defra has announced its intention to enact Schedule 3 of the FWMA 2010, which will mandate sustainable drainage systems (SuDS) in new developments in England[7]. Current policy, which has been in place since April 2015, implements SuDS through planning policy. SuDS must be included in all new major developments (over 10 homes), unless there is clear evidence that this would be inappropriate. The enactment of Schedule 3 is expected to come into effect in 2024. Key features of Schedule 3 are as follows:

- SuDS must be incorporated into new developments in England.
- Applications for the approval of SuDS on new developments that meet the criteria will need to be made to a SuDS Approving Body (SAB). SAB approval will be separate from the Local Planning Authority approval. SAB approval could be subject to conditions and may require a non-performance bond.
- Construction works covering an area of under 100 sqm or single properties will be exempt. Nationally Significant Infrastructure Projects will also be exempt.
- It also makes the right to connect surface water runoff to public sewers conditional upon the drainage system being approved before any construction work can start.

Schedule 4 of the FWMA also updates the Reservoirs Act 1975 by reducing the threshold for regulation of large raised reservoirs from a capacity of 25,000m³ to 10,000m³ and

7 UK Government (2023) Schedule 3 FWMA Update. Available at: https://www.gov.uk/government/publications/sustainable-drainage-systems-review

introducing a 'high risk' designation for reservoirs which pose a risk to life in the event of a breach. Implementation of Schedule 4 has been split into two phases. Phase 1 was implemented in 2013 and required large, raised reservoirs to be registered and designated as 'high risk', where required.

2.5.3 The Water Framework Directive & Water Environment Regulations

The purpose of the Water Framework Directive (WFD), which was transposed into English Law by the Water Environment Regulations (2003), is to deliver improvements across Europe in the management of water quality and water resources through a series of plans called River Basin Management Plans (RBMP), which were last published in 2021 and updated in 2022.

Milton Keynes administrative area is in the Anglian River Basin District.

2.5.4 Environmental permitting

The **Environmental Permitting Regulations**[8] (2016, amended 2018) set out where developers will need to apply for additional permission (as well as Planning Permission) to undertake works to an ordinary Watercourse (pollution related works only) or Main River. This includes flood risk activities relevant to the administrative area:

- on (in, over, under) or within 8 metres of a main river;
- on (in, over, under) or within 8 metres of a flood defence structure or culvert;
- involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert; and
- in a floodplain more than 8 metres from the riverbank, culvert or flood defence structure and you do not already have planning permission.

Environmental permits may also be required from the Environment Agency to discharge runoff, trade effluent or sewage into a main river. They may also be required in relation to groundwater activities, where there may be a risk of groundwater contamination.

2.5.5 Land Drainage Act (1991)

Under the **Land Drainage Act (1991)**[9] Internal Drainage Boards were also given the power to implement their own Byelaws. The act also outlines riparian responsibilities to maintain the flow of water and sets out Local Authority powers to regulate works that may alter the flow of water in a watercourse.

An Ordinary Watercourse consent may be required where work is carried out which could affect the flow of water within a watercourse which is not main river. These should be acquired from **Milton Keynes City Council**[10] or the Bedford Group of Drainage Boards (Section 2.5.6).

8 Environmental Permitting Regulations. UK Government. (2016) https://www.legislation.gov.uk/uksi/2018/110/contents/made

9 Land Drainage Act. UK Government. (1991). https://www.legislation.gov.uk/ukpga/1991/59/contents

10 Land drainage (land and homeowners). South Gloucestershire Council https://www.southglos.gov.uk/environment/drainage-and-flood-risk-management/land-drainage-land-homeowners/

2.5.6 Byelaws

Land Drainage Byelaws outline legal obligations and responsibilities when undertaking works on or close to a watercourse, for the purpose of preventing flooding, or mitigating any damage caused by flooding.

Under the Land Drainage Act (1991), Internal Drainage Boards were also given the power to implement their own Byelaws. The **Buckingham and River Ouzel Internal Drainage Board Byelaws**[11] (a member of the Bedford Group of Drainage Boards) have effect within Milton Keynes administrative area. These Byelaws have effect on any activity within the Internal Drainage Board District that affect the flow of water and flood risk. The Byelaws are stated to be considered necessary for the following purposes:

- Securing the effectiveness of flood risk management work within the meaning of Section 14A of the Land Drainage Act.
- Regulating the effects on the environment of a drainage system
- Securing the efficient working of the drainage system

Compliance with the relevant Byelaws and standards must be demonstrated by any developer planning works within the IDB's drainage district and watershed (or catchment) within the Local Plan area. The byelaws that are most relevant to flood risk management are Byelaws 3 and 10:

- Byelaw 3 - Control of Introduction of Water and Increase of in Flow or Volume or Water.
- Byelaw 10 - No Obstructions within 9 Metres of the Edge of the Watercourse.

2.5.7 Additional legislation

Additional legislation relevant to development and flood risk in Milton Keynes administrative area include:

- The **Town and Country Planning Act**[12] (1990) and the **Water Industry Act**[13] (1991). These set out the roles and responsibilities for organisations that have a role in Flood Risk Management (FRM).
- Other environmental legislation such as the **Habitats Directive**[14] (1992), **Environmental Impact Assessment Directive**[15] (2014) and **Strategic Environmental Assessment Directive**[16] (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

It should be noted that the some of the environmental directives listed are from European Union (EU) legislation, due to the UK no longer being a part of the EU these may be subject to change in the future.

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11 Buckingham and River Ouzel Internal Drainage Board Byelaws. https://www.idbs.org.uk/consent-planning/byelaws-2/

12 Town and Country Planning Act. UK Government. (1990) https://www.legislation.gov.uk/ukpga/1990/8/contents

13 Water Industry Act. UK Government. (1991) https://www.legislation.gov.uk/ukpga/1991/56/contents

14 Habitats Directive. European Commission. (1992) https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

15 Environmental Impact Assessment Directive. European Commission. (2014) https://ec.europa.eu/environment/eia/eia-legalcontext.htm

16Strategic Environmental Assessment Directive. European Commission. (2001) https://ec.europa.eu/environment/eia/sea-legalcontext.htm

2.6 Key national, regional and local policy documents and strategies

2.6.1 The National Flood and Coastal Erosion Risk Management Strategy for England (2020)

The **National Flood and Coastal Erosion Risk Management Strategy** (FCERM) for England provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. The new Strategy has been in preparation since 2018. The Environment Agency brought together a wide range of stakeholders to develop the strategy collaboratively. The Strategy is much more ambitious than the previous one from 2011 and looks ahead to 2100 and the action needed to address the challenge of climate change.

The Strategy has been split into 3 high level ambitions: climate resilient places, today's growth and infrastructure resilient in tomorrow's climate and a nation ready to respond and adapt to flooding and coastal change. Measures include:

- updating the national river, coastal and surface water flood risk mapping,
- understanding long term investment needs for flood and coastal infrastructure,
- trialling new and innovative funding models,
- flood resilience pilot studies,
- developing an adaptive approach to the impacts of climate change,
- seeking nature-based solutions towards flooding and erosion issues,
- integrating natural flood management into the new Environmental Land Management scheme,
- considering long term adaptive approaches in Local Plans,
- maximising the opportunities for flood and coastal resilience as part of contributing to environmental net gain for development proposals,
- investing in flood risk infrastructure that supports sustainable growth,
- aligning long term strategic planning cycles for flood and coastal work between stakeholders,
- mainstreaming property flood resilience measures and 'building back better' after flooding,
- consistent approaches to asset management and record keeping,
- updating guidance on managing high risk reservoirs in light of climate change,
- critical infrastructure resilience,
- increasing education, skills, capacity building, research, innovation and sharing of best practise,
- supporting communities to plan for flood events,
- develop world leading ways of reducing the carbon and environmental impact from the construction and operation of flood and coastal defences,
- the development of digital tools to communicate flood risk and transforming the flood warning service

- increasing flood response and recovery support.

The Strategy was laid before parliament in July 2020 for formal adoption and published alongside a **National Policy Statement for Flood and Coastal Erosion Risk Management.** The statement sets out five key commitments which will accelerate progress to better protect and better prepare the country for the coming years:

1. Upgrading and expanding flood defences and infrastructure across the country,
2. Managing the flow of water to both reduce flood risk and manage drought,
3. Harnessing the power of nature to not only reduce flood risk, but deliver benefits for the environment, nature, and communities,
4. Better preparing communities for when flooding and erosion does occur, and
5. Ensuring every area of England has a comprehensive local plan for dealing with flooding and coastal erosion.

It can be expected that the implementation of the National Strategy will lead to the publication of new guidance and practice that is focused on resilience and adaptation over the coming years. It will be important to adjust the content of the SFRA so that changes in approach are captured in the delivery of the Local Plan and these reflect the formulation and evolution of procedures and process that is anticipated will be developed to address the aim of the latest National FCERM.

The National Infrastructure Commission conducted an assessment, **Reducing the risk of surface water flooding**, published in 2022, which looks at how responsible bodies in England can better manage and mitigate surface water flooding. The commission recommends that:

- government acts to mitigate the impact of urban development on surface water flooding
- the Environment Agency should improve identification of the highest risk areas, drawing on local maps and models
- government should set a long term target for a reduction in the number of properties at high and medium risk of surface water flooding
- government should clarify in its strategic priorities that Ofwat should enable water and sewerage companies to invest in solutions to manage surface water flooding, including nature based solutions where appropriate
- in high risk areas, local authorities, water and sewerage companies and, where relevant, internal drainage boards, should be required to develop costed, long term, joint plans to manage surface water flooding, including local targets for risk reduction, assured by the Environment Agency with input from Ofwat
- government should devolve public funding to upper tier local authorities in the new flood risk areas based on their level of risk
- for properties remaining at high risk of flooding, government should explore options for funding property level measures.

2.6.2 Updated Strategic Flood Risk Assessment guidance

There was an update to the **'How to prepare a Strategic Flood Risk Assessment guidance'** in March 2022, which requires further adjustment to the approaches to both Level 1 and Level 2 assessments. There have also been updates to the guidance with a substantive adjustment in August 2019 and minor updates in September 2020. The Level 1 assessment is undertaken in accordance with the latest guidance.

2.6.3 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are high-level strategic plans providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management.

There are six pre-defined national policies provided in the CFMP guidance and these are applied to specific locations through the identification of 'Policy Units'. These policies are intended to cover the full range of long-term flood risk management options that can be applied to different locations in the catchment.

The six national policies are:

- No active intervention (including flood warning and maintenance). Continue to monitor and advise
- Reducing existing flood risk management actions (accepting that flood risk will increase over time)
- Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
- Take further action to sustain the current level of flood risk (responding to the potential increases in risk from urban development, land use change and climate change)
- Take action to reduce flood risk (now and/or in the future)
- Take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

Milton Keynes administrative area falls within the **Great Ouse CFMP**[17]. The Great Ouse CFMP is complemented by the Anglian River Basin District Flood Risk Management Plan. The actions specific to the Milton Keynes administrative area in the Great Ouse CFMP were:

- Develop a flood risk study for Milton Keynes, the Stratfords and Newport Pagnell to investigate options to reduce flooding.
- Reduce the consequences of flooding by improving public awareness of flooding and encouraging people to sign up to, and respond, to flood warnings.

17 Great Ouse CFMP: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/288877/Great_Ouse_Catchment_Flood_Management_Plan.pdf

- Consider developing a surface water management plan for Milton Keynes.
- Develop environmental enhancement projects to improve the natural state of the rivers and their habitats.
- Ensure any policies within the Local Development Framework or any revisions are in line with the CFMP policy.

2.6.4 Anglian River Basin Management Plans

River Basin Management Plans (RBMPs) are prepared under the Water Framework Directive (WFD) and assess the pressure facing the water environment in River Basin Districts. Milton Keynes administrative area falls within the **Anglian River Basin Management Plan**[18].

The Anglian river basin district river basin management plan describes the challenges that threaten the water environment and how these challenges can be managed. The plans was updated in 2022.

The Anglian RBMP provides information on the following:

- Current state of the water environment.
- Pressures affecting the water environment.
- Environmental objectives for protecting and improving water.
- A programme of planned measures, alongside actions to achieve the objectives related to these measures.
- Identifies progress since the last Anglian RBMP was published (2015).

2.6.5 Anglian Flood Risk Management Plan

The **Anglian River Basin District Flood Risk Management Plan 2021 to 2027**[19] was produced by the Environment Agency. The Environment Agency worked with LLFAs to develop Flood Risk Management Plans (FRMPs), which help to deliver the ambitions of the National Flood and Coastal Erosion Risk Management Strategy for England and the government's **25-Year Environment Plan**. FRMPs focus on more significant areas of flooding and describe the risk of flooding in these areas now in in the future with climate change.

The Milton Keynes administrative area Flood Risk Area has been identified because of the risk of surface water flooding. Milton Keynes City Council is the responsible authority for managing surface water flood risk and therefore leads on the development and delivery of the Flood Risk Area.

Measures that apply directly to the Milton Keynes administrative area Flood Risk Area can be found in the **Flood Plan Explorer**[20], developed by the Environment Agency. Specific measures are:

- Adapt local planning policy to require betterment from brownfield.

18 Anglian RBMP: https://www.gov.uk/government/publications/anglian-river-basin-district-river-basin-management-plan

19 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1118190/Anglian-FRMP-2021-2027.pdf

20 https://environment.data.gov.uk/flood-planning/explorer/cycle-2/home

- Explore opportunities for verification of Sustainable Drainage Schemes after development in Milton Keynes administrative area.
- Identify a long-term strategy to lower flood risk and improve flood resilience in Coffeehall and Stoke Goldington in Milton Keynes administrative area.
- Identify a long-term strategy to mitigate flood risk from all sources through scheme development in Milton Keynes administrative area.
- Investigate opportunities to utilise greenspaces for flood management in Milton Keynes administrative area.
- Investigate the capacity of the existing balancing lake network and look for opportunities for smarter controls through digitisation in Milton Keynes administrative area.
- Work with communities to improve flood resilience and flood recovery in Milton Keynes administrative area.

2.6.6 Milton Keynes City Council's Local Flood Risk Management Strategy

Local Flood Risk Management Strategies set out how Lead Local Flood Authorities such as Milton Keynes City Council will manage local flood risk i.e. from surface water runoff, groundwater and ordinary watercourses, for which they have a responsibility as LLFA and the work that other Risk Management Authorities are doing to manage flood risk in Milton Keynes administrative area.

The Local Flood Risk Management Strategy 2016[21] sets out the LLFA's plan for managing local flood risk.

The objectives for managing flood risk are:

1. Ensure that drainage management is tailored to Milton Keynes administrative areas unique drainage system.
2. Improve the Council's understanding of flood risk from all sources.
3. Ensure future development does not have a negative impact on flood risk and lowers the risk where possible.
4. Make best use of resources for maximum protection from flooding.
5. Improve public awareness of flooding and help communities to become more resilient to flooding.
6. Improve communications between asset owners and build on existing partnership working.
7. Ensure emergency planning is linked to the Council's best understanding of the risks.

2.6.7 LLFAs, surface water and SuDS

The 2023 NPPF states that: 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Paragraph 175). When considering planning applications, local planning authorities

21 Milton Keynes LFRMS: https://www.milton-keynes.gov.uk/sites/default/files/2022-02/MKC%20LFRMS_FINALpost_consultation_report_COMBINED%20MKFLO004.pdf

should consult the relevant LLFA on the management of surface water in order to satisfy that proposed schemes:

- take account of advice from the lead local flood authority;
- have appropriate proposed minimum operational standards;
- have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- where possible, provide multifunctional benefits.

The NPPF also states that 'When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere' (Paragraph 167).

Milton Keynes City Council's requirements for new developers on SuDS are set out on their **website**, alongside supporting documents. At the time of writing this SFRA, documents and policies relevant to SuDS and surface water are:

- **Milton Keynes City Council Surface Water Drainage Guidance for Developers**
- **Consent form for the Bedford Group of Drainage Boards**
- **Surface Water Management Plan**
- **SuDS Manual (C753)** published in 2007, updated in 2015
- **DEFRA Non-statutory technical standards for sustainable drainage systems, 2015**
- **DEFRA National Standards for sustainable drainage systems Designing, constructing (including LASOO best practice guidance), operating and maintaining drainage for surface runoff, 2011**
- **Building Regulations Part H (MHCLG) 2010**

The 2023 NPPF states that flood risk should be managed "using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding.". As such, although incorporating SuDS is only a requirement for major development, it is best practice for all development[22].

2.6.8 Water cycle studies

Water cycle studies assist local authorities to select and develop growth proposals that minimise impacts on the environment, water quality, water resources, infrastructure and flood risk and help to identify ways of mitigating such impacts. An Integrated Water Management Study (IWMS) Phase 1 is being prepared by JBA Consulting for Milton Keynes City Council as an update to the Water Cycle Study at the same time as this Level 1 SFRA. Part 2 is being prepared after Phase 1.

2.6.9 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. They are produced to understand the flood risks

22 https://www.gov.uk/government/collections/planning-practice-guidance

that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from surface runoff, groundwater, and Ordinary Watercourses. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments. The action plan from SWMPs should be reviewed and updated as a minimum every six years.

Milton Keynes City Council published the **Milton Keynes SWMP**[23] in 2016. As part of the SWMP, CDCs were identified across the administrative area which represent areas of catchments at greatest risk. These are located in Stony Stratford, Newport Pagnell, Olney, West Bletchley, Woburn Sands, Ravenstone, Bradwell Abbey, Wymbush/Two Mile Ash, Medbourne/Crownhill, Brinklow, Oldbrook, Bradwell, Downs Barn and Conniburrow, Stoke Goldington, Lavendon, Bletchley and Fenny Stratford, Bradwell West of Conniburrow, Wolverton, Calverton, Eaglestone, Sherington, Haversham, Tathall End and Bow Brickhill. The CDCs are shown in Appendix P.

2.6.10 Plan:MK 2016-2031

The **Plan:MK 2016-2031** was adopted by Milton Keynes City Council in March 2019. This sets out the existing policies in Milton Keynes administrative area for managing and reducing flood risk. These are locally specific strategic flood risk management policies to maintain and continue the sustainable drainage model of Milton Keynes administrative area. This prohibits development within the floodplain and requires flood management and drainage infrastructure to be provided as strategically as possible and as part of a maintained, multi-functional blue-green infrastructure. The existing policies are:

- Policy FR1 – Managing Flood Risk
- Policy FR2 – Sustainable Drainage Systems (SuDS) and Integrated Flood Risk Management
- Policy FR3 - Protecting and Enhancing Watercourses
- Policy SC1 – Sustainable Construction

2.6.11 Milton Keynes Strategy for 2050

The Milton Keynes Strategy for 2050[24] sets out the way forwards for the administrative area of Milton Keynes. The aim is to grow by a steady population increase to around 410,000 people living in the administrative area by 2050. The strategy offers seven big ambitions. The strategy states that the Council will continue to plan for water management at a city-wide level for existing areas, as well as for future development areas, using the green and blue infrastructure network.

23 Milton Keynes SWMP (2012): https://www.milton-keynes.gov.uk/media/2695/download?inline

24 https://www.mkfutures2050.com/

3 Planning policy for flood risk management

This section summaries national planning policy for development and flood risk.

3.1 National Planning Policy Framework and Guidance

The revised **National Planning Policy Framework (NPPF)** was updated in December 2023, replacing the 2021 version. The NPPF sets out Government's planning policies for England. It must be considered in the preparation of local plans and is a material consideration in planning decisions. The NPPF defines Flood Zones, how these should be used to allocate land and flood risk assessment requirements. The NPPF states that:

"Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards"

Planning Practice Guidance on flood risk was published in March 2014 and sets out how the policy should be implemented. **Diagram 1 in the NPPG** sets out how flood risk should be considered in the preparation of Local Plans. It was updated on the 25 August 2022, see Annex 1 for more information.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas. Since July 2021 the approach has adjusted the requirement for the Sequential Test (as defined in Paragraph 167 of the NPPF) so that all sources of flood risk are included in the consideration. At the time of preparation of the 2024 SFRA no updated guidance (PPG) has been published to specifically describe how the approach to the Sequential Test should be modified using the available modelling and mapping information. The following summarises how the requirement has been addressed and is explained in more detail in Appendix O:

- The test will continue to be based on the use of the Flood Zones describing river and sea flood risk (although it is noted that there is no sea risk in this instance).
- Surface Water Flood Zones have been prepared based on the available surface water flood mapping recognising that that modelling and mapping used in their preparation differs from that used for river flood risk(as set out in Appendix O).
- As there is no available competent risk mapping for other sources of risk that is comparable with that for the sea, rivers and surface water it is not considered appropriate to use such mapping in a strict process that involves comparison of differing levels of flood risk at alternative sites. However, it is important that the potential implications of such risk is assessed in performing the Sequential Test and so reservoir, groundwater and sewer flood risk are addressed during the process of finalising the selection of allocation sites. As appropriate this process is described in a Level 2 SFRA which involves a more detailed assessment of the implications of reservoir, sewer and groundwater flood risk to establish that more appropriate locations at lower risk are not available. Thus consideration is given to

all sources of flood risk using the available data to complete of the Sequential Test and when it is appropriate to consider alternative locations at lower risk so decisions on the selection of preferred sites for allocation address the potential implications of groundwater, reservoir and sewer flooding and where necessary identify sites where consideration should be given to satisfying the requirements of the Exception Test.

3.2.1 Flood Zones – watercourse risk

The definition of the Flood Zones is provided below. The Flood Zones 2 and 3a do not take into account the impact of flood defences. Flood Zone 3b does take into account the impact of defences. This is important for planning long term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

The Flood Zones do not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure. They do not consider climate change. Hence there could still be a risk of flooding from other sources and that the level of flood risk will change over time during the lifetime of a development.

The Flood Zones are:

- Flood Zone 1: Low probability: less than a 0.1% chance of river and sea flooding in any given year.
- 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.
- 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.
- Flood Zone 3b: Functional Floodplain: land where water has to flow or be stored in times of flood. SFRAs identify this Flood Zone in discussion with the LPA and the Environment Agency.

Functional floodplain will normally comprise:

- land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or
- land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are appropriate in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes.

It is required to consider climate change on the Flood Zones. This would need hydraulic modelling to confirm extents and therefore where no detailed modelling exists it is recommended that this is considered in a Flood Risk Assessment and a suitable approach is agreed with the EA.

Important note on Flood Zone information in this SFRA

The Flood Zones (Flood Zone 2 and 3a) in the Appendix C map are shown from the online Environment Agency's 'Flood Map for Planning' which incorporates modelled data where available. All the models used for this SFRA have been fully incorporated into the EA Flood Zones.

The Environment Agency Flood Zones do not cover all catchments or ordinary watercourses with areas <3 km². As a result, whilst the Environment Agency Flood Zones may show an area is in Flood Zone 1, there may be a flood risk from smaller watercourse not shown in the Flood Zones.

Functional floodplain (Flood Zone 3b) is identified as land which would flood with an annual probability of 1 in 30 years, where detailed hydraulic modelling exists. The 2% AEP (1 in 50-year) defended modelled flood extents have been used to represent Flood Zone 3b, where available from the Environment Agency, as the 3.3% AEP (1 in 30-year) outputs were not available. For areas outside of the detailed model coverage, or where no outputs were available, Flood Zone 3a can be used as a conservative indication. Further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b where no detailed modelling exists.

3.2.2 Surface Water

Paragraph 168 of the NPPF states that the Sequential Test must now "steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the information that can be used to support the test. The sequential approach (as described in Paragraph 168) should be used in areas known to be at risk now or in the future from any form of flooding."

A Sequential Test Methodology document has been prepared in consultation with Milton Keynes City Council and the Environment Agency to address the requirement that flood risk from any source is considered within the Sequential Test. This is described in Appendix O.

In summary, the Environment Agency's 0.1% AEP Risk of Flooding from Surface Water flood extent mapping has been used to define a simple zoning scheme that identifies a low risk (Zone A) and high risk (Zone B) zone. The zones are shown in Appendix Q. It should be noted that the Risk of Flooding from Surface Water includes an allowance for drainage (a flood risk management feature), so this is not strictly the same conceptual risk zone as defined for river and sea flooding (even though it is associated with the same probability). However, it does create a product that can accommodate sequential testing, as it facilitates strategic decisions that direct development to land in a "low risk surface water flood zone".

3.2.3 Reservoirs

The Sequential Test Methodology (Appendix O) also outlines how reservoir flooding should be included in the Sequential Test. The latest available Environment Agency Risk of Flood from Reservoirs mapping now shows "wet day" and "dry day" reservoir inundation extents. The "wet day" being a reservoir breach at the same time as a 0.1%

AEP (1 in 1000) river flood (as this is a likely time when a reservoir might fail) and the dry day shows the failure just from the water retained by the dam.

Neither set of mapping describes a risk-based scenario as they do not provide the probability of a dam failure but are intended to describe a "reasonable worst case". The Risk of Flooding from Reservoir dataset is not conceptually similar to the risks pertaining to river and sea flooding or surface water.

However, a high risk zone has been prepared for reservoir flood risk which identifies where reservoir flooding is predicted to make fluvial flooding worse and where the placement of new development could result in properties being in a location where hazards from flow depth and velocity were potentially severe. If sites selected through a comparative process of assessing the river, sea and surface water flood risk are located in such zones then the implications are addressed in the Level 2 SFRA and further consideration given to the identification of alternative locations at lower potential risk at this stage.

3.2.4 Other sources of flooding

Groundwater

Flood Zones have not been prepared for groundwater flooding. The readily available datasets for groundwater flooding do not provide the confidence or certainty required to undertake the Sequential Test. The available mapping provides an indication of where the risk of groundwater emergence might be higher, but competent sequential decisions cannot be appropriately made based on the available mapping. It is assumed that all sites are potential susceptible to groundwater flood risk in the Sequential Test as a precautionary approach.

All sites selected for allocation sites are then subject to a further detailed assessment of groundwater flood risk in the assessment prepared for the Level 2 SFRA. This more detailed assessment considers local conditions on a site-by-site basis using borehole, geological and LIDAR data. If necessary further consideration is given to the identification of alternative site locations at lower potential risk at this stage.

Sewer flooding

Historic sewer flood data is only available at a postcode level and does not define spatial extent or location of sewer flooding.

The data resolution provided in Anglian Water's DWMP is catchment scale and applicable to the entire study area but relates risk to broad sewerage treatment catchments rather than providing site specific data than can be used for purposes of comparison. Consequently, it is not possible to take a risk based approach using this data and it is not considered to be comparable to the river and sea flooding information. If specific spatial information becomes available on sewer flood risk that provides competent data on the spatial relative risk of flooding this will be evaluated in the Level 2 SFRA and as appropriate inform the Sequential Test process.

On this basis, Flood Zones for sewer flooding have not been prepared and the available information is not appropriate for use in the Sequential Test.

Further information can be found in Appendix O.

3.2.5 The Sequential Test

Firstly, land at the lowest risk of flooding and from all sources should be considered for development. A test is applied called the 'Sequential Test' to do this.

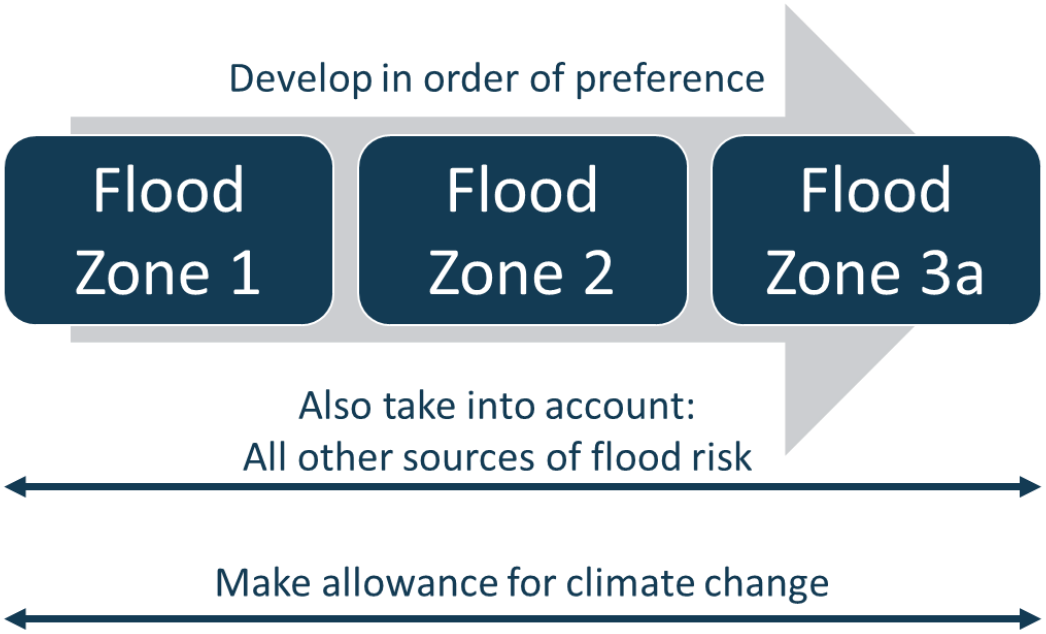


Figure 3-1 summarises the Sequential Test. The LPA will apply the Sequential Test to strategic allocations. For all other developments, developers must supply evidence to the LPA, with a Planning Application, so that the LPA can determine if the Sequential Test has been passed.

The LPA should define a suitable area of search for the consideration of alternative sides in the Sequential Test. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land or Employment Land Availability Assessments.

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone it is proposed for. **Annex 3 of the NPPG** defines the vulnerability of different development types to flooding. **Table 2 of the NPPG** shows whether, having applied the Sequential Test first, that vulnerability of development is incompatible for that Flood Zone.

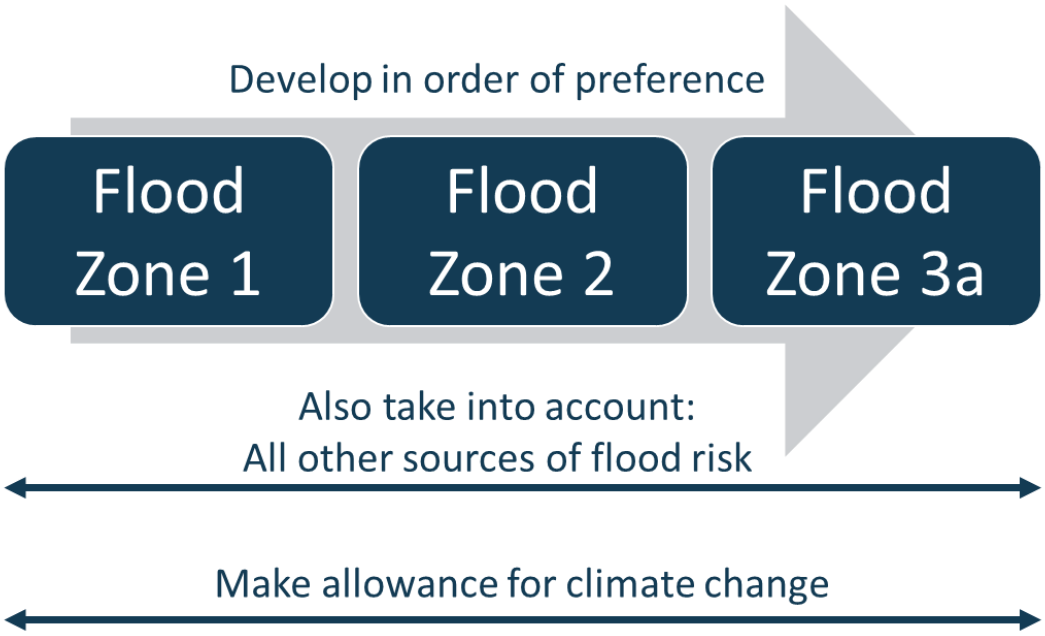
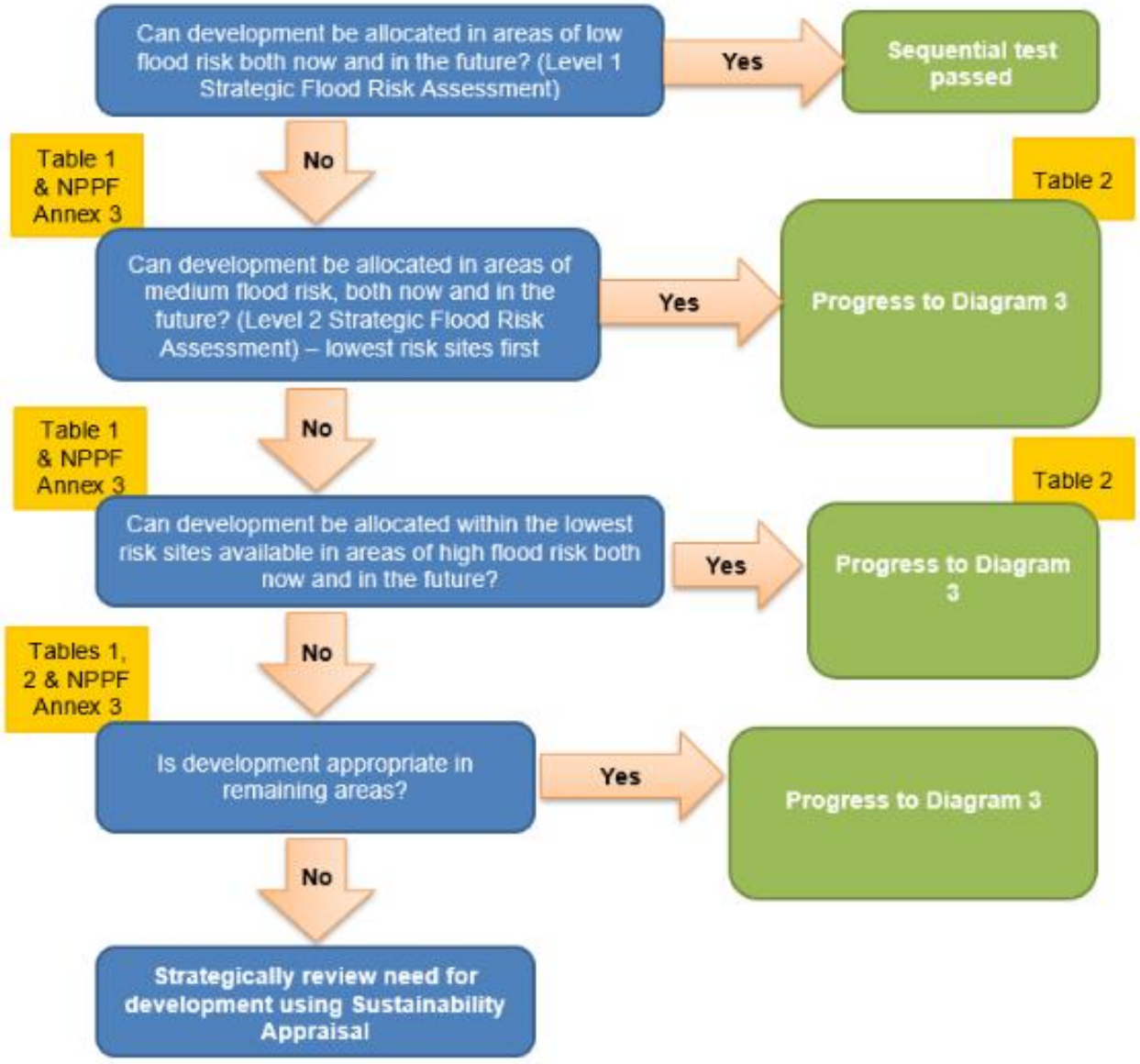


Figure 3-1 The Sequential Test

Figure 3-2 illustrates the Sequential and Exception Tests as a process flow diagram using the information contained in this SFRA to assess potential development sites against the EA's Flood Map for Planning flood zones and development vulnerability compatibilities.

This is a stepwise process, but a challenging one, as a number of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded. In addition, the risk of flooding from other sources and the impact of climate change must be considered when considering which sites are suitable to allocate. The SFRA User Guide in Appendix L shows where the Sequential and Exception Test may be required for the datasets assessed in the SFRA, and how to interpret different levels of concern with the datasets, recommending what development might be appropriate in what situations.



Note - other sources of flood risk should also be considered, as per the 2021 update to NPPF but formal zone mapping is not available (Surface Water Zones "A" and "B" used to define risk sequentially)*

Figure 3-2: Local Plan sequential approach to site allocation

3.2.6 The Exception Test

It will not always be possible for all new development to be allocated on land that is not at risk from flooding. To further inform whether land should be allocated, or Planning Permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required.

The Exception Test should only be applied having passed the Sequential Test. It applies in the following instances:

- More vulnerable in Flood Zone 3a
- Essential infrastructure in Flood Zone 3a or 3b

- Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b)
- Any development in a High Risk Surface Water Zone

Paragraph 165 of the NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere. Consideration must be given to all sources of flooding.

Figure 3-3 summarises the Exception Test.

For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test. At planning application stage, the Developer must design the site such that is appropriate flood resistant and resilient in line with the recommendations in National and Local Planning Policy and supporting guidance and those set out in this SFRA. This should demonstrate that the site will still pass the flood risk element of the Exception Test based on the detailed site level analysis.

For developments that have not been allocated in the Local Plan, developers must undertake the Exception Test and present this information to the Local Planning Authority for approval. The Level 2 SFRA can be used to scope the flooding issues that a site-specific FRA should look into in more detail to inform the Exception Test for windfall sites.

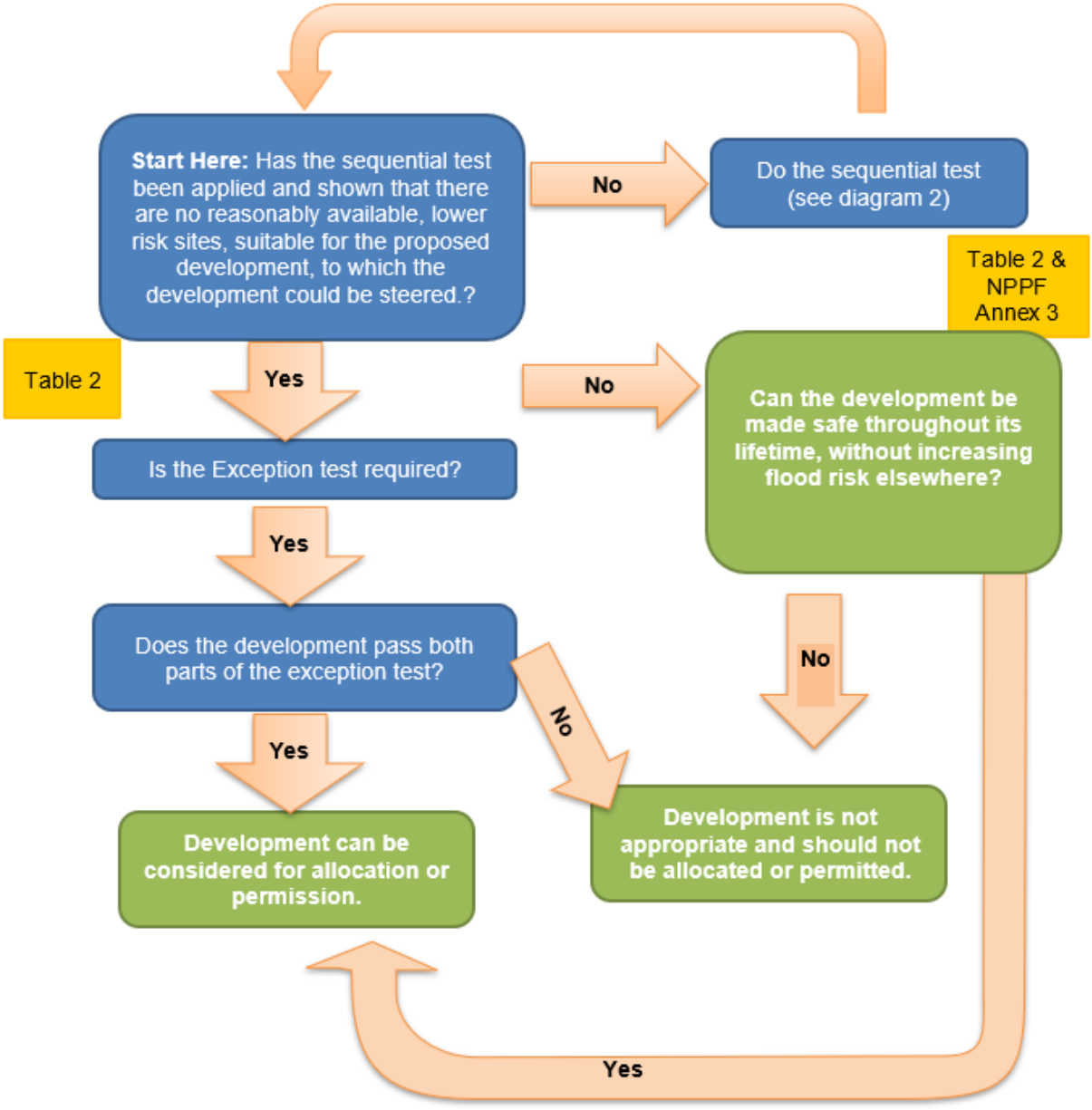


Figure 3-3: Application of the Exception Test to plan preparation

There are two parts to demonstrating a development passes the Exception Test:

- Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.

Local Planning Authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass, so no one is placed at risk. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

At the stage of allocating development sites, Local Planning Authorities should consider wider sustainability objectives, such as those set out in Local Plan Sustainability

Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

The Local Planning Authority should consider the sustainability issues the development will address and how doing so will outweigh the flood risk concerns for the site, e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc. Other impacts that need to be considered include the reliance upon defence without long term secured funding, particularly as proposed new development will not qualify for Grant in Aid Government funding.

- Demonstrating that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

In circumstances where the potential effects of proposed development are material a Level 2 SFRA is likely to be needed to inform the Exception Test in these circumstances for strategic allocations to provide evidence that the principle of development can be supported. At Planning Application stage, a site-specific Flood Risk Assessment will be needed. Both would need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

3.2.7 Making a site safe from flood risk over its lifetime

Local Planning Authorities will need to consider the actual and residual risk of flooding and how this will be managed over the lifetime of the development:

- The actual risk is the risk to the site considering existing flood mitigation measures. The fluvial and surface water 1% chance (with climate change) and 0.5% tidal (with climate change) flood in any year event are key events to consider because the National Planning Policy Guidance refers to these as the ‘design flood’ against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed.
- Safe access and egress should be available during the design flood event, as residents must evacuate safely before an extreme flooding event (0.1% AEP with climate change). Firstly, this should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.
- Residual risk is the risk that remains after the effects of flood defences have been taken into account for the lifetime of development, as would be the case for an event more severe than that considered for the design. The residual risk can be:
    - The effects of an extreme 0.1% chance flood in any year event. Where there are defences this could cause them to overtop, which may lead to failure if this causes them to erode, and/ or
    - Structural failure of any flood defences, such as breaches in embankments or walls.

- Operational failure should also be considered. If there are defences that require something to occur to enact the defences (e.g. demountable defences or telemetry triggered sluices) then there is a residual risk that these will not occur.

- Flood resistance and resilience measures (see Section 8.4) should be implemented to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage it does, should water enter a property. Emergency plans should also account for residual risk, e.g. through the provision of flood warnings and a flood evacuation plan where appropriate.

In line with the NPPF, the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk.

3.3 Applying the Sequential Test and Exception Test to individual planning applications

3.3.1 Sequential Test

Milton Keynes City Council, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied.

Developers are required to provide the evidence to the local planning authority so that the authority can determine whether the Sequential Test has been satisfied, unless the site is:

- A strategic allocation and the test has already been carried out by the LPA (unless the flood risk evidence or the development is different from that used to assess the allocation), or
- A minor development or change of use (this includes householder development, small non-residential extensions (with a footprint of less than 250m^2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate), or
- A development in flood zone 1 unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).

As changes of use are not normally subject to the Sequential or Exception tests, when formulating policy, the local planning authority will need to consider what changes of use will be acceptable, taking into account the Strategic Flood Risk Assessment. This is likely to depend on whether developments can be designed to be safe and that there is adequate emergency planning provision.

The SFRA contains the best available information at the time of the assessment on all sources of flooding and taking into account the impact of climate change. This should be considered when a developer undertakes the Sequential Test, including the consideration of reasonably available sites at lower flood risk. When discussing individual sites, preference should be given to site specific assessments.

Local circumstances must be used to define the area of application of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). The criteria used to determine the appropriate search area relate to the catchment area for the type of development being proposed. For some sites this may be clear e.g. school catchments, in other cases it may be identified by other Local Plan policies. For some sites e.g. regional distribution sites, it may be suitable to widen the search area beyond LPA administrative boundaries.

The sources of information on reasonably available sites may include:

- Site allocations in Local Plans
- Sites with Planning Permission but not yet built out
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/ five-year land supply/ annual monitoring reports
- Locally listed sites for sale

It may be that a number of smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood.

Ownership or landowner agreement in itself is not acceptable as a reason not to consider alternatives.

3.3.2 The Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding the Exception Test must then be applied if required (as set out in Table 2 of the NPPG). Developers are required to apply the Exception Test to all applicable sites (including strategic allocations).

The applicant will need to provide information that the application can pass both parts of the Exception Test:

- Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.
- Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.
- Applicants should detail the suitability issues the development will address and how doing it will outweigh the flood risk concerns for the site e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.
- Demonstrating that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
- The site-specific Flood Risk Assessment (FRA) should demonstrate that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:

- The design of any flood defence infrastructure
- Safe access and egress
- Operation and maintenance
- Design of the development to manage and reduce flood risk wherever possible
- Resident awareness
- Flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event; and
- Any funding arrangements required for implementing measures.

4 Understanding flood risk in Milton Keynes administrative area

This section explores the key sources of flooding in Milton Keynes administrative area and the factors that affect flooding including topography, soils and geology. The main sources of flooding are from watercourses, surface water and sewers.

This is a strategic summary of the risk in Milton Keynes administrative area. Developers should use this section to scope out the flood risk issues they need to consider in greater detail in a site-specific Flood Risk Assessment to support a Planning Application.

Appendix K contains a list of the sources of data used in the SFRA and the approach to using hydraulic model data to inform the mapping.

4.1 Historical flooding

The historic flood risk in the Local Plan areas has been assessed using the Environment Agency's recorded flood outline dataset and Anglian Water's Sewer Incident Report Form dataset (see Section 4.6). This has been supplemented with other information from the Milton Keynes City Council's PFRA, existing SFRA, LFRMS and Section 19 Flood Investigations and news reports. The list of historic flood incidents will not be exhaustive, especially in rural areas. Historic flood mapping for Milton Keynes administrative area can be found in Appendix A. Guidance on how this information should be used to inform the Sequential and Exception Tests can be found in Appendix L.

Milton Keynes administrative area has a history of documented flood events with the main source being from fluvial and surface water sources. These reports are summarised below.

4.1.1 Documented flood events

Areas within Milton Keynes administrative area found to have a history of flooding are shown in Table 4-1.

Table 4-1: Historic flooding in Milton Keynes administrative area

Location	Date	Information
Milton Keynes administrative area	May 2018	The Section 19 flood investigation report for South Central Milton Keynes indicates that surface water flooding (widespread flooding (686 reported incidents) affected over 315 properties in with confirmed internal flooding in Beanhill, Coffee Hall, Lakes Estate, Netherfield, Oldbrook, Stantonbury, Great Linford, Eaglestone, Central Milton Keynes administrative area, Downs Barn, Fishermead, Heelands, Neath Hill, Stony Stratford, and Bradwell Common). Furthermore, in Newport Pagnell 15 properties were affected, and 35 properties were affected in Stoke Goldington. The Independent Flood Review of the May 2018 incident estimates that flooding from surface water and ordinary watercourses affected 1000 residential and

Location	Date	Information
		non-residential properties across Milton Keynes administrative area during this event. From available data, it is estimated that 490 residential and 17 non-residential properties flooded internally. Critical infrastructure affected included the Milton Keynes University NHS Foundation Trust and Centre: MK shopping centre.
Newport Pagnell	1947	March 1947 - River Great Ouse and River Ouzel.
	1992	September 1992 - River Ouzel - Flooding to Willen Lane, Nene Close, Dove Close, Trent Close, Riverside, Mill Street, and Northampton Rd. Silver Street, Tickford Street and Priory Street flooded due to the surface water drains surcharging.
	1998	Easter 1998 - River Great Ouse and River Ouzel - Several properties flooded on Lakes Lane.
	2020	December 2020 – fluvial, surface water and groundwater flooding (15 properties affected).
Stony Stratford	1947	River Great Ouse
	1998	River Great Ouse - The Stony Stratford re-feasibility study reports that part of the town was also flooded during the Easter 1998 event, and four non-residential buildings were inundated. Environment Agency measured levels show that flooding occurred to properties in Fegans Court, the High Street, Prospect Road, Temperance Terrace and Mill Lane. The non-residential buildings were in Queen Eleanor Street and it is thought that the flooding was due to surface water drainage problems.
	2003	January 2003 - Fegans Court and the High Street
	2007	July 2007 - The local newspaper reports flooding to the High Street and Temperance Terrace.
	2020	December 2020 – fluvial and surface water flooding (55 properties affected).
Bletchley	1968	July 1968 - Water Eaton Brook – parts flooded due to exceeded channel capacity. The Water Eaton Brook Standard of Protection (SOP) Study reports that the 1968 event caused flooding to houses along the south front of Water Eaton Road, however, the lower part of Water Eaton Brook was canalised and straightened as a response to this flooding.
	1998	Environment Agency historic flood levels show flooding on Water Eaton Road and Frensham Drive, but it is not clear if any properties were flooded.
	2006	August 2006 - Local newspaper reports flooding to Water Eaton Road, but not to properties.

Location	Date	Information
	2021	Bletchley Waterhall Park January 2021 – surface water and fluvial flooding (one property affected).
	2021	Bletchley Waterhall Park January 2021 – surface water and fluvial flooding (one property affected).
Olney and Newton Blossomville	1947	March 1947 - Great Ouse - Parts of Olney and Newton Blossomville. However, the Olney, Newton Blossomvile and Turvey pre-feasibility study found no properties at risk of flooding in Newton Blossomville below a 1 in 100-year event and states that the properties in Newton Blossomville are located on high ground along the edge of the river valley and as such are outside the river flood plain. In Olney the study found the standard of protection to be as low as 1 in 5-years for some properties in Mill Close. EA measurements record flooding to a goods yard on Carey Way, Olney.
	1998	April 1998- Environment Agency measurements record that the grounds of 2 properties in Church Street, Olney.
Fenny Stratford	1947	River Ouzel. There are no recorded flood levels. The River Ouzel at Milton Keynes SoP Study identified 5 properties at risk of flooding at a 50% AEP just downstream of Fenny Stratford including Belvedere Farm and nurseries, with further properties at risk on Powel Haven, Mill Lane, Woolstone, Wattling Street, Manor Field, and Watling Terrace from higher return periods.
New Bradwell Note: The Environment Agency flood event outlines only show flooding to gardens and grounds, not buildings, for these events.	1947	River Great Ouse - New Bradwell
	1968	Loughton Brook
	1998	River Great Ouse - New Bradwell
Shenley Brook End	1980	August 1980 – obstruction/blockage of a culvert on Shenley Brook - Shenley Brook End. Local newspapers report flood damage to Long Meadow School.
Walton Park	2004	November 2004 and November 2007 - Local newspaper reports flooding to Wadesmill Lane, under the V10 road bridge. A local resident claims that the
	2007	

Location	Date	Information
		street floods once or twice a year, with flooding attributed to the brook next to the community centre.
Walnut Tree	-	Newspapers report flooding to Bourton Low due to blockage to a culvert on Caldecotte Brook.
Two Mile Ash	-	Newspapers report flooding to a garden in Ellesborough Grove.
Cosgrove	1998	Easter 1998 - Great Ouse.
Ravenstone	1980	August 1980 - channel capacity on an ordinary watercourse was exceeded.
	2020	December 2020 – fluvial and surface water flooding (several properties and highway affected).
Lavendon	1980	August 1980 - channel capacity on an ordinary watercourse was exceeded.
	2020	December 2020 – fluvial flooding (five properties affected).
Sherington	2020	Sherington December 2020 – surface water flooding (one property and highway affected).
Tathall	2020	Tathall End December 2020 – fluvial flooding (two properties and highway affected).
Stoke Goldington	1880	-
	1968	-
	1973	-
	1980	-
	1984	-
	2002	-
	2007	Two severe flooding events on 4 June and the 2 July 2007 due to a combination of surface run off from higher ground and insufficient capacity in open channels and culverts.
Tathall End	1973	1973 - Environment Agency point measurements record 150mm of flooding to a property.
	2007	July 2007 - Local newspapers report flooding to the road.
Woburn Sands	2004	August 2004 - Local newspaper reports flooding due to a blocked culvert.
Lower Weald	1998	Easter 1998 - Calverton Brook - flooded due to insufficient culvert capacity.

In addition, the EA's **Historic Flood Map (HFM)** 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. The Historic Flood Map outlines for Milton Keynes administrative area are shown in Figure 4-1. The main flood event recorded in the HFM was March 1947 and Easter 1998.

Please note this does not include all recorded flood events, such as those from other sources, which Milton Keynes City Council and LLFA have recorded. Some of the historic extents may refer to older historic flood events, prior to flood defence improvements. It is recommended that the HFM (shown in Appendix A) is viewed alongside the **Recorded Flood Outline** dataset.

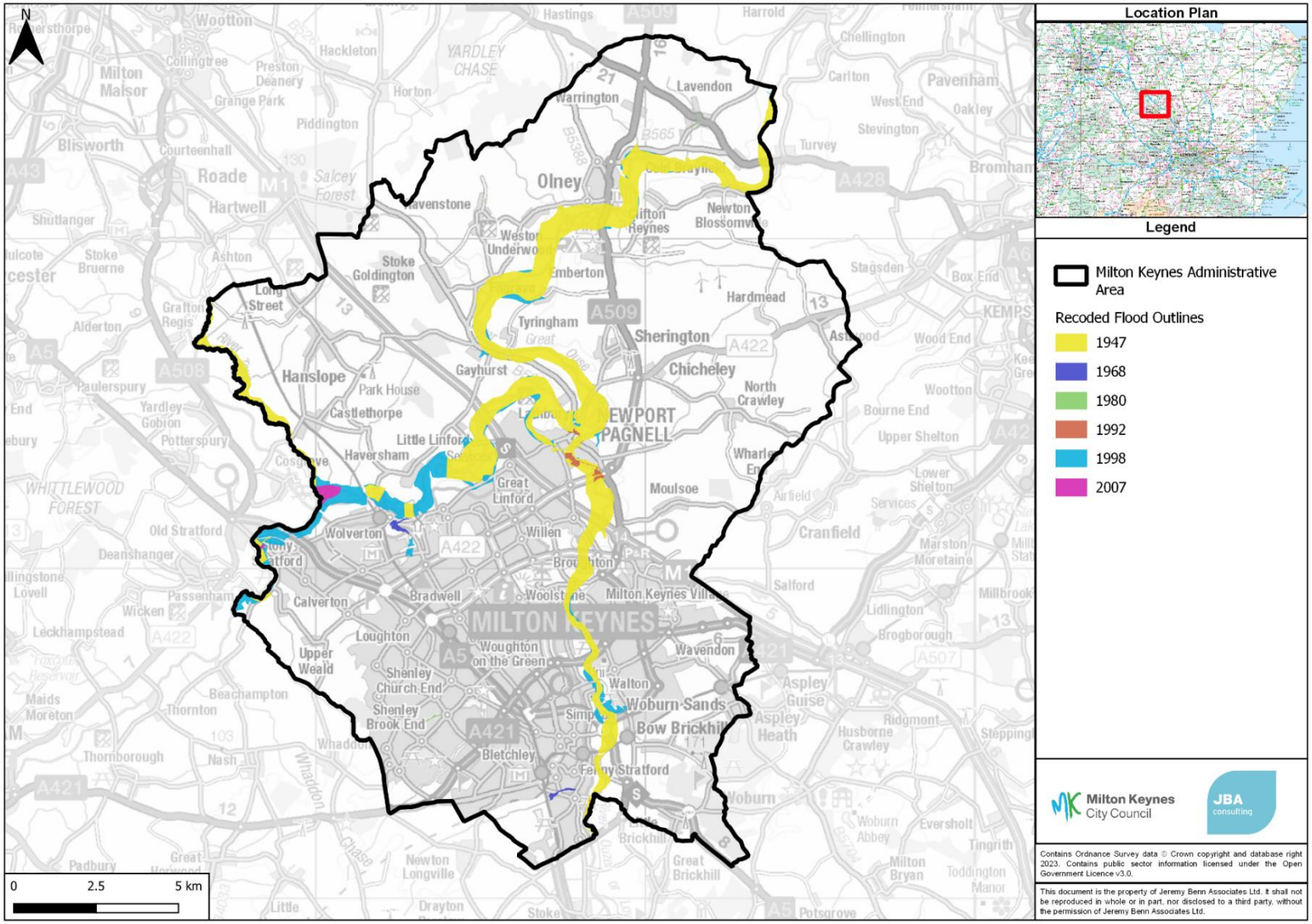


Figure 4-1: Recorded flood outlines within Milton Keynes administrative area

4.2 Topography, geology, soils and hydrology

The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of runoff reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface runoff, whereas more permeable rock such as limestone and sandstone may result in a more subdued response.

4.2.1 Topography

The topography of the study area is shown in Figure 4-2. The highest elevation is found in the south-eastern corner of the administrative area, with other high points located along the entire northern boundary and the south-western corner. The lowest elevations in the administrative area are found in the central part along the floodplain of the main watercourses, such as the River Great Ouse. The land rises towards the urban area of Milton Keynes administrative area in the south.

4.2.2 Geology and soils

The bedrock geology of Milton Keynes administrative area is dominated by sedimentary rocks. Underlying the northwest half of the administrative area is the Great Oolite Group (sandstone, limestone and argillaceous rocks). The Kellaways Formation and Oxford Clay Formation (undifferentiated) (mudstone, siltstone and sandstone) underlie the southeast half of the administrative area and a small area in the far north. A small area in the west of the study area underlying the rivers Tove and Great Ouse is comprised of Lias Group rocks (mudstone, siltstone, limestone and sandstone). Most of the northwest half of the administrative area is underlain by Blisworth limestone. In the far southeast, the hills near Bow Brickhill are underlain by the Lower Greensand Group (sandstone and mudstone).

The superficial geology comprises mainly of alluvium close to the main rivers and till deposits underlying many of the areas of mid elevations. There are also small deposits of river terrace deposits (undifferentiated) (sand and gravel) close to the rivers Great Ouse and Ouzel and small areas of lacustrine deposits (undifferentiated) (clay) and glacial sand and gravel in the south of the administrative area.

Mapping from **Cranfield Soil and Agricultural Institute** shows that the most common soil type in the administrative area is lime-rich loamy and clayey soils with slightly impeded drainage. Along the rivers Great Ouse, Ouzel and Tove there are, in a narrow linear pattern, loamy and clayey floodplain soils with naturally high groundwater. Lying just to the west of the River Ouzel from the southern edge of the administrative area to its confluence with the River Great Ouse and in the southeast of the administrative area are slightly acid loamy and clayey soils with slightly impeded drainage. Underlying areas in the west of the city, close to the Loughton Brook and its tributaries are slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage. In the north of the administrative area on either side of the River Great Ouse are freely draining lime-rich loamy soils. In the far southeast of the administrative area, on the hills above Bow Brickhill, are freely draining slightly acid sandy soils.

The bedrock geology of the study area is shown in Figure 4-3 and the superficial geology of the study area is shown in Figure 4-4.

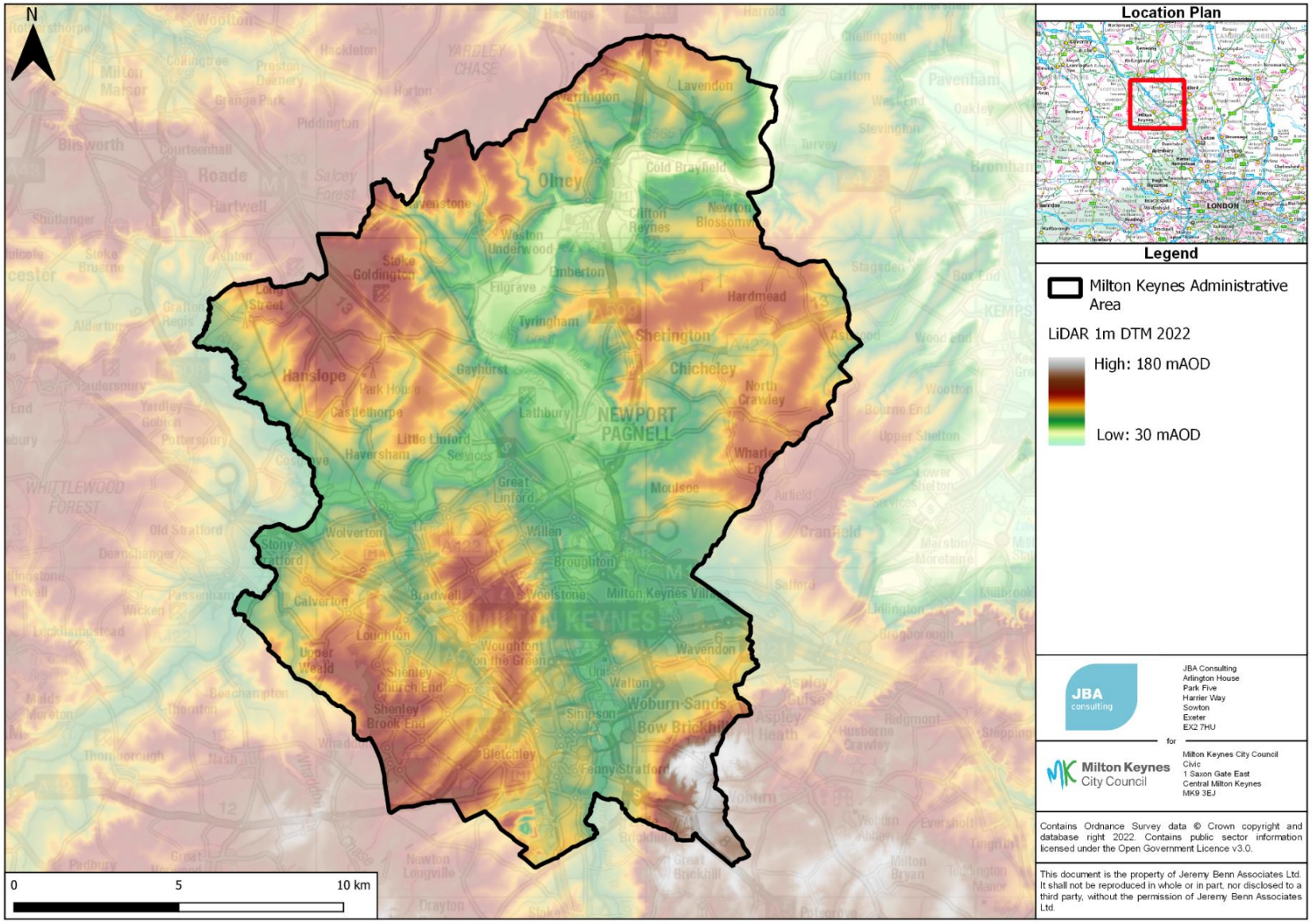


Figure 4-2: Topography of Milton Keynes administrative area

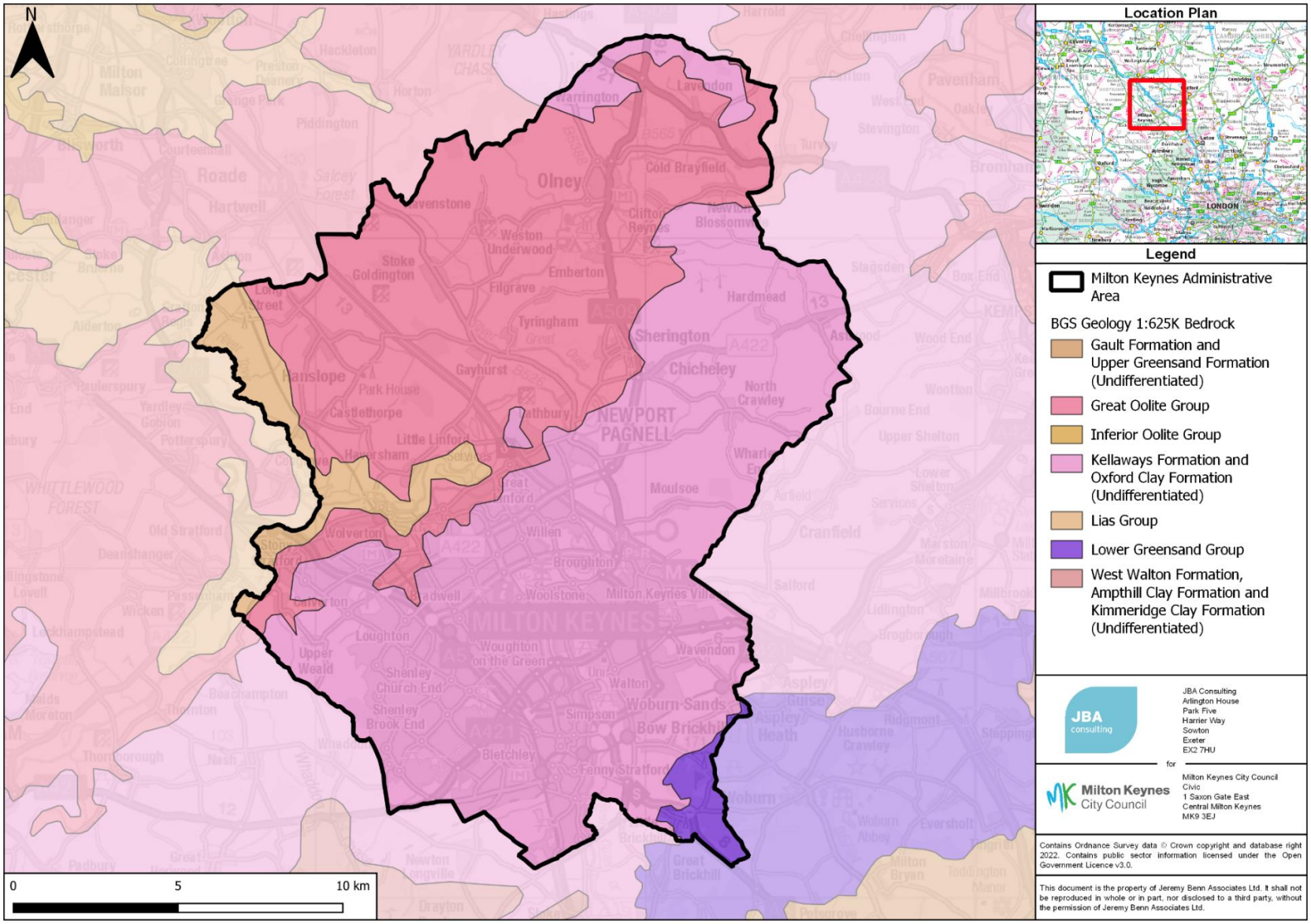


Figure 4-3: Bedrock geology of Milton Keynes administrative area

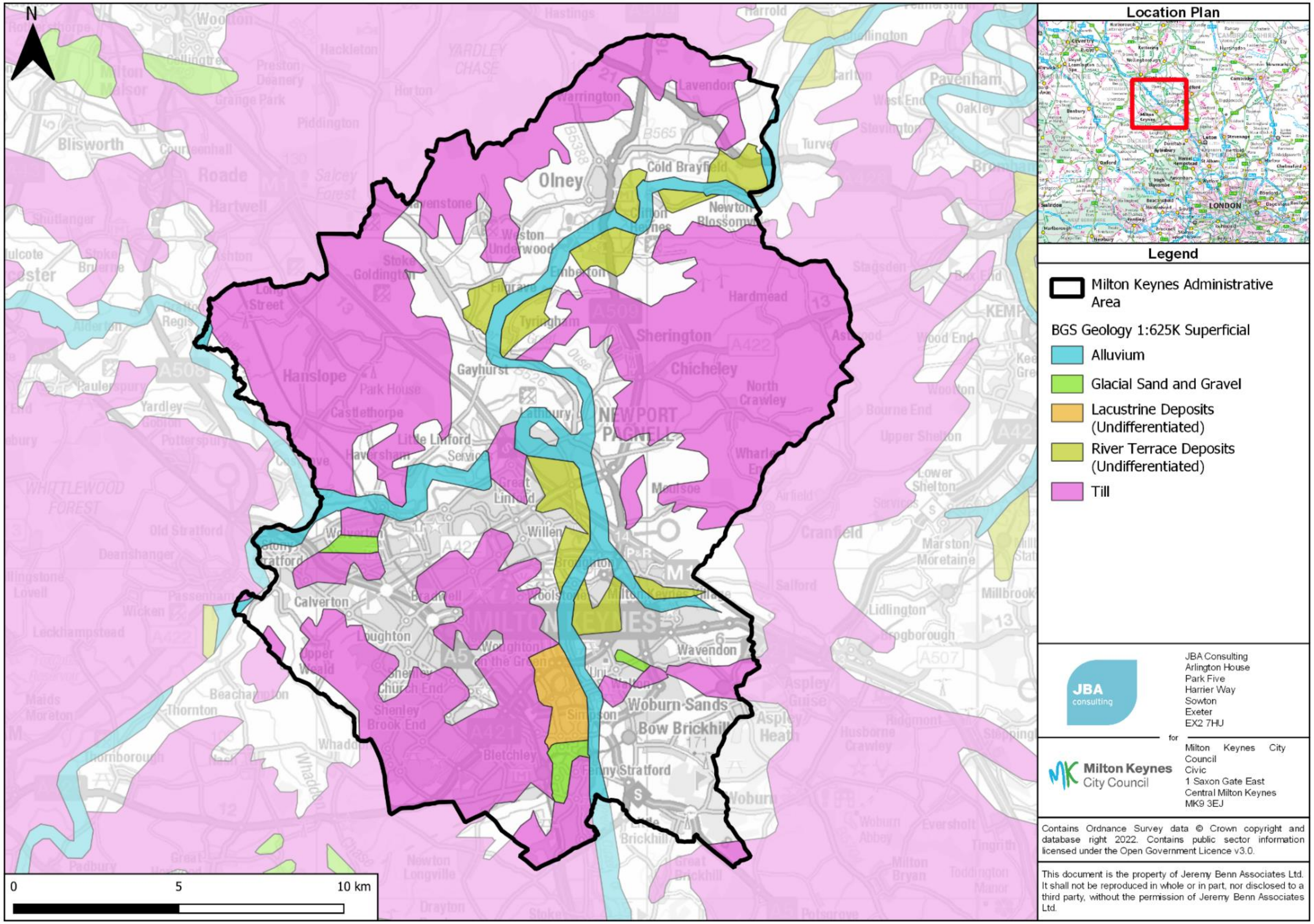


Figure 4-4: Superficial geology of Milton Keynes administrative area

4.3 Hydrology

Watercourses flowing through Milton Keynes administrative area include five Environment Agency designated Main Rivers:

- River Great Ouse
- River Ouzel
- River Tove
- Tongwell Brook
- Water Eaton Brook

Tributaries of these watercourses include smaller ordinary watercourses and numerous unnamed drains.

The Grand Union Canal and Milton Keynes to Bedford Canal also run through the administrative area.

A map of the key watercourses is included in Figure 1-2 and mapping in Appendix B.

Table 4-2: Watercourses in Milton Keynes administrative area

Watercourse name	Classification	Description
River Great Ouse	Main River	This is the largest river within the administrative area, flowing northeast across its centre along the northwest boundary of Milton Keynes administrative area. It drains a large, mainly agricultural, catchment in eastern England, with its source in Northamptonshire and its mouth in The Wash in the North Sea.
River Ouzel	Main River	The River Ouzel is a tributary of the River Great Ouse. It flows north from Leighton Buzzard outside of Milton Keynes administrative area through the eastern half of Milton Keynes to join the River Great Ouse at Newport Pagnell. There are two large balancing lakes, Caldecotte Lake and Willen Lake, which reduce flood risk from the River Ouzel.
River Tove	Main River	The River Tove is a tributary of the River Great Ouse. Its source is in Northamptonshire and it flows for approximately 15 miles through a predominantly agricultural catchment to its confluence with the Great Ouse between Cosgrove and Milton Keynes administrative area.
Tongwell Brook	Main River	The Tongwell Brook is a short tributary of the River Ouzel, flowing east through northeast Milton Keynes administrative area to join the River Ouzel in Newport Pagnell.
Water Eaton Brook	Main River	The Water Eaton Brook is a short tributary of the River Ouzel, flowing east through southern Milton Keynes administrative area to its confluence with the River Ouzel in Water Eaton.
NOTE: This table is based on information extracted from the Environment Agency's Statutory (Sealed) Main Rivers database. Ordinary watercourses within the district are not included within this table.		

Table 4-3: Ordinary watercourses within Milton Keynes administrative area

Watercourse name	Description
Loughton Brook	Loughton Brook flows northeast from the Salden area towards Tattenhoe Park and then parallel to the A421 before flowing northwest parallel to the A5. The confluence of the Loughton Brook with the Great Ouse is at New Bradwell. The Loughton Brook catchment is almost entirely within the Designated Area (DA) of Milton Keynes administrative area. Loughton Brook, downstream of Fulmer Street is in a Drainage District and the Bedford Group of Drainage Boards exercise its permissive powers to carry out works for flood defence purposes. Upstream of Fulmer Street the watercourse is under the jurisdiction of MKCC. The Parks Trust manages the public open space and manages watercourses in the linear parks. There are balancing ponds within the catchment.
Broughton Brook	Broughton Brook is a tributary of the River Ouzel on the eastern side of Milton Keynes administrative area and is within the Bedford Group of Drainage Boards area. There are balancing ponds within the catchment.
Chicheley Brook	Chicheley Brook drains the area surrounding the village of Chicheley in the east of the administrative area and flows west to join the Great Ouse immediately to the north of Newport Pagnell. It is under the jurisdiction of MKCC.
Springhill Brook	Springhill Brook flows east through Neath Hill in the northern part of Milton Keynes administrative area. It then becomes culverted for approximately 1.5km before joining the Tongwell Brook adjacent to Tongwell Lake. It is under the jurisdiction of MKCC.
Calverton Brook	Calverton Brook is a tributary of the Great Ouse which flows through the village of Lower Weald on the western side of Milton Keynes administrative area within the Bedford Group of Drainage Boards area.
Caldecotte Brook	Caldecotte Brook is a tributary of the River Ouzel. It flows west from Woburn Sands through the east side of Milton Keynes administrative area into Caldecotte Lake via twin culverts owned by MKCC and into a box culver public storm sewer. It is within the Bedford Group of Drainage Boards area.
Shenley Brook	Shenley Brook comprises a number of culverted and non-culverted sections and flows through Shenley Brook End.
Jubilee Brook	Jubilee Brook is a tributary to the River Ouzel. It flows northeast from the south of Newton Longville, in the south of Milton Keynes administrative area. The tributary flows through a few culverts before heading west to the River Ouzel.
Simpson/Ashland	Simpson/Ashland is a tributary that flows east from Ashland to the River Ouzel.
Stantonbury	Stantonbury is a tributary that flows north into the River Great Ouse.

The information in this table has been taken from Table 3-1 of the **Milton Keynes City Council Surface Water Management Plan**.

4.4 Fluvial flood risk

The primary fluvial flood risk is along the River Great Ouse and its tributaries, including River Ouzel, River Tove, Tongwell Brook and Water Eaton Brook, which present fluvial flood risk to rural communities as well as to the main urban areas in Milton Keynes administrative area. Areas where there are properties at risk from Main River flooding include Newport Pagnell, New Bradwell, Bletchley, Water Eaton and Stony Stratford. Whilst the Main Rivers, by definition, have the greatest flows, small ordinary watercourses can still pose a material risk as they are generally not defended, aren't monitored and modelling is less likely to be available. Key areas at risk of flooding from ordinary watercourses include Stoke Goldington, Tathall End, Lavendon, Calverton and Loughton.

The Flood Zone maps for Milton Keynes administrative area are provided in Appendix C, split into Flood Zones 2, 3a and 3b (including an 'indicative 3b' where FZ3a acts as FZ3b in the absence of detailed model data). For details about how the Flood Zones have been derived refer to Appendix K.

4.5 Surface water flooding

Surface water runoff (or 'pluvial' flooding) is most likely to be caused by intense downpours e.g. thunderstorms. At times the amount of water falling can completely overwhelm the drainage network, which is not designed to cope with extreme storms. The flooding can also be complicated by blockages to drainage networks, sewers being at capacity and/or high-water levels in watercourses that cause local drainage networks to back up.

The Environment Agency Risk of Flooding from Surface Water mapping (RoFSW) shows that a number of communities are at risk of surface water flooding. The mapping shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys and can pond in low-lying areas. Whilst in the majority of cases the risk is confined to roads, there are notable prominent runoff flow routes around properties, e.g. properties situated at the foot of surrounding hills. The RoFSW mapping for Milton Keynes administrative area can be found on the mapping in Appendix E.

As part of the SWMP (2016), critical drainage catchments were identified across the administrative area, which represent areas of catchments at greatest risk. These are discussed in more detail in Section 2.6.9 and shown in Appendix P.

4.6 Sewer flooding

Sewer flooding occurs when intense rainfall/river flooding overloads sewer capacity (surface water, foul or combined), and/or when sewers cannot discharge to watercourses due to high water levels.

Sewer flooding can also be caused when problems such as blockages, collapses or equipment (such as pumps) failure occur in the sewerage system. Surface water inundation of manhole openings and entry of groundwater may cause high flows for prolonged periods of time.

Section 9 provides details on guidance and advice on managing surface water runoff and flooding.

Since 1980, the Sewers for Adoption guidelines (now replaced by the Design Construction Guidance) mean that new surface water sewers have been designed to have capacity to accommodate a rainfall event with a 1 in 30 chance of occurring in any given year, although until recently this did not apply to smaller private systems.

Consequently, even where sewers are built to current specifications, they can still be overwhelmed by the "design flood" or larger events of the magnitude often considered when looking at river or surface water flooding (e.g. a 1 in 100 chance of occurring in any given year (1% AEP)). Existing sewers can also become overloaded as new development adds to their catchment, even with restrictions in place on permitted discharge, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

Defra has announced its intention to enact Schedule 3 of the FWMA 2010, which will remove the automatic right to connect surface water to public sewers. Key features of Schedule 3 are discussed in Section 2.5.2.

Anglian Water is the main water company responsible for the management of the sewer drainage networks across Milton Keynes administrative area.

Incidents of sewer flooding are recorded in Anglian Water's Hydraulic Sewer Flooding Risk Register are set out in Table 4-4 by postcode and Table 4-5 by year. For confidentiality this data has been supplied on a 4-digit postcode basis.

The 2,342 Anglian Water sewer historic flooding data points provided are shown to be dispersed across Milton Keynes administrative area. Within the boundary the majority of points are located within the southern half of the district boundary in the town centre, with smaller clusters in the north in Castlethorpe, Hanslope, Ravenstone, Olney and Sherington.

In May 2023, Anglian Water published its DWMP. The DWMP describes the basis for long term investment proposals by Anglian Water that span the next 25 years and set out the commitment needed to ensure they're robust and resilient to future pressures.

Anglian Water's plan contains substantive volumes of mapping, information and data that has not previously been made available by water companies. The focus is on planning for the future, so customer flooding is reduced. However, catchments were hydraulically modelled for the 2% annual exceedance probability (AEP) event. By comparison, fluvial, tidal and surface water modelling already used within the Sequential Test is for the 3.3%, 1% and 0.1% AEP events.

Anglian Water have prepared a regional (Level 1) DWMP which is supported by plans for each of the Catchment Based Approach areas (CaBA) (Level 2 DWMP) and wastewater recycling catchments (Level 3 DWMP). However, it was acknowledged at Level 2 that CaBA would not be appropriate or applicable to all, so a range of L2 options were made available: L2 information at CaBA, council boundaries, Regional Flood and Coastal Committees (RFCC), Internal Drainage Board (IDB) areas and by county. Milton Keynes is located within the Upper & Bedford Ouse Catchment Partnership CaBA.

As part of the DWMP, a risk based catchment screening (RBCS) exercise was completed, where existing, readily available data was used to identify where there is a current and/or potential risk or vulnerability in the wastewater system to future changes, such as new residential development or changes in climate.

The screening exercise informed the scope of the Baseline Risk and Vulnerability Assessment (BRAVA) enabling comparison across wastewater systems based on different levels of risk. However, as some catchments have been screened out through the RBCS, the BRAVA does not provide an assessment of the entire catchment.

The DWMP for Anglian Water provides more detailed information on the performance of the sewerage network. There is no mapping available that enables risk to be compared at site scale (as it is prepared at sewer catchment scale) and so the data and mapping is not appropriate to inform the execution of a risk-based sequence. On this basis, Flood Zones for sewer flooding have not been prepared and the available information is not appropriate for use in the Sequential Test. Further information can be found in Appendix O.

Table 4-4: Sewer Flooding Incidents in Milton Keynes administrative area supplied by Anglian Water by postcode

Postcode	Total number of incidents
Unknown	**416**
MK1	**12**
MK10	**24**
MK11	**85**
MK12	**42**
MK13	**142**
MK14	**145**
MK15	**57**
MK16	**161**
MK17	**58**
MK19	**32**
MK2	**172**
MK3	**258**
MK4	**101**
MK43	**5**
MK46	**68**
MK5	**74**
MK6	**328**
MK7	**87**
MK8	**60**
MK9	**15**

Table 4-5 Sewer Flooding Incidents supplied by Anglian Water by year

Year	Approximate number of internal incidents	Approximate number of external incidents
2022	14	201
2021	32	168
2020	11	161
2019	6	183
2018	8	208
2017	9	180
2016	19	227
2015	15	225
2014	29	154
2013	31	234
2012	25	203

Note: Garage and Cellar flooding has been included within internal flooding. Any incidents that did not specify internal or external flooding have been included within external flooding.

4.7 Groundwater flooding

In general, less is known about groundwater flooding than other sources. Groundwater flooding can be caused by:

- High water tables, influenced by the type of bedrock and superficial geology.
- Seasonal flows in dry valleys, which are particularly common in areas of chalk geology.
- Rebounding groundwater levels, where these have been historically lowered for industrial or mining purposes.
- Where there are long culverts that prevent water easily getting into watercourses.

Groundwater flooding can last for days, weeks or even months and is much harder to predict and warn for than other types of flooding. Monitoring does occur in certain areas, for example where there are major aquifers or when mining stops.

Defra identified zones of potential groundwater emergence are located within the administrative area of Milton Keynes. The JBA Groundwater flood risk map for Milton Keynes administrative area is provided in Appendix G. The map indicates that most of the Milton Keynes administrative area has groundwater emergence great than 0.5m below the ground surface or is at no risk of groundwater flooding. Areas where groundwater levels are either at or within 0.025m of the surface, and between 0.025m and 0.5m below the ground surface are mostly found near Newport Pagnell in the centre of the administrative area, in the northern extent between Tyringham and Lavendon, towards Stony Stratford in the west and near Simpson in the south. Groundwater flooding was reported in Newport Pagnell in 2020. Groundwater flooding was also recorded in Olney in 1969 and 1976.

In high-risk areas, a site-specific risk assessment for groundwater flooding may be required to fully inform the likelihood of flooding.

4.8 Flooding from canals

Canals are regulated waterbodies and are unlikely to flood unless there is a sudden failure of an embankment or a sudden ingress of water from a river in areas where they interact closely. Embankment failure can be caused by:

- Culvert collapse
- Overtopping
- Animal burrowing
- Subsidence/ sudden failure e.g. collapse of former mine workings
- Utility or development works close or encroaching onto the footings of a canal embankment.

Flooding from a breach of a canal embankment is largely dictated by canal and ground levels, canal embankment construction, breach characteristics and the volume of water within the canal that can discharge into the lower lying areas behind the embankment. The volume of water released during a breach is dependent on the pound length (i.e. the distance between locks) and how quickly the operating authorities can react to prevent

further water loss, for example by the fitting of stop boards to restrict the length of the canal that can empty through the breach, or repair of the breach. The Canal and River Trust monitor embankments at the highest risk of failure.

There is one canal within the administrative area of Milton Keynes, the Grand Union Canal. The Canal and Rivers Trust have two records of breaches on the Grand Union Canal in 1808 and 1971. There are also two records of overtopping of the Grand Union Canal to the west of the administrative area in South Northamptonshire, in 2007 and 2013.

The canals have the potential to interact with other watercourses in the study area, including the River Great Ouse. These have the potential to become flow paths if these canals were overtopped or breached. Any development proposed adjacent to a canal should include a detailed assessment of how a canal breach would impact the site, as part of a site-specific Flood Risk Assessment. Guidance on development near canals is available from the **Canal and River Trust.**

4.9 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the **Reservoir Act 1975** and are on a register held by the Environment Agency. The level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low.

Flooding from reservoirs occurs following partial or complete failure of the control structure designed to retain water in the artificial storage area. Reservoir flooding is very different from other forms of flooding; it may happen with little, or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate but is extremely low compared to flooding from other sources. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe. The risk of inundation to Milton Keynes administrative area as a result of reservoir breach or failure of a number of reservoirs within the area was assessed as part of the Reservoir Flood Mapping (RFM) study. The reservoirs inundation extents provided by the Environment Agency can be found on the Environment Agency's **Long term flood risk map for England.**

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.

The current mapping shows that there are 16 reservoirs that affect the administrative area within the 'dry-day' scenario, as shown in Appendix H. A further two reservoirs (Brickhill Copse Reservoir and Fish Pond) affect the administrative area during the 'wet-day' scenario. These reservoirs are shown in Table 4-6. 11 of these are located within the administrative area of Milton Keynes, and seven are located outside. The reservoirs inundation extents provided by the Environment Agency can be found on the Environment Agency's **Long term flood risk map for England.** Developers and planners should check the online mapping before using the reservoir data shown in this SFRA to make sure they are using the most up to date mapping.

The Environment Agency maps represent a credible worst-case scenario. In these circumstances it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential. Additional modelling may need to be carried out as part of a site-specific risk assessment to identify these residual risks.

Table 4-6 Reservoirs that may potentially affect Milton Keynes administrative area in the event of a breach

Reservoir	Location (grid reference)	Reservoir owner[25]	Local authority
Willen Lake	SP8810340880	Anglian Water Services Ltd	Milton Keynes City Council
Caldecotte Lake	SP8887835802	Anglian Water Services Ltd	
Tongwell Lake	SP8690042200	Anglian Water Services Ltd	
Furzton Balancing Lake	SP8490036000	Anglian Water Services Ltd	
Bradwell Lake	SP8290040900	Anglian Water Services Ltd	
Brooklands Meadows (Linear Park Flood Attenuation Ponds)	SP8973340321	Buckingham and River Ouzel IDB	
Simpson Balancing Reservoir	SP8777435910	Anglian Water Services Ltd	
Loughton Lake	SP8440037400	Anglian Water Services Ltd	
Brick Kiln Lake	SP7990040500	Anglian Water Services Ltd	
Brickhill Copse Reservoir	SP9190032800	Anglian Water Services Ltd	
Lodge Lake	SP8310038500	Anglian Water Services Ltd	
Foscott	SP7250035200	Anglian Water Services Ltd	Buckinghamshire Council
Foxcote Reservoir	SP7120036400	Anglian Water Services Ltd	Buckinghamshire Council
Wakefield Lodge	SP7390042800	Private Individual	West Northamptonshire Council
Basin Pond	SP9610032600	Bedford Estates Nominees Ltd	Central Bedfordshire Council

25 Data from Defra data services Check your long term flood risk https://check-long-term-flood-risk.service.gov.uk/postcode

Reservoir	Location (grid reference)	Reservoir owner[25]	Local authority
Fish Pond (Battlesden Park Lake)	SP9570028700	Bedford Estates Nominees Ltd	Central Bedfordshire Council
Lower Drakloe Pond	SP9510033700	Bedford Estates Nominees Ltd	Central Bedfordshire Council
Towcester Storage Reservoir	SP6880049200	Environment Agency	West Northamptonshire Council

As above, the risk of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage.

- Developers should seek to contact the reservoir owner to obtain information which may include:
    - reservoir characteristics: type, dam height at outlet, area/volume, overflow location;
    - operation: discharge rates/maximum discharge;
    - discharge during emergency drawdown; and
    - inspection/maintenance regime.
- Developers should apply the sequential approach to locating development within the site.
- Developers should consult with the relevant authorities to find information regarding emergency plans in case of reservoir breach.
- Developers should contact the reservoir owners to the Reservoir Risk Designation (if determined) and identify the inspection and maintenance regime of the reservoir.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond. It should also be understood that the "risk category" of a reservoir is set by the potential damage and loss of life in circumstances where there is a breach or an extreme flood event. Accordingly, it is possible that allocation of new development downstream of an existing reservoir could potentially change the risk category and result in a legal requirement (under the Reservoirs Act 1975) to improve the structural and hydraulic capacity of the dam. As the cost of implementing such works can be substantial consideration should be given to considering the implications and whether it would be more appropriate to place development in alternative locations not associated with such risk.

The Environment Agency online Reservoir Flood Maps contain information on the extents, depths and velocities following a reservoir breach (note: only for those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoirs Act 1975). Consideration should be given for proposed sites located within the extents, shown in these online maps.

In addition to the risk of inundation, those considering development in areas affected by breach events should also assess the potential hydraulic forces imposed by the rapid flood event and check that that the proposed infrastructure fabric can withstand the loads imposed on the structures by a breach event.

4.10 Flood alert and flood warnings

The Environment Agency is the lead organisation for providing warnings of river flooding. Flood warnings are supplied via the Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3.

There are currently four Flood alert areas (Middle River Great Ouse in Milton Keynes administrative area, Bedford Borough and Central Bedfordshire, Upper River Great Ouse in Northamptonshire, Oxfordshire and Buckinghamshire, River Tove in Northamptonshire and River Ouzel in Central Bedfordshire, Buckinghamshire and Milton Keynes administrative area) and 12 Flood Warning Areas (FWA) covering Milton Keynes administrative area:

- River Great Ouse at Turvey,
- River Great Ouse at Olney and Newton Blossomville,
- Low lying areas close to the River Great Ouse and River Ouzel at Newport Pagnell,
- Area close to the River Great Ouse and River Ouzel at Newport Pagnell,
- Wider area at risk from the River Great Ouse and River Ouzel at Newport Pagnell,
- River Ouzel at Simpson, Woolstone, Middleton and Willen,
- River Ouzel at Bletchley and Caldecotte,
- River Ouzel at Leighton Buzzard, Stoke Hammond and Great Brickhill,
- River Great Ouse at New Bradwell and Haversham,
- River Tove at Towcester and Cosgrove,
- Low lying areas close to the River Great Ouse at Stony Stratford,
- River Great Ouse and Padbury Brook at Thornton, Beachampton and Passenham.

Appendix J shows the FWA coverage for the administrative area of Milton Keynes. If your home or business falls within the FWA coverage, this means that the Environment Agency can provide you with flood warnings. Not all watercourses trigger flood alerts or warnings (even if the property is in a warning area). Emergency plans should consider the availability of alerts and whether they are suitable for providing early warning from all sources of fluvial flood risk.

4.11 Summary of flood risk in Milton Keynes administrative area

A table summarising sources of flood risk to the wards in Milton Keynes administrative area can be found in Appendix M.

5 Impact of climate change

The NPPF sets out that flood risk should be managed over the lifetime of a development, taking climate change into account. This section sets out how the impact of climate change should be considered.

Climate change projections show an increased chance of warmer, wetter winters and hotter, drier summers with a higher likelihood of more frequent and intense rainfall. This is likely to make severe flooding happen more often.

5.1 Revised climate change guidance

The Climate Change Act 2008 creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050.

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency used these projections to update their climate change guidance for new developments with regards to updated fluvial, tidal and rainfall allowances which were released in July 2021.

The Environment Agency published **updated climate change guidance** for fluvial risk in July 2021 on how allowances for climate change should be included in both strategic and site-specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development and considers risk allowances on a management catchment level, rather than a river basin level. The guidance was further updated in May 2022 to address the changes to the requirements for rainfall allowances.

Developers should check the government website for the latest guidance before undertaking a detailed Flood Risk Assessment.

5.2 Applying the climate change guidance

To apply the climate change guidance, the following information needs to be known:

- The vulnerability of the development – see the **NPPF (Annex 3: Flood risk vulnerability classification)**
- The likely lifetime of the development – in general 75 years is used for commercial development and 100 for residential, but this needs to be confirmed in an FRA. As appropriate, consideration should be given to residual risk in circumstances where longer development lifetimes are potentially material considerations.
- The Management Catchment that the site is in – the administrative area lies within the Upper and Bedford Ouse management catchment.
- Likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s)
- The 'built in' resilience measures used, for example, raised floor levels
- The capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

5.3 Relevant allowances for Milton Keynes administrative area

Table 5-1 shows the updated peak river flow allowances that apply in the Milton Keynes administrative area for fluvial flood risk (last updated in July 2021). These allowances supersede the previous allowances by River Basin District. SFRAs are required to assess both the central and higher central peak river flow allowances. For Milton Keynes administrative area, for the '2080s' this is 19% and 30%.

Table 5-2 shows the peak rainfall intensity allowances that apply for small catchments (less than 5km2) and urban catchments for surface water flood risk. Catchments which are larger than 5km² or are rural should use Table 5-1 for peak river flow allowances. For SFRAs, the upper end allowance should be used for development with a lifetime beyond 2100. For Milton Keynes administrative area, for the '2070s' this is 35% for the 3.3% AEP event, and 40% for the 1% AEP event. No guidance on allowances for the 0.1% AEP event is provided.

The **climate change allowance guidance** should be checked before submission so that the latest allowances are used.

Table 5-1 Peak river flow allowances for the Upper and Bedford Ouse management catchment

Allowance Category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Upper end	24%	30%	58%
Higher central	10%	11%	30%
Central	5%	4%	19%

Table 5-2: Peak rainfall intensity allowance in small and urban catchments for the Upper and Bedford Ouse management catchment

Allowance Category	3.3% annual exceedance rainfall event 2050s	3.3% annual exceedance rainfall event 2070s	1% annual exceedance rainfall event 2050s	1% annual exceedance rainfall event 2070s
Upper end	35%	35%	40%	40%
Central	20%	25%	20%	25%

5.4 Representing climate change in the Level 1 SFRA

Representation of climate change within the SFRA was discussed with Milton Keynes City Council and the Environment Agency. The best available data has been used at the time of producing the SFRA.

The existing Environment Agency models of the River Great Ouse were run with the latest climate change allowances (19% and 30%) to produce indicative extents for Flood Zone 3b, 3a and 2 in the future, in line with the latest PPG. As the 3.3% AEP event was not available in the existing models, the 2% AEP event has been used as a conservative proxy for Flood Zone 3b. The extents of the 4% AEP and 2% AEP events were compared and the model extents where not shown to be significantly different. More details can be found in Appendix K.

Climate change allowances were run on the 1% AEP undefended models (for Flood Zone 3a) and 0.1% AEP undefended models (for Flood Zone 2). For some events the 20% climate change allowance was already available. This was used as a conservative proxy for the 19% climate change event, rather than re-running this event, in agreement with the Environment Agency. Elsewhere the 19% and 30% climate change allowances were run for the 2% defended, 1% undefended and 0.1% undefended AEP events.

It is worth noting that the models of the River Great Ouse models are in the process of being updated. National Flood Risk Assessment 2 (NaFRA 2) is also due to be released in 2024. Developers should check with the Environment Agency and Milton Keynes City Council that they are using the best available data.

The RoFSW dataset was run with the latest climate change allowances (upper end) to understand the effect of climate change on surface water flooding, and risk to smaller watercourses, which are too small to be covered by the Environment Agency's Flood Zones. This was run for the 35% allowance for the 3.3% AEP event, and the 40% allowance for the 1% AEP and 0.1% AEP events, as agreed with the EA.

Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing Flood Risk Assessments, using the percentage increases which relate to the proposed lifetime and the vulnerability classification of the development. In areas where no modelling is present, this may require development of a 'detailed' hydraulic model, using channel topographic survey. The Environment Agency should be consulted to provide further advice for developers on how best to apply the new climate change guidance.

Climate change mapping has been provided in Appendices D and F.

It is important to note that although the flood extent may not increase noticeably on some watercourses, the flood depth, velocity and hazard may increase compared to the 1% AEP current-day event.

When undertaking a site-specific Flood Risk Assessment, developers should:

- Confirm which national guidance on climate change and new development applies by visiting **GOV.uk.**

- Apply this guidance when deciding the allowances to be made for climate change, having considered the potential sources of flood risk to the site (using this SFRA), the vulnerability of the development to flooding and the proposed lifetime of the development. If the site is near to the indicative climate change extents in this SFRA, the impact of climate change should still be considered because these may get affected should the more extreme climate change scenarios materialise.
- Refer to Section 8 which provides further details on climate change for developers, as part of the FRA guidance, and the SFRA User Guide in Appendix L.

5.5 Impact of climate change in Milton Keynes administrative area

This section explores which areas of the administrative area are most sensitive to increases in flood risk due to climate change. It should be noted that areas that are already at high risk will also become at increasing risk in future and the frequency of flooding will increase in such areas.

It is recommended that the Council works with other Risk Management Authorities to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the administrative area.

5.5.1 Impact of climate change on fluvial flood risk

The climate change modelling of the River Great Ouse undertaken as part of the SFRA has been used to assess the impact of climate change on fluvial flood risk. Where detailed modelling is not available, the Environment Agency's Flood Map for Planning Flood Zone 2 has been used as a proxy for changes to flood extent for Flood Zone 3 due to climate change. Comparing the change in flood extent between Flood Zone 3a and Flood Zone 2 indicates areas where the extent of flooding is most sensitive to fluvial impacts of climate change. It is important to note that although the flood extent may not increase noticeably on some watercourses, the flood depth, velocity and hazard may increase with climate change.

If a development site is located within Flood Zone 2 or 3b using generalised modelling then an assessment of climate change for this zone can be undertaken at the Level 2 SFRA stage.

Mapping of the impact of climate change on fluvial flood risk is shown in Appendix D.

Areas in the administrative area most sensitive to fluvial impacts of climate change are:

- Along the River Great Ouse in the north, affecting Cold Brayfield, Filgrave, Lathbury and Little Linford.
- Along the River Ouzel flowing in a southerly direction, affecting Broughton, Woolstone, Simpson and Fenny Stratford.
- On the confluence between the Chicheley Brook to the River Great Ouse located at Newport Pagnell.

5.5.2 Impact of climate change on surface water flood risk

The RoFSW dataset has been used to understand changes to flood extent due to climate change. Comparing the changes in flood extent between present day and climate changes runs indicate the areas of the administrative area that are most sensitive to surface water impacts of climate change. Mapping is shown in Appendix F.

Areas in the administrative area most sensitive to changes between the present day and climate change surface water extents are typically in areas of low-lying topography on the floodplains of the main watercourses. As shown in Appendix F, the majority of the administrative area is at risk to increased surface water due to climate change, with the southern extent experiencing the greatest increase. In the north the largest increase in extent is seen along the Great River Ouse and its tributaries.

5.5.3 Impact of climate change on groundwater flood risk

There is no technical modelling data available to assess climate change impacts on groundwater. The impact of climate change on groundwater flooding would depend on the flooding mechanism and geological characteristics, for example prolonged rainfall in a chalk catchment. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding.

A high likelihood of groundwater flooding may mean infiltration SuDS are not appropriate and groundwater monitoring may be recommended.

5.5.4 Adapting to climate change

The **NPPG Climate Change guidance** contains information and guidance for how to identify suitable mitigation and adaptation measure in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime.
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development.
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses.
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity, for example by leaving areas shown to be at risk of flooding as public open space.
- Considering the standard of protection of defences and sites for future development, in relation to sensitivity to climate change. Milton Keynes City Council and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating

development in such areas of risk may not be a sustainable long-term option, such as at the defence locations mentioned in Section 6; and

- It is recommended that the differences in flood extents from climate change are compared by Milton Keynes City Council when allocating sites, to understand how much additional risk there could be, where this risk is in the site, whether the increase is marginal or activates new flow paths, whether it affects access/escape routes and how much land could still be developable overall. Recommendations for development are made for the levels of risk in the SFRA User Guide in Appendix L.

6 Flood alleviation schemes and assets

This section provides a summary of existing flood alleviation schemes and assets in Milton Keynes administrative area. Planners should note the areas that are protected by defences where further work to understand the actual and residual flood risk through a Level 2 SFRA may be beneficial. Developers should consider the benefit they provide over the lifetime of a development in a site-specific Flood Risk Assessment.

6.1 Asset management

The following Risk Management Authorities hold databases, as described for flood risk management and drainage assets:

- The Environment Agency holds a national database that is updated by local teams
- The LLFA holds a database of significant local flood risk assets, required under Section 21 of the Flood and Water Management Act (2010)
- Highways Authorities hold databases of highways drainage assets, such as gullies and connecting pipes
- Water Companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.

The databases include assets RMAs directly maintain and third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA contains full information on the location, condition and ownership of all the assets in their area. They take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.

Developers should collect the available asset information and undertake further survey as necessary to present an understanding of current flood risk and the existing drainage network in a site-specific Flood Risk Assessment. In particular buried and old assets i.e. culverts, need to be surveyed rather than assumed to follow a straight line between inlet and outlet.

6.2 Standards of protection

Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP SoP means that the flood risk in the defended area is reduced to at least a 1% chance of flooding in any given year. The SoP is considered using a list of factors including crest height, strength and condition, so crest level alone should not be used to define SoP.

Over time the actual SoP provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change. The understanding of SoP may also change over time as RMAs undertake more detailed surveys and flood modelling studies.

It should be noted that the Environment Agency's on-going hydraulic modelling programme may revise flood risk datasets and, as a consequence, the standard of

protection offered by flood defences in the area may differ from those discussed in this report.

Developers should consider the SoP provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

The Environment Agency and local authorities have permissive powers to maintain and improve Main Rivers and ordinary watercourses, respectively. There is no legal duty to maintain watercourses, defences or assets. Therefore maintenance and improvements are normally prioritised based on flood risk. The ultimate responsibility for maintaining watercourses rests with the landowner.

Highway's authorities have a duty to maintain public roads, making sure they are safe, passable and the impacts of severe weather have been considered. Water companies have a duty to effectually drain their area. What this means, in practise, is that the approach to prioritise asset maintenance is to consider performance in relation to defined standards, and improvements are prioritised for the parts of the network that do not meet the respective standard e.g. where there is frequent highway or sewer flooding.

Milton Keynes City Council, as the LLFA, has permissive powers, and limited resources are therefore prioritised and targeted to where it can have the greatest effect.

There is potential for the risk of flooding to increase in areas where flood alleviation assets are not maintained regularly. Breaches in raised flood defences are most likely to occur where the condition of a flood defences has degraded over time. Drainage networks in urban areas can also frequently become blocked with debris and this can lead to blockages at gullies, culverts or bridges.

Developers should not assume that any defence, asset or watercourse is being or will continue to be maintained throughout the lifetime of a development. They should contact the relevant RMA about current and likely future maintenance arrangements and ensure future users of the development are aware of their obligations to maintain watercourses. More information about riparian owner responsibilities can be found in the Environment Agency's guidance on **Owning a Watercourse** (2018).

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the Environment Agency for condition is provided in Table 6-1. The condition stated by the Environment Agency will reflect its state at the last inspection. Events after that inspection may result in degradation of the asset i.e. a flood event, erosion, inappropriate activities on the structure, animal action etc. the condition of the asset should be verified by the applicant during the FRA. Capital funding for repair, upgrading and replacement assets is determined, primarily, by the number of properties the asset protects (as this is influential with respect to risk) that were constructed pre-2012. Anything after that is not counted.

Table 6-1: Grading system used by the Environment Agency to assess flood defence condition

Grade	Rating	Description
1	Very good	Cosmetic defects that will have no effect on performance
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very Poor	Severe defects resulting in complete performance failure.

Source: Condition Assessment Manual – Environment Agency 2006

6.4 Major flood risk management assets in Milton Keynes administrative area

The Flood Map for Planning was updated in December 2022 to remove the 'Areas Benefiting from Defences' (ABD). This has been superseded by a dataset called 'Reduction in Risk of Flooding from Rivers and Sea due to Defences'. This shows areas where this is a reduction in flood risk due to defences, taking into account the condition the defences are in. This shows areas of reduced risk not removed risk. This means there are areas within the risk reduction extent that may still flood in a design event. Areas within the administrative area of Milton Keynes shown in the dataset are located in Newport Pagnell, Willen, Woolstone and at Caldecotte Lake.

The Environment Agency 'AIMS' spatial flood defence dataset gives further information on all flood defence assets within the administrative area. Mapping showing the condition and design standards of existing flood defences in Milton Keynes administrative area can be found in Appendix I; this information is derived from the Environment Agency's Spatial Flood Defences dataset. Other than natural high ground, there are few defences within the administrative area of Milton Keynes contained in the AIMS flood defence layer. There is a section of embankment on the east bank of Willen Lake and along the River Ouzel just to its south in Walton. In Newport Pagnell, there are some embankments, walls and bridge abutments along the River Ouzel.

Surface water and foul sewer networks were incorporated into the original design of Milton Keynes administrative area to drain the urban area in the south. Surface Water sewers drain the highways infrastructure and residential and commercial areas through a strategic sewer and balancing lake network. These play an important role in managing surface water and main river flood risk. The balancing lakes, which act as flood storage areas, and are shown in the LLFA Asset dataset. These are maintained by Anglian Water and locations of these lakes is outlined in Section 4.9. The linear parks that link the network of balancing lakes are owned by Milton Keynes City Council but leased to the Parks Trust on a 999 year lease.

There are Environment Agency gauging stations along the linear parks which measures inflows and outflows and are important to the management of flood risk.

The Anglian River Basin District FRMP also mentions that flood defences have been constructed in Stoke Goldington and Tathall End, and Anglian Water have installed a larger sewer on Wolverton Road, Newport Pagnell to reduce flooding in this area.

6.4.1 Natural flood management

Natural Flood Management (NFM) is used to protect, restore and renaturalise the function of catchments and rivers to reduce flood risk. A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes in order to store or slow down flood waters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). Techniques and measures, which could be applied in the Milton Keynes administrative area include:

- Creation of offline storage areas
- Re-meandering streams (creation of new meandering courses or reconnecting cut-off meanders to slow the flow of the river)
- Targeted woodland planting
- Reconnection and restoration of functional floodplains
- Restoration of rivers and removal of redundant structures i.e. weirs and sluices no longer used or needed
- Installation or retainment of large woody material in river channels
- Improvements in management of soil and land use
- Creation of rural and urban SuDS.

In 2017, the Environment Agency published an **online evidence directory** to support the implementation of NFM and maps showing locations with the potential for NFM measures. These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them.

There are areas within Milton Keynes administrative area whereby removing existing defences and reconnecting the floodplain could create areas for potential without causing risk to properties. This is discussed further in Section 10.4.

6.5 Other schemes

The EA's **Asset Management** map provides the following key assets management datasets that are approved as open data.

- The location of flood defences and associated maintenance activities
- Asset Maintenance Programme - the first year (2021/22) is the funded delivery programme from April 2021 to March 2022. The following years show the maintenance needs that will be considered and prioritised for potential funding as part of our annual Flood Defence Grant in Aid allocation process. The Maintenance History section shows maintenance work that was completed in previous years.
- Completed FCERM schemes within the 2015-2021 6-year Capital Investment Programme which are now better protecting homes.

- Completed FCERM schemes within the first year of the current Capital investment programme (2021-2027) which are now better protecting homes.

There are no completed capital schemes shown in the Milton Keynes administrative area.

6.6 Actual and residual flood risk

A Level 2 SFRA (for strategic allocations) or developer site-specific Flood Risk Assessment will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail (although it should be noted that Zone 3b is based on the actual flood risk).

6.6.1 Actual flood risk

Understanding the implications of development is accomplished by considering information on the "actual risk" of flooding. The assessment of actual risk takes account of the presence of flood defences and provides a picture of the safety of existing and proposed development. It also accounts for hydraulic modelling, topographic surveys of the site in question and any historic flooding information. It should be noted that the use of flood defences is not always the most appropriate way of protecting new residential development against flooding. Other options should also be considered such as natural flood risk management (e.g. the creation of floodplain storage areas). It should be understood that the standard of protection afforded by flood defences is not constant and it is presumed that the required minimum standards for new development are:

- Residential development should be protected against flooding with an annual probability of river flooding of 1% (1 in 100-year chance of flooding) taking into account climate change in any year.

This is the risk to the site considering existing flood mitigation measures and any planned to be provided through new development. The original baseline assessment of actual flood risk should not include planned mitigation measures, although if the measures are in place and operational it is appropriate that account is taken of the operational performance is Note that it is not likely to be acceptable to allocate developments in existing undefended areas on the basis that they will be protected by developer works, unless there is a wider community benefit that can be demonstrated. Other factors will also be considered, such as long term maintenance funding and funding mechanism for future adaptation.

The assessment of the actual risk should take into account that:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated. These improvements will have to be appropriately funded and allow for the requirements associated with the growth, funding will include the initial development and then the ongoing maintenance actions to maintain SoP.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for the Flood Risk Management Strategy

to be reviewed. Growth will unlikely be a factor in increased government spend on flood defences as this is based on properties at risk as of 2012.

- The standard of protection must be maintained for the intended lifetime of the development. Over time the effects of climate change will erode the present-day standard of protection afforded by defences and so commitment is needed to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained and where necessary, land secured and safe-guarded that is required for affordable future flood risk management measures. Safeguarding land for flood storage is discussed in Section 10.2.
- By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources.

6.6.2 Residual risk

Residual risk is the risk that remains after the effects of flood risk infrastructure have been taken into account. It is important that these risks are quantified to confirm that the consequences can be safely managed. Paragraph 041 of the PPG (Reference ID: 7-041-20220825) sets out that the residual risk can be:

- The effects of a larger flood than defences were designed to alleviate (the 'design flood'). This can cause overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming amount of water.
- Failure of the defences or flood risk management measures, such as breaches in embankments or walls, failure of flood gates to open or close or failure of pumping stations.

It is the responsibility of the developer to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed.

This SFRA does not assess the probability of failure. However, in accordance with NPPF, all sources of flooding need to be considered. If a breach or overtopping event were to occur, then the consequences to people and property could be high. Developers should be aware that any site that is at or below defence level, may be subject to flooding if an event occurs that exceeds the design capacity of the defences, or the defences fail, and this should be considered in a detailed Flood Risk Assessment.

The assessment of residual risk should take into account:

- The flood hazard, depth and velocity that would result from overtopping or breach of defences. Flood gate or pumping station failure and/ or culvert blockage (as appropriate). The Environment Agency can provide advice at site-specific development level for advice on breach/ overtopping parameters for flood models.
- The design of the development – taking into account of the highest risk areas of the site e.g. allowing for flood storage on parts of the site, and keeping people safe e.g. with sleeping accommodation above the flood level.
- A system of warning and a safe means of access and egress from the site in the event of a flood for users of the site and emergency services.

- Climate change and/ or policy-dependent residual risks (such as those that may be created if necessary, future defence improvements are required, or those associated with any managed adaptive strategies).

6.6.3 Overtopping

The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest level of the defence. The Defra and Environment Agency **Flood Risks to People** guidance document provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

Any sites located next to defences or perched ponds/ reservoirs, may need overtopping modelling or assessments at the site-specific FRA stage, and climate change needs to be taken in to account.

6.6.4 Defence breach

A breach of a defence occurs when there is a failure in the structure and a subsequent ingress of flood water.

Where defences are present, risk of breach events should be considered as part of the site-specific FRA. Flood flows from breach events can be associated with significant depths and flow velocities in the immediate vicinity of the breach location and so FRAs must include assessment of the hazards that might be present so that the safety of people and structural stability of properties and infrastructure can be appropriately taken into account. Whilst the area in the immediate vicinity of a breach can be subject to high flows, the whole flood risk area associated with a breach must also be considered as there may be areas remote from the breach that might, due to topography, involve increased depth hazards. In some situations, the flood extent of a breach can be larger than the undefended extent of the same magnitude.

Considerations include the location of a breach, when it would occur and for how long, the depth of the breach (toe level), the loadings on the defence and the potential for multiple breaches. There are currently no national standards for breach assessments and there are various ways of assessing breaches using hydraulic modelling. Work is currently being undertaken by the Environment Agency to collate and standardise these methodologies. It is recommended that the Environment Agency are consulted if a development site is located near to a flood defence, to understand the level of assessment required and to agree the approach for the breach assessment.

7 Cumulative impact of development and strategic solutions

This section provides information regarding Cumulative Impact of Development and Strategic Solutions.

Under the NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRAs), are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (paragraph 166), rather than just to or from individual development sites.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe. Similarly, the effect of the loss of surface water flow paths, surface ponding and infiltration can also give rise to cumulative effects and potentially exacerbate surface water flood risk.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage and appropriate consideration is given to surface water flow paths and storage proposals should normally not increase flood risk downstream.

Catchments within the study area that have the potential to influence existing flood risk issues in neighbouring Local Authorities were identified, as well as catchments in the study area that may be influenced by development in catchments in neighbouring Local Authorities. Historic flood incidents, the current and predicted increase in surface water flood risk to properties and cross boundary issues in each catchment were assessed to identify the catchments at greatest risk.

Local planning policies can also be used to identify areas where the potential for development to increase flood risk is highest and identify opportunities for such new development to positively contribute to decreases in flood risk downstream.

7.1 Strategic flood risk solutions

Milton Keynes City Council 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 Milton Keynes Local Flood Risk Management Strategy (as LLFA) and Anglian River Basin Flood Risk Management Plan set out specific actions for the authority region.

Section 2 sets out the strategic plans that exist for the authority region.

7.2 Assessment of cross-boundary issues

Milton Keynes administrative area partially contains catchment areas within the following Local Authorities (see Figure 1-1 for the Local Authority Boundaries):

- Bedford Borough Council
- Buckinghamshire Council
- Central Bedfordshire Council
- North Northamptonshire Council
- West Northamptonshire Council

The River Great Ouse and tributaries drains areas from Buckinghamshire, Central Bedfordshire and West Northamptonshire into Milton Keynes administrative area, and from Milton Keynes administrative area into Bedford Borough, Huntingdonshire, Fenland, South Cambridgeshire, East Cambridge, Kings Lynn and West Norfolk.

As such, future development, both within and outside of Milton Keynes administrative area 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 administrative area during the planning stage and appropriate development management decisions put in place so there are 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 administrative area. The neighbouring authorities were contacted for information on their site allocations, to determine where development in neighbouring authorities may have an impact.

The following Local Plans for neighbouring local authorities include policies relevant to flood risk and drainage. More details about the status of the plans can be found on the Council websites.

- **Bedford Borough Council**
- **Central Bedfordshire Council**
- **Buckinghamshire Council** (plan has not yet been adopted)
- **West Northamptonshire Council** (plan in preparation. The West Northamptonshire Local Plan will replace the West Northamptonshire Joint Core Strategy Local Plan (Part 1) and the Part 2 Local Plans which were adopted for the former Daventry, Northampton and South Northamptonshire areas).
- **North Northamptonshire Council** (plan in preparation. North Northamptonshire Council has replaced Corby Borough Council, East Northamptonshire Council, Kettering Borough Council and the Borough Council of Wellingborough).

For the CIA, Milton Keynes administrative area was assessed at a sub-catchment level (see Figure 7-1).

7.3 Approach and methodology

The approach is based on providing an assessment of catchments where the allocation of more than one site could result in effects that increase the flood risk to third parties. At a strategic level this involves comparison of catchments, to assess the quantum of proposed development and the sensitivity of the catchment to changes in flood risk. Historic flooding incidents are also included in the assessment, as these are an indicator of the actual sensitivity of locations within a catchment to flood events.

The methodology deploys a range of metrics to assess the potential for cumulative impacts to be experienced, which provide a balance between predicted and observed flooding data recorded by Anglian Water and the Environment Agency Recorded Flood outlines.

7.4 Datasets

The WFD river catchments defined in the River Basin Management Plans were used to divide Milton Keynes administrative area and surrounding local authorities into manageable areas on which to base a cumulative impact assessment. The surrounding local authorities included in the CIA are set out in Section 7.2. The catchments are shown in Figure 7-1.

7.4.1 Proposed level of growth

To understand areas of Milton Keynes administrative area that are likely to experience the greatest pressure for future growth, the Plan:MK Sites and recommended growth options from the MK2050 strategy have been analysed. This data was collated from shapefiles directly provided by Milton Keynes City Council and Neighbouring Local Planning Authorities.

This will allow calculation of the overall area of suggested sites within each catchment, illustrating the relative pressures on the catchments. This can be used with existing development extent, to identify catchments likely to be under the greatest pressure for development. The context for this being that in circumstances where the proportion of proposed new development is greater, the more likely it is to give rise to cumulative effects.

The proposed level of growth was assessed using development sites provided by Milton Keynes City Council and neighbouring authorities. This was then compared with to the existing area of development, as indicated through the OS Vector Map dataset.

The OS Vector Map dataset is an OS basemap of the UK which contains various receptor layers, of which the buildings layer was used to identify the current level of development.

A development pressure score was derived for each catchment within the study area.

The risk metrics calculated for development pressure were:

- Calculation of total development currently within the catchment (%)
- Indicator of potential change in developed area within a catchment (%)

The total proposed development area was divided by the area of the catchment, and the catchments ranked to see which had the highest level of potential development.

The context for this being that in circumstances where the proportion of proposed new development is greater, then it is more likely to give rise to cumulative effects.

It should be noted that for the purposes of the assessment it has been assumed that all sites will be developed, and that the entire site footprint would be developed. This is a conservative approach and does not account for sites that are brownfield.

7.4.2 Historic and predicted flood risk

A composite flood risk score was derived for each catchment within the study area by taking an average ranking of both recorded (historic incidents) and modelled (predicted) flood risk.

The risk metrics calculated for predicted (modelled) flood risk were:

- Percentage of catchment within the combined Flood Zone 3 and RoFSW 1 in 100-year (1% AEP) flood risk extent
- Sensitivity of catchment to an increase in flood flows to a 1 in 1000-year (0.1% AEP) surface water and Flood Zone 2
- Percentage of properties within the combined Flood Zone 2 and RoFSW 1 in 1000-year (0.1% AEP) flood risk extent
- Sensitivity of catchment to an increase in flood flows to a 1 in 1000-year (0.1% AEP) surface water and Flood Zone 2)

To do this, the RoFSW 1% AEP extent was merged with Flood Zone 3a and the 0.1% AEP RoFSW extent was merged with Flood Zone 2, to create combined layers showing predicted flood risk. The sensitivity is a measure of the increase in the percentage of catchment / properties at risk of flooding from a 1 in 100-year event to a 1 in 1000-year event.

The risk metrics calculated for historic flood risk were:

- Number of sewer flooding incidents, recorded by Anglian Water
- Percentage of National Receptor Database (NRD) points within the Environment Agency's historic flood map

The % of each catchment covered by a Critical Drainage Catchment (CDC) was also considered as a separate metric. CDCs represent areas or catchments of greatest risk where multiple or interlinked sources of flood risk were identified. These were defined though consideration of potential sources of flooding and historic flooding events.

7.5 Scoring

A relative risk score of 1 to 3 (low to high) was applied to each flood risk (Table 7-2) and development pressure metric (Table 7-3) and summed to give an overall relative flood risk score for each WFD catchment (Table 7-4).

It should be noted that scoring is based on the use of national datasets that may not account for localised differences in flood risk. Datasets may be periodically updated and there is a potential for information to not be fully represented (i.e. historic flood events may be under reported). However, the results are deemed suitable for use as a broad-scale assessment of WFD catchments.

Table 7-1: Summary of datasets used within the Broadscale Cumulative Impact Assessment

Dataset	Coverage	Source of Data	Use of Data
Catchment Boundaries	Milton Keynes administrative area & within neighbouring authorities	Water Framework Directive Catchments	Assessment of susceptibility to cumulative impacts of development by catchment.
National Receptor Dataset	Milton Keynes administrative area & within neighbouring authorities	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment.
Risk of Flooding from Surface Water	Milton Keynes administrative area & within neighbouring authorities	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment.
Fluvial Flood Zones 2 and 3	Milton Keynes administrative area & within neighbouring authorities	Environment Agency	Assessing the number of properties at risk of fluvial flooding within each catchment.
Critical Drainage Catchments	Milton Keynes administrative area	Milton Keynes City Council	Assessing catchments with existing critical drainage issues.
Future development areas (recently built out sites/sites under construction/sites with planning permission/previously allocated sites/currently allocated sites)	Milton Keynes administrative area & within neighbouring authorities	Bedford Borough Council, Buckinghamshire Council, Central Bedfordshire Council, North Northamptonshire Council, West Northamptonshire Council	Assessing the impact of proposed future development on risk of flooding.
Historic Flooding Incidents	Milton Keynes administrative area & within neighbouring authorities	Anglian Water, Environment Agency	Assessing incidences of historic flooding within the study area.

Table 7-2: Individual components of the relative cumulative impacts score for historic and predicted flood risk (per WFD catchment)

Point Score	% of catchment within the combined FZ3 and 100-year RoFSW flood risk extent	% increase in percentage of catchment at risk during the combined 1000-year ROFSW and FZ2 flood risk exent	% of properties within the combined FZ3 and 100-year RoFSW	% increase in percetnage of properties at risk during the combined 1000-year RoFSW and FZ2 extent	Recorded flood incidents (Anglian Water)	% of NRD points within the EA historic flood map	% of catchment covered by CDC
1 – Low risk	<1%	<50%	<1%	<1%	<10	<1%	0-5%
2 – Medium risk	1-10%	50-100%	1-3%	1-3%	10-50	1-5%	5-25%
3 – High risk	>10%	>100%	>3%	>3%	>50	>5%	>25%

Table 7-3: Individual components of the relative cumulative impacts score for development pressure (per WFD catchment)

Point Score	% of total current development in catchment	% of potential future change in development
1 – Low risk	<2%	<50%
2 – Medium risk	2 to 5%	50-500%
3 – High risk	>5%	>500%

Table 7-4: Matrix of flood risk and future development pressure

	Historic and predicted flood risk		
Development pressure	**Low**	**Medium**	**High**
Low	1	3	4
Medium	3	4	5
High	4	5	6

Table 7-5: Summary of Cumulative Impact Assessment results

Catchment	Flood Risk		Development Pressure		Overall Score
Bromham Brook	MEDIUM	2	LOW	1	LOW
Broughton Brook	MEDIUM	2	HIGH	3	HIGH
Chicheley Brook	MEDIUM	2	HIGH	3	HIGH
Grendon Brook	MEDIUM	2	LOW	1	LOW
Loughton Brook	HIGH	3	MEDIUM	2	HIGH
Newton Longville Brook	MEDIUM	2	HIGH	3	HIGH
Ouse (Buckingham to Cosgrove)	MEDIUM	2	MEDIUM	2	MEDIUM
Ouse (Newport Pagnell to Roxton)	MEDIUM	2	LOW	1	LOW
Ouse (Wolverton to Newport Pagnell)	MEDIUM	2	MEDIUM	2	MEDIUM
Ouzel DS Caldecote Mill	HIGH	3	HIGH	3	HIGH
Ouzel US Caldecote Mill	MEDIUM	2	HIGH	3	HIGH
Potterspury Brook	LOW	1	LOW	1	LOW

Catchment	Flood Risk		Development Pressure		Overall Score
Ravenstone Brook	HIGH	3	LOW	1	MEDIUM
Tathall Brook	MEDIUM	2	LOW	1	LOW
Tove (DS Greens Norton)	MEDIUM	2	MEDIUM	2	MEDIUM
Weald Brook	MEDIUM	2	MEDIUM	2	MEDIUM
Wootton Brook	LOW	1	MEDIUM	2	LOW

7.6 Assumptions

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 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	GIS data sourced provided the best available results for the location of historic flooding incidents in Milton Keynes administrative area and neighbouring authorities.

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
		there has been a flood incident. It is understood that Milton Keynes City Council do not have a GIS layer containing records of flooding therefore other sources of flooding are not included.	
Proposed development	All proposed development sites added onto existing development	Does not account for development that may be on brownfield land and where betterment that may occur, or for windfall sites	Largest proposed development sites are on greenfield land. This is a conservative approach.

7.7 Conclusions of the cumulative impact assessment

A summary of the cumulative impacts assessment results is shown in Figure 7-1.

It can be seen that the highest risk catchments are located in the south and east of Milton Keynes administrative area. The cumulative impact assessment highlights areas where there is a greater sensitivity to cumulative effects from planned development. In these catchments this should potentially be considered by developers and specifically addressed within FRAs for proposed development.

Within Milton Keynes, it is understood that the River Ouzel and Great Ouse confluence causes a double flood peak at Newport Pagnell. Cumulative impacts of small changes in either catchment could result in the combining of those peaks, increasing the risk to Newport Pagnell.

Including consideration of cumulative effects requires that FRAs should assess:

- The location and sensitivity of receptors to cumulative effects and the mechanisms that potentially result in flooding (e.g. locations that are reliant on the performance of pumped drainage systems to manage flood risk, locations where existing flooding is experienced and can be exacerbated by relatively small changes in flood flow magnitude, volume or flood duration, etc).
- The potential quantum of proposed cumulative development within a River Basin and assessment of the effect on sensitive receptors of the cumulative benefit afforded by piecemeal mitigation at the respective allocation sites.
- The requirement for measures to address potential cumulative effects (these can be both ‘on-site’ measures and contributions to strategic ‘off-site’ measures).

- The opportunity to integrate site mitigation measures with strategic flood risk management measures planned in the River Basin.
- The long-term commitments to management and maintenance.

There are other impacts of development that have a cumulative impact that should be considered as part of a site-specific FRA, such as removal of flow restrictions, piped conveyance rather than overland flow. Temporary or enabling works can also have impacts, such as creation of compacted ground reducing infiltration.

Recommendations from the Cumulative Impact Assessment are set out in Section 13.2.

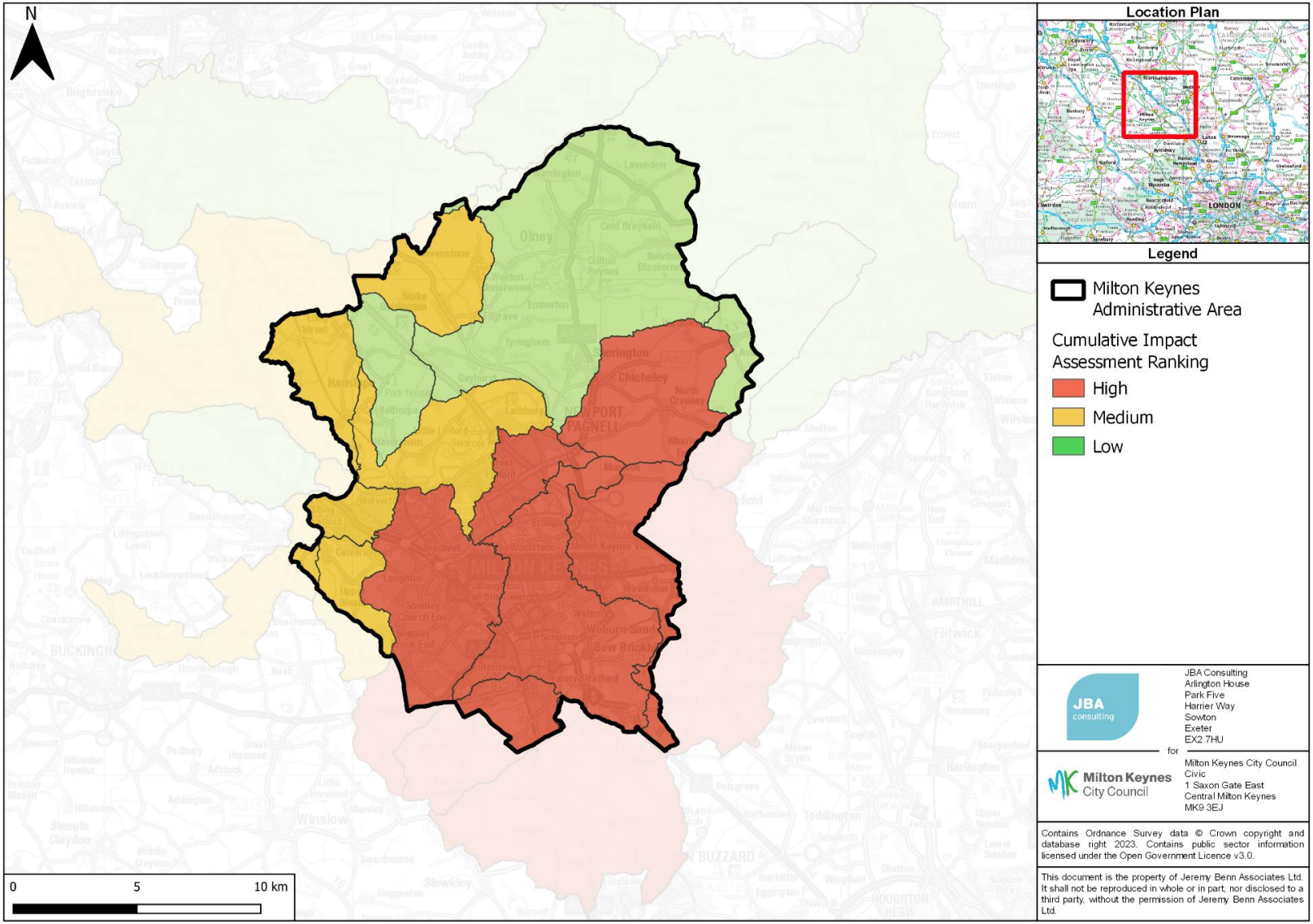


Figure 7-1: Cumulative impact assessment catchment rankings

8 Flood risk management requirements for developers

This section provides guidance on site-specific Flood Risk Assessments (FRAs). These are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted with Planning Applications and should demonstrate how flood risk will be managed over the development's lifetime, considering climate change and vulnerability of users.

The report provides a strategic assessment of flood risk within Milton Keynes administrative area. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk, the actual and residual risk, and standard of protection and safety at a site are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of watercourses to verify flood extents (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the Exception Test can be satisfied.

A detailed FRA may show that a site, windfall[26] or other, is not appropriate for development of a particular vulnerability or even at all. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not been seen as an alternative to proving these tests have been met.

8.1 Principles for new developments

8.1.1 Apply the Sequential and Exception Tests

Developers should refer to Section 3 for more information on how to consider the Sequential and Exception Tests. Before strategic sites are allocated, Milton Keynes City Council should use the information in this SFRA to apply the Sequential Test. For windfall sites a developer must undertake the Sequential Test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the Sequential Test should the Exception Test then be applied if required. The Planning Practice Guidance (PPG) puts the onus on LPAs to confirm that the Sequential Test has been satisfied.

Using information supplied by applicants Milton Keynes City Council should confirm that the Sequential Test has been appropriately applied for windfall sites not included in the Plan. To comply with the NPPF Developers should apply the sequential approach to locating development within the site following the application of the Sequential Test. The following questions should be considered:

- can risk be avoided through substituting less vulnerable uses or by amending the site layout?[27]

26 'Windfall sites' is used to refer to those sites which become available for development unexpectedly and are therefore not included as allocated land in a planning authority's development plan.

27 A site can fail the Sequential Test even if the built development is located outside of the identified Flood Zones. Sequential layout is a mitigation measure so part of the exception test.

- can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
- can the site layout be varied to reduce the number of people, the flood risk vulnerability or the building units located in higher risk parts of the site?

8.1.2 Consult with statutory consultees at an early stage to understand their requirements

Developers should consult with the Environment Agency, Milton Keynes City Council (as LPA and LLFA), the IDB (where applicable) and the water companies at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design.

8.1.3 Consider the risk from all sources of flooding and that they are using the most up to date flood risk data and guidance

Alongside an assessment of the site, the SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific Flood Risk Assessment. At a site level, developers will need to check before commencing on a more detailed Flood Risk Assessment that they are using the latest available datasets. Developers should apply the most up-to-date **Environment Agency climate change guidance** (last updated in May 2022) and ensure the development has taken into account climate change adaptation measures.

8.1.4 Ensure that the development does not increase flood risk elsewhere and seek to reduce risk overall

Section 9 sets out these requirements for taking a sustainable approach to surface water management. Developers should also ensure mitigation measures do not increase flood risk elsewhere and that floodplain compensation is provided where necessary.

8.1.5 Ensure the development is safe for future users

Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered. Developers should consider both the actual and residual risk of flooding to the site, as discussed in Section 6.6.

Further flood mitigation measures may be needed for any developments in an area protected by flood defences.

8.1.6 Enhance the natural river corridor and floodplain environment through new development

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted. Where possible, developers should identify and work with partners to explore all avenues for improving the wider river corridor environment. Developers should open up existing culverts and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings.

8.1.7 Consider and contribute to wider flood mitigation strategy and measures in the administrative area and apply the relevant local planning policy

Developments should seek to help reduce flood risk in the wider area e.g. by contributing to a wider community scheme or strategy for strategic measures, such as defences or NFM or by contributing in kind by mitigating wider flood risk on a development site. More information on the contribution developers are expected to make towards achieving the wider vision for FRM and sustainable drainage in the district can be found in Section 8.3. Developers must demonstrate in an FRA how they are contributing towards this vision.

8.2 Requirements for site-specific Flood Risk Assessments

8.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1.
- Proposals for new development (including minor development such as non-residential extensions, alterations which do not increase the size of the building or householder developments and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 that which is within a critical drainage catchment (as identified in the SWMP) . In this case the FRA will be required to demonstrate that the development will not increase the flood risk to the CDC and where possible will provide an improvement to the existing situation.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.
- At locations where it is proposed to locate development in a high-risk surface water flood zone.
- Proposals of less than one hectare in Flood Zone 1 where they could be affected by sources of flooding other than rivers and the sea (e.g. surface water)

An FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1)
- Where evidence of historical or recent flood events have been passed to the LPA
- Land identified in an SFRA as being at increased risk in the future.
- A watercourse is located on, adjacent to or nearby a site, even if there are no flood zones associated with it.
- Sites that are directly adjacent to the flood zone
- Sites whose access is located within in areas at risk of flooding or Sites in dry islands

8.2.2 Objectives of a site-specific FRA

Site-specific FRAs should be proportionate to the degree of flood risk and the scale, nature and location of the development. Site-specific FRAs should establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source.
- Whether a proposed development will increase flood risk elsewhere.
- Whether the measures proposed to deal with the effects and risks are appropriate.
- The evidence, if necessary, for the local planning authority to apply the Sequential Test; and
- Whether, if applicable, the development will be safe and pass the Exception Test.

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the Environment Agency and Milton Keynes City Council.

8.2.3 Guidance and advice for developers on the preparation of site-specific FRAs

- **Standing Advice on Flood Risk** (Environment Agency)
- **Flood Risk Assessment for Planning Applications** (Environment Agency)
- **Site-specific Flood Risk Assessment: CHECKLIST** (NPPF PPG, Defra)
- **Flood risk guidance for developers** (Milton Keynes City Council)
- **Planning Application Validation Requirements** (Milton Keynes City Council)

Guidance for local planning authorities for reviewing Flood Risk Assessments submitted as part of planning applications has been published by Defra in 2015 – **Flood Risk Assessment: Local Planning Authorities.**

8.3 Local requirements for mitigation measures

8.3.1 Site layout and design

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from Flood Zones to higher ground, while more flood-compatible development can be located in higher risk areas. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning.

Waterside areas, or areas along known flow routes, can act as green infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise. It is also important to avoid hiding watercourses behind structures like garden fences and walls.

8.3.2 Modification of ground levels

Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment.

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken as raising land above the floodplain could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). This should be discussed with the Environment Agency on a case-by-case basis. Guidance on how to address floodplain compensation is provided in **Appendix A3 of the CIRIA Publication C624**.

Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

8.3.3 Raised floor levels

The raising of internal floor levels within a development avoids damage occurring to the interior, furnishings and electrics in times of flood.

According to the government's guidance on '**Preparing a flood risk assessment: standing advice**' minimum finished floor levels for vulnerable development should normally be above whichever is higher of the following:

- a minimum of 300 mm above average ground level of the site.
- a minimum of 300 mm above the adjacent road level to the building.
- 300 mm above estimated design flood level.

Construction materials that have low permeability up to at least the same height as finished floor levels should be used. If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency will be required to determine alternative approaches.

The above guidelines should also apply to replacement dwellings not solely the construction of new properties and in line with the August 2022 changes to the PPG thresholds should be set to provide appropriate freeboard above flooding from surface water and groundwater and not just river and sea flooding.

The additional height that the floor level is raised above the maximum water level is referred to as the "freeboard". Additional freeboard may be required because of risks

relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA. Additional freeboard may also be required when there is low confidence I the flood model data and therefore low confidence in the flood level provided.

Allocating the ground floor of a building for less vulnerable, non-residential or non habitable (garages, toilets, utilities etc) use is an effective way of raising living space above flood levels.

Single storey buildings such as ground floor flats or bungalows are especially vulnerable to flooding, especially rapid onset flooding (such as that experienced during a breach). There is also the potential risk that those inhabiting single storey buildings are themselves more vulnerable users. This risk can be reduced through the layout of the development by use of multiple storey construction and raised areas that provide an escape route. However, safe access and escape would still be an issue, particularly when flood duration covers many days.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the Exception Test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

8.3.4 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain.

Where development is located behind defences, the residual risk of flooding must be considered.

8.3.5 Developer contributions

In some cases, and following the application of the Sequential Test, it may be appropriate for the developer to contribute to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS).

In some cases, and following the application of the Sequential Test, it may be necessary for the developer to contribute to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS). These could be funded through the Community Infrastructure Levy (CIL) or Section 106 agreements. Such measures can put in place commitments so that development is safe for its users during its lifetime, whilst also ensuring that the development does not increase flood risk elsewhere.

DEFRA's Flood and Coastal Erosion Risk Management Grant in Aid (FCERM GiA) can be obtained by operating authorities to contribute towards the cost of a range of activities including flood risk management schemes that help reduce the risk of flooding and coastal erosion. Some schemes are only partly funded by FCERM GiA and therefore any

shortfall in funds will need to be found from elsewhere when using Resilience Partnership Funding, for example local levy funding, local businesses or other parties benefitting from the scheme.

For new development in locations without existing defences, or where the development is the only beneficiary, the full costs of appropriate risk management measures for the life of the assets proposed must be funded by the developer.

However, the provision of funding by a developer for the cost of the necessary standard of protection from flooding or coastal erosion does not of itself mean the development is appropriate in flood risk terms, as other policy aims must also be met. This will include application of the NPPF sequential, and as necessary, exception tests. Funding from developers should be explored prior to the granting of planning permission and in partnership with the council and the Environment Agency.

The most appropriate route for the consideration of strategic measures to address flood risk issues is the Local Flood Risk Management Strategy prepared by the Lead Local Flood Authority (Section 2.6.6). The LFRMS describes the priorities with respect to local flood risk management, the measures to be taken, the timing of these measures and how they will be funded. It will be preferable for the developer to demonstrate that strategic provisions are in accordance with the LFRMS, can be afforded and have an appropriate priority.

The Environment Agency is committed to working in partnership with developers to reduce flood risk. Where assets are in need of improvement or a scheme can be implemented to reduce flood risk, the Environment Agency request that developers contact them to discuss potential solutions.

8.3.6 Buffer strips

The provision of a buffer strip to 'make space for water', allows additional capacity to accommodate climate change and ensure access to the watercourse, structures and defences is maintained for future maintenance purposes. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection. Plan:MK Policy FR3 states that all new development must be set back at a distance of at least 8 metres from any main rivers, at least 9 metres from all other ordinary watercourses, or at an appropriate width as agreed by the Environment Agency, Lead Local Flood Authority or Internal Drainage Board, in order to provide an adequate undeveloped buffer zone. Where flood defences are present, these distances should be taken from the toe of the defence.

Building adjacent to riverbanks can cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult. Any development in these areas will likely require a Flood Risk Permit from the Environment Agency alongside any permission. There should be no built development within these distances from main rivers / flood defences (where present), and within the 9 metre distance in IDB areas.

There maybe a need to safeguard land for future defences or land adjacent to current defences to adapt them for increases in flood risk.

8.3.7 Making space for water

The PPG sets out a clear aim in Flood Zone 3 to create space for flooding by restoring functional floodplain. Generally, development should be directed away from these areas.

All new development close to rivers should consider the opportunity to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

8.4 Resistance and resilience measures

The consideration of resistance and resilience measures should not be used to justify development in inappropriate locations.

Having applied planning policy, there will be instances where developments, such as those that are water compatible and essential infrastructure are permitted in high flood risk areas. The above measures should be considered before resistance and resilience measures are replied on. The effectiveness of these forms of measures are often dependant on the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. The proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate. Available resistance and resilience measures are shown in

Table 8-1.

Paragraph 068 of the PPG sets out that measures should preferably be passive, such as the use of resilient building materials as opposed to demountable ones, and that temporary and demountable defences are not appropriate for new-build developments.

Table 8-1: Available temporary measures

Measures	Description
Permanent barriers	Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers
Temporary barriers	Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water. Flood water can put pressure on buildings, causing structural issues where there is greater than a depth of 600mm of water.

Measures	Description
Community resistance measures	These include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.
Flood resilience measures	These measures aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuitry installed at a higher level and water-resistant materials for floors, walls and fixtures.

8.5 Reducing flood risk from other sources

8.5.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and so many conventional flood mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1 in 100-year plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off a site. Developers should provide evidence and ensure that this will not be a significant risk.

8.5.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. It is important that a Surface Water Drainage Strategy (often done as part of a Flood Risk Assessment) shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk. Surface water entering the site from elsewhere may interact with the onsite drainage infrastructure, reducing its capacity to attenuate surface water originating from the site.

When redeveloping existing buildings, the installation of some permanent or temporary floodproofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly maintained.

Consideration must also be given to attenuation and flow ensuring that flows during the 1% AEP plus climate change storm event are retained within the site if any flap valves shut. This should be demonstrated with suitable modelling techniques.

8.5.3 Reservoirs

As discussed in Section 4.9, the risk of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage:

- Developers should contact the reservoir owner for information on:
- the Reservoir Risk Designation
- reservoir characteristics: type, dam height at outlet, area/volume, overflow location
- operation: discharge rates / maximum discharge
- discharge during emergency drawdown; and
- inspection / maintenance regime.
- The EA online Reservoir Flood Maps contain information on the extents, depths and velocities following a reservoir breach (note: only for those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975). Consideration should be given to the extent shown in these online maps.
- The GOV.UK website on **Reservoirs: owner and operator requirements** provides information on how to register reservoirs, appoint a panel engineer, produce a flood plan and report an incident.
- In addition, developers should consult the **'Thames Valley Local Resilience Forum'** about emergency plans.

Developers should use the above information to:

- Apply the sequential approach to locating development within the site.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond, and whether in fact it is appropriate to place development immediately on the downstream side of a reservoir.
- Assess the potential hydraulic forces imposed by sudden reservoir failure event and check that that the proposed infrastructure fabric could withstand the structural loads.
- Develop site-specific Emergency Plans and/ or Off-site Plans if necessary and ensure the future users of the development are aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand.

Consideration should also be given to the potential implications of proposed development on the risk designation of the reservoir, as it is a requirement that in particular circumstances where there could be a danger to life that a commitment is made to the hydraulic capacity and safety of the reservoir embankment and spillway.

The implications of such potential obligations should be identified and understood so that it can be confirmed that these can be met if proposed new development is permitted.

8.6 Emergency planning

Emergency planning covers three phases: before, during and after a flood. Measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding. National Planning Policy takes this into account by seeking to avoid inappropriate development in areas of flood risk and considering the vulnerability of new developments to flooding.

The Association of Directors of Environment, Economy, Planning and Transport (ADEPT) and the Environment Agency have published a **Flood Risk Emergency Plans for New Development**[28] document which provides guidance for Local Planning Authorities regarding their decisions over planning applications.

The NPPF Planning Practice Guidance outlines how developers can provide safe access and escape to and from development in order to demonstrate that development satisfies the second part of the Exception Test. The depth, velocity and hazard mapping from hydraulic modelling should help inform the provision of safe access and egress routes. As part of an FRA, the developer should review the acceptability of the proposed access in consultation with the LPA and the Environment Agency.

The 2023 NPPF requires site level Flood Risk Assessments to demonstrate that

> *"d) any residual risk can be safely managed; and*
>
> *e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."*

Certain sites will need emergency plans:

- Sites with vulnerable users, such as hospitals and care homes
- Camping and caravan sites
- Sites with transient occupants e.g. hostels and hotels
- Developments at a high residual risk of flooding from any source e.g. immediately downstream of a reservoir or behind raised flood defences
- Situations where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. at risk of a breach).

Emergency Plans will need to consider:

- The characteristics of the flooding e.g. onset, depth, velocity, hazard, flood borne debris

28 Flood Risk Emergency Plans for New Development. ADEPT, Environment Agency. (2019). https://www.adeptnet.org.uk/system/files/documents/ADEPT%20%26%20EA%20Flood%20risk%20emergency%20plans%20for%20new%20development%20September%202019....pdf

- The vulnerability of site occupants
- Structural safety
- The impact of the flooding on essential services e.g. electricity, drinking water
- Flood warning systems and how users will be encouraged to sign up for them
- Safe access and escape routes for users and emergency services
- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.
- A safe place of refuge where safe access and escape routes and advance warning may not be possible, having discussed and agreed this first with emergency planners. Proposed new development that places an additional burden on the existing response capacity of the Milton Keynes City Council will not normally be appropriate.

Best practice is to have the emergency plan setup prior to approval because, if safe access and escape is not possible then the site should not gain approval.

The Thames Valley Local Resilience Forum[29] (TVLRF) is one of a number of Local Resilience Forums (LRFs) that have been set up across England. The overall aim of an LRF is to ensure that the various agencies and organisations plan and subsequently work together so that responses to emergencies are coordinated appropriately. The TVLRF is made up of a number of different agencies and organisations that work together across a range of areas including planning for emergencies.

8.6.1 Milton Keynes City Council Flood Response Plan

The Milton Keynes City Council Flood Response Plan sets out the principles that govern the Milton Keynes City Council's response to a significant flooding event within their local authority administrative area. The Plan was produced to meet the requirements of the Civil Contingencies Act 2004, and is built upon the existence and maintenance by Category 1 and 2 Responders of their own plans for response to flooding.

Category 1 Responders for Milton Keynes administrative area are:

- Milton Keynes City Council
- Thames Valley Police
- Buckingham Fire and Rescue Service
- South Central Ambulance Service
- Environment Agency

The Category 2 Responders for Milton Keynes administrative area are utility and transport providers, such as Anglian Water, Network Rail etc.

The response plan provides information on Milton Keynes City Council's actions, roles and responsibility in response to a flood emergency in their administrative area.

[29] Thames Valley Local Resilience Forum: http://www.thamesvalleylrf.org.uk/

Further information is available from:

- **The National Planning Policy Guidance**
- **2004 Civil Contingencies Act**
- **DEFRA (2014) National Flood Emergency Framework for England**
- **FloodRe**
- The Environment Agency and DEFRA's **Standing Advice for FRAs**
- Milton Keynes City County Council's **'Flooding' Page**
- Environment Agency's **'How to plan ahead for flooding'**
- Sign up for **Flood Warnings** with the Environment Agency
- The **National Flood Forum**
- **GOV.UK** - Make a Flood Plan guidance and templates
- **ADEPT Flood Risk Plans for new development**

9 Surface water management and SuDS

This section provides guidance and advice on managing surface water runoff and flooding.

9.1 Introduction

Sustainable Drainage Systems (SuDS) are management practices which enable surface water to be drained in a more sustainable manner and to mimic the local natural drainage. The inclusion of SuDS within developments is an opportunity to enhance ecological and amenity value, and promote Green Infrastructure, incorporating above ground facilities into the development landscape strategy.

9.2 Role of the LLFA and LPA in surface water management

In April 2015, Milton Keynes City Council as the LLFA was made a statutory planning consultee on the management of surface water. They provide technical advice on surface water drainage strategies and designs put forward for major development proposals, to ensure that onsite drainage systems are designed in accordance with the current legislation and guidance.

As of April 2023, the current role of the LLFA is to provide technical advice on surface water drainage strategies and designs put forward for major development proposals.

When considering proposals for major development the LLFA must be consulted on surface water drainage. Milton Keynes Council acting as the LLFA will determine the circumstances and locations where site specific flood risk assessments will be required due to surface water or other local flood risks and advise on other planning applications which raise surface water or other local flood risk issues. Where surface water or other local flood risks are likely to significantly affect a proposed development site, early discussions between the planning authority and the developer will help to identify the flood risk issues that the authority would expect to see addressed in the planning application and accompanying site-specific flood risk assessment.

However, the UK Government are in the process of implementing Schedule 3 of the Flood and Water Act. In January 2023, the UK Government released their report setting out the findings of a **review into the implementation of Schedule 3 to The Flood and Water Management Act 2010** which outlined the possibility of LLFAs becoming SuDS Approving Body (SAB). This would create a new process for the approval and adoption of SuDS, separate to the planning system.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. To further inform development proposals at the master-planning stage, pre-application submissions are accepted by Milton Keynes City Council, dependent on the area. This will assist with the delivery of well designed, appropriate and effective SuDS.

9.3 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are designed to maximise the opportunities and benefits that can be secured from surface water management practices.

SuDS provide a means of dealing with the quantity and quality of surface water and provide amenity and biodiversity benefits. Given the flexible nature of SuDS they can be used in most situations within new developments as well as being retrofitted into existing developments. SuDS can also be designed to fit into most spaces. For example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

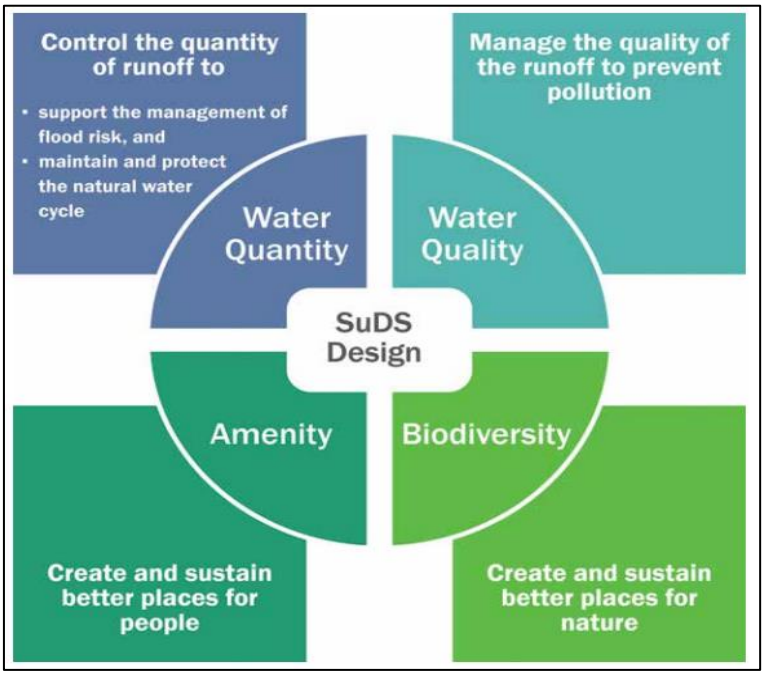
It is a requirement for all new major development proposals to ensure that sustainable drainage systems for management of runoff are put in place, unless there is clear evidence that this would be inappropriate (NPPF paragraph 169). Likewise, minor developments should also ensure sustainable systems for runoff management are provided. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential.

All new major development proposals should ensure that sustainable drainage systems for management of runoff are put in place. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and existing drainage arrangements is essential.

9.4 Types of SuDS System

There are many different SuDS techniques that can be implemented in attempts to mimic pre-development drainage (Table 9-1). Techniques can include soakaways, infiltration trenches, permeable pavements, grassed swales, green roofs, ponds and wetlands and these do not necessarily need to take up a lot of space. The suitability of the techniques will be dictated in part by the development proposal and site conditions. Advice on best practice is available from the LLFA, Environment Agency and the Construction Industry Research and Information Association (CIRIA) e.g. the **CIRIA SuDS Manual C753** (2015).

SuDS designs should aim to meet the 'four pillars of SuDS design' (shown in Figure 9-1) - water quantity, water quality, amenity and biodiversity. Multifunctional SuDS also provide an opportunity to meet several planning requirements within one feature, such as Biodiversity Net Gain.



Source: The SuDS Manual C753 (2015)

Figure 9-1: Four pillars of SuDS design

Table 9-1: Examples of SuDS techniques and potential benefits

SuDS Technique	Flood risk management	Water quality treatment & enhancement	Landscape and wildlife benefit
Living roofs	✓	✓	✓
Basins and ponds	✓	✓	✓
Construction wetlands	✓	✓	✓
Balancing ponds	✓	✓	✓
Detention basins	✓	✓	✓
Retention ponds	✓	✓	✓
Filter strips and swales	✓	✓	✓
Infiltration devices	✓	✓	✓
Soakaways	✓	✓	✓
Infiltration trenches and basins	✓	✓	✓
Permeable surfaces and filter	✓	✓	

SuDS Technique	Flood risk management	Water quality treatment & enhancement	Landscape and wildlife benefit
drains			
Gravelled areas	✓	✓	
Solid paving blocks	✓	✓	
Porous pavements			
Tanked systems	✓		
Oversized pipes / tanks	✓		
Storm cells	✓		

9.4.1 SuDS Management

SuDS should not be used individually but as a series of features in an interconnected system designed to capture water at the source and convey it to a discharge location. Collectively this concept is described as a SuDS Management Train. The number of treatment stages required within the Management Train depends primarily on the source of the runoff and the sensitivity of the receiving waterbody or groundwater. A drainage strategy will need to demonstrate that an appropriate number of treatment stages are delivered.

SuDS components should be selected based on design criteria and how surface water management is to be integrated within the development and landscaping setting. By using a number of SuDS features in series it is possible to reduce the flow and volume of runoff as it passes through the system as well as minimising pollutants which may be generated by a development.

In line with PPG (paragraph 080), Milton Keynes City Council requires surface water from development sites to be discharged using the following hierarchy of drainage options:

- into the ground (infiltration)
- to a surface water body
- to a surface water sewer, highway drain, or another drainage system
- to a combined sewer

Although rainwater harvesting is not included within the PPG, the Council considers water re-use to be at the top of the drainage hierarchy. Evidence must be submitted to demonstrate why the most favourable drainage discharge location cannot be met.

9.4.2 Treatment

A key part of the four pillars of SuDS is to provide the maximum improvement to water quality through the use of the "SuDS Management Train". To maximise the treatment within SuDS, CIRIA recommends[30] the following good practice is implemented in the treatment process:

1. **Manage surface water runoff close to source:** This makes treatment easier due to the slower velocities and also helps isolate incidents rather than transport pollutants over a large area.
2. **Treat surface water runoff on the surface:** This allows treatment performance to be more easily inspected and managed. Sources of pollution and potential flood risk is also more easily identified. It also helps with future maintenance work and identifying damaged or failed components.
3. **Treat a range of contaminants:** SuDS should be chosen and designed to deal with the likely contaminants from a development and be able to reduce them to acceptably low levels.
4. **Minimise the risk of sediment remobilisation:** SuDS should be designed to prevent sediments being washed into receiving water bodies or systems during events greater than what the component may have been designed.
5. **Minimise the impact of spill:** Designing SuDS to be able to trap spills close to the source or provide robust treatment along several components in series.

A drainage strategy will need to demonstrate that an appropriate number of treatment stages are delivered. This involves determining a pollutant hazard score for each pollutant type. An index is then used to determine the treatment potential of different SuDS features for different pollutant types. This is known as the Simple Index Approach. The Total SuDS mitigation index should be equal or greater than the pollution hazard score to deliver adequate treatment.

9.4.3 Overcoming SuDS constraints

The design of a SuDS system will be influenced by a number of physical and policy constraints. These should be taken into account and reflected upon during the conceptual, outline and detailed stages of SuDS design.

Table 9-2 details some possible constraints and how they may be overcome.

30 C753 CIRIA SuDS Manual (2015)

Table 9-2: Example SuDS design constraints and possible solutions

Considerations	Solution
Land availability	SuDS can be designed to fit into small areas by utilising different systems. For example, features such as permeable paving and green roofs can be used in urban areas where space may be limited.
Contaminated soil or groundwater below site	SuDS can be placed and designed to overcome issues with contaminated groundwater or soil. Shallow surface SuDS can be used to minimise disturbance to the underlying soil. The use of infiltration should also be investigated as it may be possible in some locations within the site. If infiltration is not possible linings can be used with features to prevent infiltration.
High groundwater levels	Non-infiltrating features can be used. Features can be lined with an impermeable line or clay to prevent the egress of water into the feature. Additional, shallow features can be utilised which are above the groundwater table.
Steep slopes	Check dams can be used to slow flows. Additionally, features can form a terraced system with additional SuDS components such as ponds used to slow flows.
Shallow slopes	Use of shallow surface features to allow a sufficient gradient. If the gradient is still too shallow pumped systems can be considered as a last resort.
Ground instability	Geotechnical site investigation should be done to determine the extent of unstable soil and dictate whether infiltration would be suitable or not.
Sites with deep backfill	Infiltration should be avoided unless the soil can be demonstrated to be sufficiently compacted. Some features such as swales are more adaptable to potential surface settlement.
Open space in floodplain zones	Design decisions should be done to take into consideration the likely high groundwater table and possible high flows and water levels. Features should also seek to not reduce the capacity of the floodplain and take into consideration the influence that a watercourse may have on a system. The LLFA does not tend to support SuDS/attenuation in flood zones. Facts such as siltation after a flood event should also be taken into account during the design phase.
Future adoption and maintenance	LPA should ensure development proposals, through the use of planning conditions or planning obligations, have clear arrangements for on-going maintenance over the development's lifetime.

For SuDS techniques that are designed to encourage infiltration, it is imperative that the water table is low enough and a site-specific infiltration test is conducted early on as part of the design of the development. Infiltration should be considered with caution within areas of possible subsidence or sinkholes. Where sites lie within or close to groundwater protection zones (GSPZs) or aquifers, further restrictions may apply, and guidance should be sought from the LLFA and the Environment Agency.

9.5 Sources of SuDS guidance

9.5.1 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) provides guidance on planning, design, construction and maintenance of SuDS. The manual is divided into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document.

9.5.2 Non-Statutory Technical Guidance, Defra (March 2015)

Non-Statutory Technical guidance provides non-statutory standards on the design and performance of SuDS. It outlines peak flow control, volume control, structural integrity, flood risk management and maintenance and construction considerations.

9.5.3 Non-statutory Technical Guidance for Sustainable Drainage Practice Guidance, LASOO (2016)

The Local Authority SuDS Officer Organisation produced their **practice guidance** in 2016 to give further detail to the Non-statutory technical guidance.

9.5.4 Milton Keynes City Council SuDS Guidance

Milton Keynes Council has published **specific guidance** on the preparation of surface water drainage strategies. This provides information on the level of detail we require depending on the type of planning application. The document should be used by all developers and their consultants who wish to submit an application within Milton Keynes administrative area. Developers should also refer to Milton Keynes City Council **Planning Application Validation Requirements**.

9.6 Other surface water considerations

9.6.1 Groundwater Vulnerability Zones

The Environment Agency published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise of the underlying bedrock. The map shows the vulnerability of groundwater at a location based on the hydrological, hydro-ecological and soil propertied within a one-kilometre grid square.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas. Groundwater vulnerability maps can be found on **Defra's interactive mapping.**

9.6.2 Groundwater Source Protection Zones (GSPZ)

The Environment Agency also defines Groundwater Source Protection Zones (GSPZs) near groundwater abstraction points. These protect areas of groundwater used for drinking water. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. GSPZs can be viewed on **DEFRA's Magic Map.** One GSPZ has been identified on the southeast edge of Milton Keynes administrative area.

9.6.3 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process.

NVZs can be viewed on the **Environment Agency's website.** The map highlights that the site is located within a number of Nitrate Vulnerable Zones, located entirely within the Great Ouse NVZ, and partly within the Bedford Great Oolite in the north, Woburn Sands in the southeast and Anglian Great Oolite in the west.

10 Strategic flood risk measures

This section provides information on strategic flood risk measures.

10.1 Introduction

Strategic flood risk solutions may offer a potential opportunity to reduce flood risk in the Local Plan area. The following sections outline different options which could be considered for strategic flood risk solutions. Any strategic solutions should ensure they are consistent with wider catchment policy and the local policies. It is important that the ability to deliver strategic solutions in the future is not compromised by the location of proposed development. When assessing the extent and location of proposed development consideration should be given to the requirement to secure land for flood risk management measures that provide wider benefits. Funding for these solutions could be sought via S106 agreements or the Community Infrastructure Levy (CIL).

10.2 Safeguarding land for flood storage

Where possible, the LPA may look to allocate land designed for flood storage functions. Such land can be explored through the site allocation process where an assessment is made, using this SFRA, of the flood risk at assessed sites and what benefit could be gained by leaving the site undeveloped. In some instances, the storage of flood water can help to alleviate flooding elsewhere, such as downstream developments. Where there is a large area of a site at risk that is considered large enough to hinder development, it may be appropriate to safeguard this land for the storage of floodwater.

Section 14; Paragraph 167 of the NPPF states that, to avoid where possible, flood risk to people and property, the LPAs should manage any residual risk by, 'safeguarding land from development that is required, or likely to be required, for current or future flood management'.

Applicable sites assessed through this SFRA may include any current greenfield sites:

- That are considered to be large enough (>1 hectare) to store floodwater to achieve effective mitigation
- With large areas of their footprint at high or medium surface water flood risk (based on the RoFSW)
- That is within the functional floodplain (Flood Zone 3b)
- With large areas of their footprint at risk from Flood Zone 3a and
- That are large enough and within a suitable distance to receive floodwater from a nearby development site using appropriate SuDS techniques which may involve pumping, piping, or swales/drains.

Brownfield sites could also be considered, though this would entail site clearance of existing buildings, conversion to greenspace and contaminated land assessments. By

using the sequential approach to site layout, the LPA and developers should be able to avoid the areas at risk and leave clear for potential flood storage. See the flood risk maps in the Appendix to spatially assess the areas of the sites at risk.

10.3 Flood storage schemes

Flood storage schemes aim to reduce flows to mitigate downstream flooding. Development increases the impermeable area within a catchment, creating additional and faster runoff into watercourses. Flood storage schemes aim to detain this additional runoff, releasing it downstream at a slower rate, to avoid any increase in flood depths and/or frequency downstream. Methods to provide these schemes include[31]:

- enlarging the river channel;
- raising the riverbanks; and/or
- constructing flood banks set back from the river

Flood storage schemes have the advantage that they generally benefit areas downstream, not just the local area.

The **Milton Keynes Strategy for 2050** states that new balancing lakes, local wet/dry ponds and strategic river maintenance and management may be explored as potential solutions for flooding and drainage requirements.

10.4 Nature-based solutions

Nature based solutions are defined by the World Bank as "actions to protect, sustainably manage, or restore natural ecosystems, that address societal challenges such as climate change, human health, food and water security, and disaster risk reduction effectively and adaptively, simultaneously providing human well-being and biodiversity benefit"[32].

Developments provide opportunities to work with natural processes to reduce flood and erosion risk, benefit the natural environment and reduce costs of schemes. NFM is an example of nature-based solutions. This requires integrated catchment management and involves those who use and shape the land. It also requires partnership working with neighbouring authorities, organisations and water management bodies. The Environment Agency has developed **Working with natural process mapping** which displays opportunities for NFM, as discussed in Section 6.4.1. There are areas within Milton Keynes administrative area whereby removing existing defences and reconnecting the floodplain could create areas for potential without causing risk to properties. Areas where such opportunities could potentially be considered includes along the Rivers Great Ouse and Ouzel. Areas in Milton Keynes administrative area where tree planting could potentially be considered as an NFM measure are most notably along the Rivers Great Ouse and Ouzel also.

31 http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter10.aspx?pagenum=2

32 https://www.worldbank.org/en/news/feature/2022/05/19/what-you-need-to-know-about-nature-based-solutions-to-climate-change

Conventional flood prevention schemes may be preferred, but consideration of 're-wilding' rivers upstream could provide cost efficiencies as well as considering multiple sources of flood risk. For example, reducing peak flows upstream such as through felling trees into streams or building earth banks to capture runoff, could be cheaper and smaller-scale measures than implementing flood walls. With flood prevention schemes, consideration needs to be given to the impact that flood prevention has on the WFD status of watercourses. It is important that any potential schemes do not have a negative impact on the ecological and chemical status of waterbodies.

10.5 Catchment and floodplain restoration

Compared to flood defences and flood storage, floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, and by creating space for naturally functioning floodplains working with natural processes.

Although the restoration of floodplain is difficult in previously developed areas where development cannot be rolled back, the following measures should be adopted:

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible. Buffer areas around watercourses provide an opportunity to restore parts of the floodplain.
- Removal of redundant structures to reconnect the river and the floodplain.
- Apply the sequential approach to avoid new development within the floodplain.

For those sites considered within the Local Plan Review and / or put forward by developers, that also have watercourses flowing through or past them, the sequential approach should be used to locate development away from these watercourses. This will ensure the watercourses retain their connectivity to the floodplain. Loss of floodplain connectivity could potentially increase flooding.

10.5.1 Renaturalisation

There is potential to renaturalise a watercourse by re-profiling the channel, removing hard defences, re-connecting the channel with its floodplain and introducing a more natural morphology (particularly in instances where a watercourse has historically been modified through hard bed modification). Detailed assessments and planning would need to be undertaken to gain a greater understanding of the response to any proposed channel modification.

10.5.2 Structure removal and/ or modification (e.g. weirs)

Structures, both within watercourses and adjacent to them can have significant impacts upon rivers including alterations to the geomorphology and hydraulics of the channel through water impoundment and altering sediment transfer regime, which over time can significantly impact the channel profile including bed and bank levels, alterations to flow regime and interruption of biological connectivity, including the passage of fish and invertebrates.

Many artificial in-channel structures (examples include weirs and culverts) are often redundant and / or serve little purpose and opportunities exist to remove them where feasible. The need to do this is heightened by climate change, for which restoring natural river processes, habitats and connectivity are vital adaptation measures. However, it also must be recognised that some artificial structures may have important functions or historical/cultural associations, which need to be considered carefully when planning and designing restoration work.

In the case of weirs, whilst removal should be investigated in the first instance, in some cases it may be necessary to modify a weir rather than remove it. For example, by lowering the weir crest level or adding a fish pass. This will allow more natural water level variations upstream of the weir and remove a barrier to fish migration.

10.5.3 Bank stabilisation

Bank erosion should be avoided, and landowners encouraged to avoid using machinery and vehicles close to or within the watercourse.

There are several techniques that can be employed to restrict the erosion of the banks of a watercourse. In an area where bankside erosion is particularly bad and/or vegetation is unable to properly establish, ecologically sensitive bank stabilisation techniques, such as willow spiling, can be particularly effective. Live willow stakes thrive in the moist environment and protect the soils from further erosion allowing other vegetation to establish and protect the soils.

10.6 Green Infrastructure

Green Infrastructure (GI) is a planned and managed network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and rural fringe and consist of:

- Open spaces – parks, woodland, nature reserves, lakes
- Linkages – River corridors and canals, and pathways, cycle routes and greenways
- Networks of “urban green” – private gardens, street trees, verges and green roofs

The identification and planning of Green Infrastructure is critical to sustainable growth. It merits forward planning and investment as much as other socio-economic priorities such as health, transport, education and economic development. GI is also central to climate change action and is a recurring theme in planning policy. With regards to flood risk, green spaces can be used to manage storm flows and free up water storage capacity in existing infrastructure to reduce risk of damage to urban property, particularly in city centres and vulnerable urban regeneration areas. Green infrastructure can also improve accessibility to waterways and improve water quality, supporting regeneration and improving opportunity for leisure, economic activity and biodiversity.

The **Milton Keynes Strategy for 2050** displays the existing strategic green infrastructure and potential expanded strategic green infrastructure, within and outside Milton Keynes administrative area. The vision in Milton Keynes administrative area is to create new

green infrastructure and biodiversity assets that are interconnected and integrate with the way ecosystems work and enhance the capacity of the natural environment to provide ecosystem services.

Natural England released a **Green Infrastructure Framework** in February 2023. This is aimed at planners and developers, and is a new tool to help towns and cities turn greener.

Blue infrastructure includes green roofs and walls, sustainable drainage systems (SuDS). It includes rivers, streams, canals, and other water bodies encapsulating the wider hydrological aspects of physical geography within the environment. This is explored in the IWMS, which is being prepared at the same time as the Level 1 SFRA.

10.7 Promotion of SuDS

By considering SuDS at an early stage in the development of a site, the risk from surface water can be mitigated to a certain extent within the site as well as reduce the risk that the site poses to third party land. Regionally SuDS should be promoted on all new developments to ensure the quantity and quality of surface water is dealt with sustainably to reduce flood risk. Given the various policies and guidance available on SuDS, developers should use this information to produce technically proficient and sustainable drainage solutions that conform with the non-statutory standards for SuDS (2015). Brownfield sites should provide betterment in areas of sewer stress to reduce flood risk and better protect communities within Milton Keynes administrative area.

10.8 Flood defences

There are a number of formal flood defences present within the study area (see Section 6 for further information).

Flood mitigation measures should only be considered if, after application of the Sequential Approach, development sites cannot be located away from higher risk areas. If defences are constructed to protect a development site, it will need be demonstrated that the defences will not have a resulting negative impact on flood risk elsewhere, and that there is no net loss in floodplain storage.

10.9 Engaging with key stakeholders

Where complex flood risk issues are highlighted it is important that all stakeholders are actively encouraged to work together to identify issues and provide suitable solutions.

Engagement with riparian owners is also important to ensure they understand their rights and responsibilities including:

- maintaining river bed and banks;
- allowing the flow of water to pass without obstruction; and
- controlling invasive alien species e.g. Japanese knotweed.

More information about riparian owner responsibilities can be found in the Environment Agency's guidance on **Owning a Watercourse** (2018).

11 Level 1 summary assessment of potential development locations

This section provides information on flood risk to potential development sites.

11.1 Introduction

A total of 233 Plan:MK sites were provided by Milton Keynes City Council as shown in Appendix N. A further 8 recommended growth options and 2 potential intensification areas from the MK2050 strategy were also assessed.

The site boundaries were screened in GIS against a suite of available flood risk information and spatial data to provide a summary of risk to each site (see Appendix N).

The information considered includes the flood risk datasets listed below:

- SFRA Flood Zones 2, 3a and 3b
- Fluvial climate change allowances
- Environment Agency Risk of Flooding from Surface Water
- Environment Agency Risk of Flooding from Surface Water with allowances for climate change
- Environment Agency Historic Flood Map
- JBA Groundwater Flood Map
- Critical Drainage Catchments

A site screening spreadsheet has been prepared that identifies the proportion of each site that is affected by the different sources of flooding. The information provided is intended to enable a more informed consideration of the sites when applying the sequential approach. The site screening spreadsheet, shown in Appendix N, should be used to determine whether more detailed assessment of sites is needed to further identify those that should be taken forward as potential development allocations for a Level 2 assessment.

11.2 Overview of flood risk at identified sites

A summary of flood risk at each of the sites in light of the screening is provided below:

- The majority of the sites are predominantly located in Flood Zone 1, with 220 sites completely located within Flood Zone 1.
- 21 sites are partially located in Flood Zone 3b.
- 12 sites are partially located in Flood Zone 3a.
- 19 sites are partially located in Flood Zone 2.
- 157 sites are predicted to be at risk during a current day 1% AEP surface water flood event.

- 212 sites are predicted to be a risk during a future 1% AEP surface water flood event with a 40% increase in rainfall.
- 13 sites intersect the Environment Agency's historic flood outlines.
- 112 sites intersect Critical Drainage Catchments.

11.3 Sequential Testing

The SFRA does not include the Sequential Test of the development sites that were screened. However, Appendix N summarises the flood risk to the potential development sites and provides evidence for use in the completion of the Sequential Test by Milton Keynes City Council.

The assessments undertaken for this SFRA will assist Milton Keynes City Council in the preparation of the Sequential Test.

12 Summary

This Level 1 SFRA delivers a strategic assessment of all sources of flooding in the Local Plan area. It also provides an overview of policy and provides guidance for planners and developers.

The study area comprises the administration area of Milton Keynes.

Parts of Milton Keynes administrative area are at risk of flooding from the following sources: fluvial, surface water, groundwater, sewers, reservoir inundation and canal overtopping/breaches. This study has shown that the most significant sources of flood risk in Milton Keynes administrative area are fluvial and surface water.

- *Fluvial flood risk:* The primary fluvial flood risk in Milton Keynes administrative area is along the River Great Ouse and its tributaries, including the River Ouzel and River Tove. Areas where there are properties at risk from Main River flooding include Newport Pagnell, New Bradwell, Bletchley and Water Eaton and Stony Stratford. Key areas at risk of flooding from ordinary watercourses include Bletchley, Lavendon, Stoke Goldington, Tathall End and Walton Park.
- *Surface water flood risk:* The Risk of Flooding from Surface Water map shows a number of prominent overland flow routes; these predominantly follow topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas. There are also considerable flow routes following the roads through the main urban areas of Milton Keynes administrative area which alongside isolated areas of ponding affect many properties across these settlements. Within Milton Keynes administrative area Bletchley is designated as a Flood Risk Area within the 2018 Environment Agency Preliminary Flood Risk Assessment due to surface water flooding.
- *Sewer flood risk:* The 2,342 Anglian Water sewer historic flooding data points provided are shown to be dispersed across Milton Keynes administrative area. These are mostly from foul sewer, but there are also combined sewer and surface sewer records. Within the boundary the majority of points are located within the southern half of the district boundary in the town centre, with smaller clusters in the north in Castlethorpe, Hanslope, Ravenstone, Olney and Sherington.
- *Groundwater flood risk:* JBA's Groundwater Flood Risk map shows the areas with the highest risk of groundwater emergence generally follow the flow paths of the major watercourses in Milton Keynes administrative area, particularly along the River Great Ouse and its tributaries such as the River Ouzel, and areas of low-lying topography. Across the majority of the administrative area of Milton Keynes, the risk of groundwater flooding is considered to be low due to the nature of the local geological deposits.
- *Canal flood risk:* The Grand Union Canal flows through Milton Keynes administrative area. This has the potential to interact with other watercourses and become flow paths during flood events or in a breach scenario. There have been 2 recorded incidents of breach and 2 of overtopping on the Grand Union Canal.

- *Reservoir flood risk:* There is a potential risk of flooding from reservoirs both within the administrative area and those outside. The level and standard of inspection and maintenance required under the Reservoirs Act (1975) means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant).

13 Recommendations

A review of national and local policies has been conducted against the information collated on flood risk in this SFRA. Following this, several recommendations have been made for Milton Keynes City Council to consider as part of Flood Risk Management in the study area.

13.1 Existing policy to be maintained

13.1.1 Sequential approach to development

The NPPF supports a risk-based and sequential approach to development and flood risk in England, so that development is located in the lowest flood risk areas where possible; it is recommended that this approach is adopted for all future developments within the administrative area.

New development and re-development of land should wherever possible seek opportunities to reduce overall level of flood risk at the site, for example by:

- Reducing volume and rate of runoff through the use of SuDS, as informed by the Milton Keynes City Council's **Surface Water Drainage Guidance for Developers** (SPD) in the relevant wastewater treatment catchments.
- Relocating development to areas with lower flood risk
- Creating space for flooding
- GI should be considered within the mitigation measures for surface water runoff from potential development and consider using areas at risk of flooding as public open space
- Consideration must be given to the potential cumulative impact of development on flood risk.

In Critical Drainage Catchments, a Flood Risk Assessment is required to demonstrate that the development will not increase the flood risk to the Critical Drainage Catchment, and where possible will provide an improvement to the existing situation.

13.1.2 Site-specific Flood Risk Assessments

Site-specific FRAs are required by developers to provide a greater level of detail on flood risk and any protection provided by defences and, where necessary, demonstrate the development passes Part b of the Exception Test.

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), inform development zoning within the site and prove, if required, whether the Exception Test can be passed. The assessment should also identify the risk of existing flooding to adjacent land and properties to establish whether there is a requirement to secure land to implement strategic flood risk management measures to alleviate existing

and future flood risk. Any flood risk management measures should be consistent with the wider catchment policies set out in the CFMP, FRMPs and LFRMS.

Developers should consult with Milton Keynes City Council, the Environment Agency, the IDB and Anglian Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

13.1.3 Sequential and Exception tests

The SFRA has identified that areas of the study area are at high risk of flooding. Therefore, it is expected that several proposed development sites will be required to pass the Sequential and, where necessary, Exception Tests in accordance with the NPPF. Milton Keynes City Council should use the information in this SFRA when deciding which development sites to take forward in the Local Plan Review. It is the responsibility of Milton Keynes City Council to be satisfied that the Sequential Test has been satisfied.

13.1.4 Council review of planning applications

The Council should consult the Environment Agency's '**Flood Risk Assessment: Local Planning Authorities**', last updated February 2022, when reviewing planning applications for proposed developments at risk of flooding.

The Council will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases, also contact non-statutory consultees (e.g. Anglian Water) that have an interest in the planning application.

13.1.5 Drainage strategies and SuDS

Planners should be aware of the conditions set by the LLFA for surface water management and ensure development proposals and applications are compliant with Milton Keynes City Council's **Sustainable Drainage System – Guidance for Developers** for the relevant wastewater treatment catchment. The enactment of Schedule 3 of the FWMA means that there will be mandatory standards for delivery and adoption of SuDS in new developments.

Plan:MK advocates the continuation of a strategic, integrated approach to managing flood risk which seeks the management of surface water to be planned at the largest appropriate scale for the new development and incorporated into the site at the earliest opportunity in the design process.

As set out in Plan:MK policy FR2, new development is required to incorporate SuDS; in line with national policy and guidance and, which meet the requirements set out in national standards and the Council's relevant local guidance. It is expected that:

1. Flood risk management and SuDS will be provided at a strategic scale and in an integrated manner, wherever possible;
2. Space will be specifically set aside for SuDS and fluvial flood risk reduction features and used to inform the overall layout of development sites;
3. Above ground attenuation will be provided in preference to below ground attenuation;
4. SuDS will be designed as multi-purpose green infrastructure and open space, to maximise additional environmental, biodiversity, social and amenity value, wherever possible. The use of land to provide flood storage capacity should not conflict with required amenity and recreation provision - floodplains and floodplain habitats should be safeguarded;
5. SuDS will be designed with an allowance for climate change and the potential impact it may have over the lifetime of the proposed development;
6. Proposals for development within Critical Drainage Catchments, as identified in the Milton Keynes Surface Water Management Plan, should investigate the potential for the scheme to reduce or mitigate existing risk in the surrounding area;
7. All surface water drainage proposals for new development must include full details of the means of achieving future management, maintenance and adoption of the systems, prior to approval of any planning permission, to ensure that it will function effectively over the lifespan of the development. This will include details of funding and should be formulated through discussion with the relevant responsible bodies, including Milton Keynes Council, The Parks Trust, Anglian Water and the Internal Drainage Board;
8. Development will ensure no adverse impact on the functions and setting of a watercourse and its associated corridor;
9. Development should avoid building over or culverting watercourses, encourage the removal of existing culverts and seek opportunities to create wetlands and wet grasslands and woodlands and restore natural river flows and floodplains.

13.1.6 Protecting and enhancing watercourses

As set out in Plan: MK Policy FR3, all new development must be set back at a distance of at least 8 metres from any main rivers, at least 9 metres from all other ordinary watercourses, or at an appropriate width as agreed by the Environment Agency, Lead Local Flood Authority or Internal Drainage Board, in order to provide an adequate undeveloped buffer zone. Development that restricts future de-culverting of waterways should be avoided.

The Council will resist proposals that would adversely affect the natural functioning of main rivers, ordinary watercourses and wet or dry balancing lakes, this includes through the culverting of open channels, unless for access purposes.

13.1.7 Residual risk

Residual risk is the risk that remains after mitigation measures are considered. The residual risk includes the consideration of flood events that exceed the design thresholds of the flood defences or circumstances where there is a failure of the defences, e.g. flood banks collapse. Residual risks should be considered as part of site-specific Flood Risk Assessments.

Further, any developments located within an area protected by flood risk management measures, where the condition of those defences is 'fair' or 'poor', where the standard of protection is not of the required standard or where the failure of the intended level of service gives rise to unsafe conditions should be identified.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage. They should seek to contact the reservoir owner to obtain information and should apply the sequential approach to locating development within the site. Developers should also consult with relevant authorities regarding emergency plans in case of reservoir breach.

Consideration should be given to the potential for safe access and egress routes in the event of rapid inundation of water due to a breach with little warning.

13.1.8 Safe access and escape routes

Safe access and escape routes will need to be demonstrated at all development sites. Emergency vehicular access should be possible during times of flood.

Where development is located behind, or in an area benefitting from, defences, consideration should be given to the potential safety of the development, finished floor levels and for safe access and escape routes in the event of rapid inundation of water due to a defence breach with little warning.

Resilience measures will be required if buildings are situated in the flood risk area, and opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought.

13.1.9 Future flood management

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted.

The information provided in the SFRA should be used as a basis for investigating potential strategic flood risk solutions within the study area. Opportunities could consist of the following:

- Catchment and floodplain restoration;
- Flood storage areas;
- Opening up culverts, weir removal, and river restoration;

- The Regional Habitat Creation Programme; and
- Green infrastructure.

For successful future flood risk management, it is recommended that local planning authorities adopt a catchment partnership working approach in tackling flood risk and environmental management.

13.1.10 Mitigate against risk, improved emergency planning and flood awareness

Milton Keynes City Council should work with communities to improve flood resilience and flood recovery within Milton Keynes administrative area and better prepare communities for future flooding.

- Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.
- For a partial or completely pumped drainage system, an assessment should be undertaken to assess the risk of flooding due to any failure of the pumps to be assessed. The design flood level should be determined if the pumps were to fail; if the attenuation storage was full, and if a design storm occurred.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 1%AEP rainfall event, inclusive of climate change and urban creep.
- Consideration and incorporation of flood resilience measures up to the 0.1% AEP event.
- Ensure robust emergency (evacuation) plans are produced and implemented for major developments.
- Increase awareness and promote sign-up to the Environment Agency Flood Warnings Direct (FWD) within Milton Keynes administrative area.

13.2 Recommendations from cumulative impact assessment

The cumulative impact of development should be considered at the planning application and development design stages and the appropriate mitigation measures undertaken to ensure flood risk is not exacerbated, and in many cases the development should be used to improve the flood risk. Recommendations from the Cumulative Impact Assessment (Section 7) are outlined below.

13.2.1 Broadscale recommendations

The broadscale cumulative impact assessment for Milton Keynes administrative area has highlighted the potential for development to have a cumulative impact on flood risk. 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 Milton Keynes administrative area is appropriate.

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

- Milton Keynes City Council should work closely with neighbouring local authorities listed in Section 7.2 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 (Milton Keynes City Council) for the requirements for SuDS in Milton Keynes administrative area, including Technical and Development Type-specific Guidance for Developers. Further guidance on SuDS can be found in Section 9 of the main SFRA report.
- Milton Keynes City 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.
- Developments should seek betterment of existing flood risks both within the site and in surrounding areas. As a minimum, developments must meet national and local standards for Flood Risk Assessments and surface water drainage strategies. By looking at flood risks beyond the site boundary, developers should be encouraged to implement sustainable solutions which manage flood risk.
- Where applicable, 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 be 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.

- Milton Keynes City 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.
- Section 8 details the local requirements for mitigation measures. Catchment-specific recommendations are made for high-risk catchments below.

13.2.2 Recommendations for developments in high-risk catchments

- The LLFA and LPA should work closely with the EA to identify any areas of land that should be safeguarded for any future flood alleviation schemes and natural flood management features.
- The LPA 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.
- Within the FRA consideration should be given to the potential cumulative effects of all proposed development and how this affects sensitive receptors.
- For developments in high-risk catchments, the LLFA and LPA 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.

13.2.3 Development within medium risk catchments

Catchments that have been scored an overall ranking of medium, but where development proposals are present, should also consider the following recommendations:

- LPAs 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.

There is the potential for development in these catchments to contribute towards works to reduce flood risk and enable regeneration as well as contributing to the wider provision of green infrastructure.

13.3 Further specific policy recommendations for Milton Keynes Administrative Area

13.3.1 Safeguarding of land

The Working with Natural Processes mapping shows there are opportunities for floodplain reconnection, riparian woodland and additional floodplain woodland along the watercourses. The mapping also indicates locations where there are potential for runoff attenuation features to reduce flows. Milton Keynes City Council should work

closely with the Environment Agency to identify areas of land that should be safeguarded for the future use of natural flood management features.

Milton Keynes City Council should also identify long-term opportunities to remove development from the floodplain and safeguard the functional floodplain from future development to make space for water.

13.4 Requirements for Level 2

Following the application of the Sequential Test, where sites cannot be appropriately accommodated in low risk areas, Milton Keynes City Council will apply the NPPF's Exception Test. In these circumstances, a Level 2 SFRA may be required, to assess in more detail the nature and implications of the flood characteristics.

13.5 Technical recommendations

13.5.1 Potential modelling improvements

The Environment Agency regularly reviews its 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. The Environment Agency is in the process of updating the modelling of the River Great Ouse but this was not available in the timescales of the SFRA. Appendix K outlines the data sources used in the SFRA.

13.5.2 Updates to SFRA

SFRAs are high-level strategic documents and, as such, do not go into detail on an individual site-specific basis. This SFRA has been developed using the best available information, supplied at the time of preparation.

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. The Environment Agency is in the process of updating the modelling of the River Great Ouse. When using the SFRA to prepare FRAs it is important to check that the most up to date information is used, as is described in amendments to the flood mapping prepared and issued by the Environment Agency at regular intervals.

Other datasets used to inform this SFRA may also be periodically and following the publication of this SFRA, new information on flood risk may be provided by Risk Management Authorities.

Annex 1 – Updates to the planning practice guidance (25 August 2022)

The Planning Practice Guidance on Flood Risk and Coastal Change was updated on the 25 August 2022, triggered by: revisions to the NPPF in 2018, 2019 and 2021; practice experience since the PPG was first published in 2014; Policy review of development in flood risk areas; and other stakeholder and committee reviews.

Key Details of the changes included in the PPG update of 25 August 2022:

General

- 'Design flood' includes Climate Change and surface water risk
- Hierarchical approaches prioritises avoidance and passive approaches, which also applies to residual risk.
- Safety of development now accounts for impact of flooding on the services provided by development
- Inappropriate to consider likelihood of defence breach
- Functional floodplain "starting point" for extent uplifted to the 3.3%AEP from 5% AEP
- Lifetime of non-residential development now has a 75yrs starting point
- New culverting and building over culverts is discouraged
- Defra FD2320 research referenced for calculating flood hazard to people

Sequential Test

- Removal of reference to Flood Zones (Diagram 2) when performing Sequential Test and requirement must now consider whether development can be located in the lowest areas (high – medium – low) of flood risk both now and in the future (the test applies to all source of flood risk – whereas previously the test was only performed for present day flood risk for the "Flood Zones" i.e. river and sea flood risk).
- Improved clarity about when test needs to be applied. Potential confusion about 'minor' development has been clarified.
- Clearer roles and responsibilities, with emphasis on the LP to define the area of search and decide if the test is passed.
- Key terms defined (e.g. 'reasonably available')
- Suggests approaches to improve certainty and efficiency
- Clarification about when it's appropriate to move onto the Exception Test
- Explicit statement that Table 2 (was Table 3) cannot be used to support performance of Sequential Test

Exception Test

- Key terms defined (e.g. 'wider sustainability benefits to the community')
- New section on how to demonstrate development has reduced flood risk overall
- Table 2 (was Table 3) shows flood zone ***incompatibility***, NOT whether 'development is appropriate'.

Integrated approach to flood risk management

- Catchment based approaches
- Improved connectivity with other strategies e.g. water cycle studies and drainage and wastewater management plans
- Encourages measures which deliver multiple benefits – including those which unlock sustainable development

Impact of development on flood risk elsewhere

- FRA's must detail any increase in risk elsewhere
- Guidance on compensatory flood storage – requirement for level-for-level storage
- Guidance on mitigating cumulative impacts
- Clarification that stilts/voids should not be relied upon for compensatory storage

Safeguarding land and relocation

- Guidance on how to safeguard land needed for future FCERM infrastructure
- Definition included for unsustainable locations
- Guidance for control of developments in unsustainable locations
- More detail and expectation on requirement to exercise Plan process to relocate development that is susceptible to frequent flood risk or coastal erosion.

Sustainable Drainage Systems

- Clearer definition of what SuDS are – this must meet the '4 pillars'
- Clearer requirement for SuDS Strategy
- Better recognition of wider SuDS benefits e.g. BNG, carbon sequestration, urban cooling
- Encouragement for earlier consideration in the design process
- Encourages policies setting out where SuDS would bring greatest benefits
- Highlights the need to check the need for other permits for SuDS

Reducing the causes & impacts of flooding

- Whole new section – links to all the EA's latest NFM tools, maps and research
- Support for river restoration such as culvert removal and other 'slow the flow' approaches

- Support for making space for river geomorphology e.g. meander migration

Coastal Change

- Encourages more precautionary designation of Coastal Change Management Areas (CCMAs)
- Allows more flexibility for existing buildings/land-use to adapt to change
- Clearer requirement for a 'coastal change vulnerability assessment' with apps for development in CCMAs
- Highlights need to consider removal of some Permitted Development rights in CCMAs

Other changes

- Guidance on how to consider flood risk in LDOs
- More detailed framework for local design code preparation
- Approach to article 4 in relation to flood risk
- Greater clarity on the application of the call-in direction process
- Guidance on development that might affect existing reservoirs
- Updated links to the latest tools and guidance

Impacts on the SFRA

The most relevant points to consider in relation to updating the SFRA process relate to the changes to the Sequential Test requirements and Exception Test requirements, particularly the requirement for updated Climate Change modelling for all sources of flood risk and the functional floodplain starting point at 3.3% AEP. Consideration also needs to be made to the changes to Table 2 (was Table 3) and the Flood Zone incompatibility. This should be considered during the screening phase prior to the Level 2 SFRA being undertaken.

For more information on the PPG updates, please visit the **gov.uk website**.

Appendices

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