Huntingdonshire Integrated Water Management Strategy: Level 1 Strategic Flood Risk Assessment

Final Report

March 2024

Prepared for:

Huntingdonshire DISTRICT COUNCIL

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This report describes work commissioned by Huntingdonshire District Council, by an instruction dated 18 October 2022. The Client's representative for the contract was Frances Schulz of Huntingdonshire District Council. Sue Jones, Laura Thompson and Mike Williamson of JBA Consulting carried out this work.

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Abbreviations

AEP ..... Annual Exceedance Probability
AW ..... Anglian Water
CC ..... Climate Change
CCC ..... Cambridgeshire County Council
CFMP ..... Catchment Flood Management Plan
CFRMP ..... Cambridgeshire Flood Risk Management Partnership
CSO ..... Combined Sewer Overflow
Defra ..... Department for Environment Food & Rural Affairs
DLUHC ..... Department for Levelling Up, Housing and Communities
EA ..... Environment Agency
FAS ..... Flood Alleviation Scheme
FCERM ..... Flood and Coastal Erosion Risk Management
FDGiA ..... Flood Defence Grant-in-Aid
FMfP ..... Flood Map for Planning
FRA ..... Flood Risk Assessment
FRM ..... Flood Risk Management
FRR ..... Flood Risk Regulations
FRCC-PPG ..... Flood Risk and Coastal Change planning Practice Guidance
FRMP ..... Flood risk management plan
FSA ..... Flood Storage Area
FWMA ..... Flood and Water Management Act
GI ..... Green Infrastructure
HDC ..... Huntingdonshire District Council
HFM ..... Historic Flood Map
IWMS ..... Integrated Water Management Studies
LA ..... Local Authority
LDP ..... Local Development Plan
LFRMS ..... Local Flood Risk Management Strategy
LLFA ..... Lead Local Flood Authority
LPA ..... Local Planning Authority
mAOD ..... Metres above Ordnance Datum
NFM ..... Natural Flood Management
NGO ..... Non-governmental organisation

NPPF.....National Planning Policy Framework
OFWAT .....Water Services Regulation Authority
PFR.....Property Flood Resilience
PFRA.....Preliminary Flood Risk Assessment
PPG.....Planning Practice Guidance
RBD.....River Basin District
RBMP.....River Basin Management Plan
RFCC .....Regional Flood and Coastal Committee
RFO.....Recorded Flood Outline
RMA .....Risk Management Authority
RoFSW.....Risk of Flooding from Surface Water
SA .....Sustainability Appraisal
SAB.....SuDS Approving Body
SFRA.....Strategic Flood Risk Assessment
SoP .....Standard of Protection
SuDS.....Sustainable Drainage Systems
SWMP.....Surface Water Management Plan
WCS.....Water Cycle Study
WFD.....Water Framework Directive
WwNP .....Working with Natural Processes

Executive Summary

This Level 1 Strategic Flood Risk Assessment (SFRA) is an update to the previous SFRA, completed in 2017, using the latest flood risk information available at the time of writing, together with the most current flood risk and planning policy available from the National Planning Policy Framework (NPPF) (2023)[1] and Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG)[2]. The latest SFRA guidance has also been considered, including 'How to prepare a strategic flood risk assessment' guidance, March 2022[3], and the 'Strategic flood risk assessments a Good Practice Guide' guidance, November 2021[4].

This Level 1 SFRA is focused on collecting readily available flood risk information from key stakeholders, the aim being to help identify the spatial distribution of all sources of flood risk present throughout Huntingdonshire District Council's (HDC) Local Plan area to inform the application of the Sequential Test.

HDC requires this Level 1 SFRA to initiate the sequential risk-based approach to the allocation of land for development and to identify whether application of the Exception Test is likely to be necessary. This will help to inform and provide the evidence base for the update to the Local Plan. This SFRA considers risk across the whole authority area and takes a catchment-based approach to flood risk management and the cumulative impacts of new development.

The Local Planning Authority (LPA) provided its latest sites information from the Call for Sites (CfS) process carried out in 2023. An assessment of flood risk has been undertaken on all CfS sites provided to assist the LPA in its decision-making process for sites to support the Local Plan.

A number of HDC's sites are shown to be at varying risk from fluvial and surface water. Development consideration assessments for all sites are summarised through a number of strategic recommendations within Appendix E and the development sites assessment spreadsheet in Appendix C. The strategic recommendations broadly entail the following:

1 National Planning Policy Framework, Department for Levelling Up, Housing and Communities, UK Government, 2023

2 Flood Risk and Coastal Change Planning Practice Guidance; Ministry of Housing, Communities & Local Government, 2022

3 How to prepare a Strategic Flood Risk Assessment, Defra and Environment Agency, 2022

4 Strategic flood risk assessments A GOOD PRACTICE GUIDE, Report produced using Environment Agency research on 'using flood risk information in spatial planning' (2019-2020), 2021

- Strategic Recommendation A – development could be allocated on flood risk grounds based on the evidence of this Level 1 SFRA; LPA to make decision on allocation.
- Strategic Recommendation B – site to progress to developer-led FRA stage or carry out Level 2 SFRA to confirm climate change risks;
- Strategic Recommendation C – Exception Test required through a detailed Level 2 SFRA if site passes Sequential Test; and
- Strategic Recommendation D – consider withdrawal due to functional floodplain unless functional floodplain can be included in site design or the site boundary can be redrawn to remove function floodplain from the boundary.

A total of 348 sites were screened against the latest available flood risk information.

Strategic Recommendation D applies to 82 sites. Strategic Recommendation C applies to 240 sites. There are 10 sites to which Strategic Recommendation B applies. Strategic Recommendation A applies to 16 sites.

See Appendix C for a full breakdown of the risk at each site and Appendix E which discusses the identified risks.

SFRA Recommendations

The main planning policy and flood risk recommendations to come out of this SFRA are outlined briefly below and are based on the fundamentals of the National Planning Policy Framework and the Flood Risk and Coastal Change Planning Practice Guidance (see Sections A.3.1 and A.3.2 of Appendix A).

SFRA recommendation:

- No development within the functional floodplain, unless development is water compatible;
- Surface water flood risk should be considered with equal importance as fluvial risk;
- The sequential approach must be followed in terms of site allocation and site layout;
- Ensure site-specific Flood Risk Assessments are carried out to a suitable standard, where required, with full consultation required with the LPA/LLFA, the EA, Anglian Water and Cambridge Water;
- Appropriate investigation and use of SuDS;
- Natural Flood Management techniques must be considered for mitigation;
- Phasing of development must be carried out to avoid possible cumulative impacts; and
- Planning permission for at risk sites can only be granted by the LPA following an acceptable site-specific FRA being submitted, in line with the local plan, SFRA and NPPF.

Included within this Level 1 SFRA, along with this main report, are:

- Discussion of relevant Planning Framework and Flood Risk Management Policies – Appendix A *The Planning Framework and Flood Risk Policy*;
- Detailed interactive GeoPDF maps showing all available flood risk information together with the assessed sites – Appendix B *Interactive GeoPDF maps*;
- Development site assessment spreadsheet detailing the risk to each site with recommendations on development – Appendix C *Development site assessment spreadsheet*;
- A technical note on the delineation of the functional floodplain following discussion and agreement between HDC and the EA – Appendix D *Functional floodplain delineation*;
- Discussion of the strategic recommendations outlined in the site assessment spreadsheet – Appendix E *Strategic Recommendations of the proposed sites*;
- Huntingdonshire Level 1 SFRA User Guide – Appendix F; and
- Catchment-level assessment of Cumulative Impacts of Development on Flood Risk - Appendix G.

1 Introduction

1.1 Commission

Huntingdonshire District Council (HDC) commissioned JBA Consulting for the undertaking of an Integrated Water Management Study (IWMS). Phase 1 of the IWMS incorporates a Level 1 Strategic Flood Risk Assessment (SFRA) and a Stage 1 Water Cycle Study (WCS). Phase 2, if required following the outcomes of Phase 1, will entail a more detailed Level 2 SFRA and Stage 2 WCS.

Phase 1 is presented over two reports: this report entailing the Level 1 SFRA and one for the Stage 1 WCS. However, each study is not considered in isolation and references to the Stage 1 WCS are apparent throughout this report, where applicable.

The IWMS will be used as an important element of the evidence base in the development of HDC's new Local Plan.

HDC's current Level SFRA 1, prepared by JBA and published in 2017, requires updating to meet the requirements of the latest policy and guidance on planning and flood risk including for the potentially significant impacts of climate change. A WCS is required because the water companies' (Anglian Water and Cambridge Water) supply and demand balances have changed significantly since 2017, hence the requirement for an IWMS.

Since the 2017 Level 1 SFRA was published, the National Planning Policy Framework (NPPF), the Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG), and Environment Agency (EA) guidance and best practice, including updated climate change allowances, have been significantly updated. There have also been updates to EA modelling of the River Great Ouse and other main rivers in the district since 2017. This Level 1 SFRA accounts for these updates.

A number of potential development sites have been identified as potential development allocations within the Regulation 19 (publication) Local Plan. HDC requires this updated Level 1 SFRA to screen and assess flood risk to potential development site allocations to provide the evidence to inform the Sequential Test.

1.2 Purpose of the Strategic Flood Risk Assessment

All local planning authorities should produce a Level 1 SFRA to include in the evidence base for the local plan. A Level 2 SFRA may also be required depending on whether the Local Authority has plans for development in flood risk areas, identified through this Level 1 SFRA. The EA's SFRA guidance for local planning authorities (updated March 2022, at the time of writing) states:

"*Your SFRA will help your planning authority make decisions about:*

- *your local plan or spatial development strategy*

- *individual planning applications*
- *how to adapt to climate change*
- *future flood 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*

You also need it to help you:

- *carry out the sequential test for the local plan or spatial development strategy, and individual planning applications*
- *do the exception test, when you're 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 and structures*
- *do the sustainability appraisal of the local plan or spatial development strategy*."

1.3 Huntingdonshire Level 1 Strategic Flood Risk Assessment

The Huntingdonshire Level 1 SFRA has been carried out in accordance with Government's latest development planning guidance including the NPPF[5], first published in March 2012 and last updated September 2023, and the accompanying flood risk and planning practice guidance the FRCC-PPG[6], first published in 2014 and last updated August 2022. The latest SFRA guidance has also been considered, including 'How to prepare a strategic flood risk assessment[7]'guidance, March 2022, and the 'Strategic flood risk assessments a Good Practice Guide[8]' guidance, November 2021.

5 National Planning Policy Framework; Ministry of Housing, Communities & Local Government, 2023

6 Flood Risk and Coastal Change Planning Practice Guidance; Ministry of Housing, Communities & Local Government, 2022

7 How to Prepare a Strategic Flood Risk Assessment, Defra and Environment Agency, 2022

8 Strategic flood risk assessments A GOOD PRACTICE GUIDE, Report produced using Environment Agency research on 'using flood risk information in spatial planning' (2019-2020), 2021

This SFRA makes use of the most up-to-date flood risk datasets, available at the time of submission, to assess the extent of risk, at a strategic level, across the district and specifically to potential development site allocations.

The SFRA appendices contain interactive GeoPDF maps (Appendix B) showing the potential development sites overlaid with the latest, readily available, gathered flood risk information along with a Development Site Assessment spreadsheet (Appendix C) indicating the level of flood risk to each site following a strategic assessment of risk. This information allows the Local Planning Authority (LPA) to identify the strategic development options that may be applicable to each site and to inform on the application of the Sequential Test and to identify sites that may require the Exception Test, in order to be allocated, through a Level 2 SFRA.

1.4 Objectives

The aims and objectives of this Level 1 SFRA, in line with the NPPF (2023), FRCC-PPG (2022), EA SFRA guidance (2022), EA Good Practice guide (2021) and more specifically included in HDC's Brief, are to:

- Provide a sound and up to date strategic assessment of the risk to Huntingdonshire of flooding from all sources including fluvial from main rivers (Flood Map for Planning) and ordinary watercourses, designation of functional floodplain (Flood Zone 3b), surface water (pluvial and sewer), groundwater and residual risk from reservoirs taking account of the impacts of climate change, where data is available,
- Carry out a screening assessment of all potential development sites against all available sources of flood risk, including for climate change, and provide a basis to allow for the application of the Sequential Test to the location of additional development sites which may come forward (e.g. planning applications, windfall sites, alternative sites which may come forward through the Local Plan examination process) and assess areas best equipped for sustainable growth,
- Provide a sound and up to date evidence base to inform the preparation of the new Local Plan, particularly the site allocation process and policies related to flood risk and water resources,
- Identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river flooding,
- Determine the acceptability of flood risk in relation to emergency planning capability, in particular safe access and escape routes from potential development sites,
- Assess flood defence infrastructure, including defence types, Standards of Protection, condition as per T98 specifications, and residual risk,
- Document any current or planned EA or Lead Local Flood Authority (LLFA) Flood and Coastal Erosion Risk Management (FCERM) schemes, strategies and plans,

- Consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance, storage of floodwater through appropriate Sustainable Drainage Systems (SuDS) and possible areas of critical drainage. Also, through natural flood management and the use of green infrastructure and open space for flood storage and amenity use through blue / green infrastructure. Consideration of Property Flood Resilience (PFR) measures, including retrofitting SuDS for existing communities and formulating policy for surface water management from new development i.e. restrictions to greenfield rates, percentage betterments on current, etc.,
- Similarly, consider how SuDS can contribute towards improving water quality and providing alternative water resources,
- Review locations, including in neighbouring authorities, where additional development may significantly increase flood risk elsewhere (cumulative impacts) and where development pressures may require the Exception Test to be applied (i.e. where a Level 2 assessment is required),
- Provide a reference and policy document to advise and inform the public and private and commercial developers of their obligations under the latest planning guidance,
- Enable the IWMS to be used as a tool to inform the Development Management process about the potential risk of flooding associated with future planning applications and the basis for requiring site-specific FRAs where necessary.
- Provide evidence to support the Council as they move from the call for sites stage through to developing spatial strategies and to the allocation of sites.
- Demonstrate an integrated approach to flood risk and water management in preparing the SFRA and WCS simultaneously to ensure issues relating to flood risk and water resource are dealt with in an integrated manner with particular emphasis on constraints, risks, and required interventions.

1.5 Consultation

The EA's 2022 SFRA guidance recommends consultation with the following parties, external to the LPA:

- The EA;
- The LLFA (Cambridge County Council);
- Emergency planners;
- Emergency services;
- Water and sewerage companies;
- Reservoir owners or undertakers, if relevant;
- Internal drainage boards;
- Highways authorities;
- Neighbouring district councils; and

- Regional flood and coastal committees.

1.6 SFRA future proofing

This Level 1 SFRA has been developed using the most up-to-date data and information available at the time of submission. The SFRA has been future proofed as far as possible though the reader should always confirm with the source organisation (HDC) that the latest information is being used when decisions concerning development and flood risk are being considered. The FRCC-PPG, alongside the NPPF, is considered throughout this SFRA, being the current primary development and flood risk guidance information available at the time of the finalisation of this SFRA.

The EA's 2022 SFRA guidance states a review of a SFRA should be carried out when there are changes to:

- The predicted impacts of climate change on flood risk;
- Detailed flood modelling - such as from the EA or LLFA;
- The local plan, spatial development strategy or relevant local development documents;
- Local flood management schemes;
- Flood risk management plans;
- Local flood risk management strategies; and
- National planning policy or guidance.

The SFRA should also be reviewed after a significant flood event. It is in any authority's interest to keep the SFRA as up to date as possible.

Ideally, the SFRA should be kept as a 'live' entity and continually updated when new information becomes available. The EA requests for reports and maps to be published online and be easily updateable, when required.

This SFRA uses the EA's Flood Map for Planning (FMfP) version issued in November 2022 to assess fluvial risk to potential development sites. The Flood Map for Planning is updated by the EA, as and when accepted new modelling data becomes available. The reader should therefore refer to the online version of the Flood Map for Planning to check whether the flood zones may have been updated since November 2022, via the following link:

Flood Map for Planning

To assess surface water risk to the potential development sites, this SFRA uses the EA's Risk of Flooding from Surface Water (RoFSW) dataset, last updated May 2021 at the time of writing. This dataset can be updated periodically when applicable local surface water modelling is carried out that adheres to the EA's required methodology. The reader should therefore refer to the online version of the RoFSW map to check whether the surface water flood outlines have been updated, via the following link:

Check the long term flood risk for an area in England

At the time of writing, the RoFSW is subject to significant updates and is due for release in late-2024.

2 Study Area and Wider Catchment

According to the mid-2021 Office for National Statistics population estimates, 180,000 people live in the local authority area of Huntingdonshire. HDC functions as the LPA and Cambridgeshire County Council (CCC) the LLFA for the district.

Huntingdonshire is situated in the south east of England within the county of Cambridgeshire and covers an area of approximately 910km^2. Huntingdonshire is a predominantly rural area interspersed with numerous villages and hamlets, which retain their natural character. The main towns within the district include Huntingdon, Ramsey, St Ives and St Neots. The largest of these is St Neots, which is located to the south of the district. Other distinct settlements include, but are not limited to, the villages of Brampton, Godmanchester, Buckden, Sawtry and Yaxley and the most recent development Alconbury Weald.

The district of Huntingdonshire is bounded by the unitary authorities of the City of Peterborough to the north; north Northamptonshire and Bedford to the west and Central Bedfordshire to the south and the districts of Fenland, East Cambridgeshire and South Cambridgeshire to the east. The east and west of the district is split by the A1 which runs north to south.

Huntingdonshire falls within the River Great Ouse catchment, which is linked to the Ouse Washes, which are designated as a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar site. The River Great Ouse valley dominates the landscape in the central and eastern parts of the district. The River Great Ouse enters Huntingdonshire from Bedford to the south east and flows through the town of St Neots then flowing in a north easterly direction as it passes through the towns of Huntingdon, Godmanchester, Wyton and St Ives before crossing the district boundary into Cambridgeshire. Other notable main rivers include the River Nene, the River Kym and their tributaries.

The topography of the catchment is characterised by higher elevations in the west and south of the district in contrast to the flatter fen landscape to the north and west.

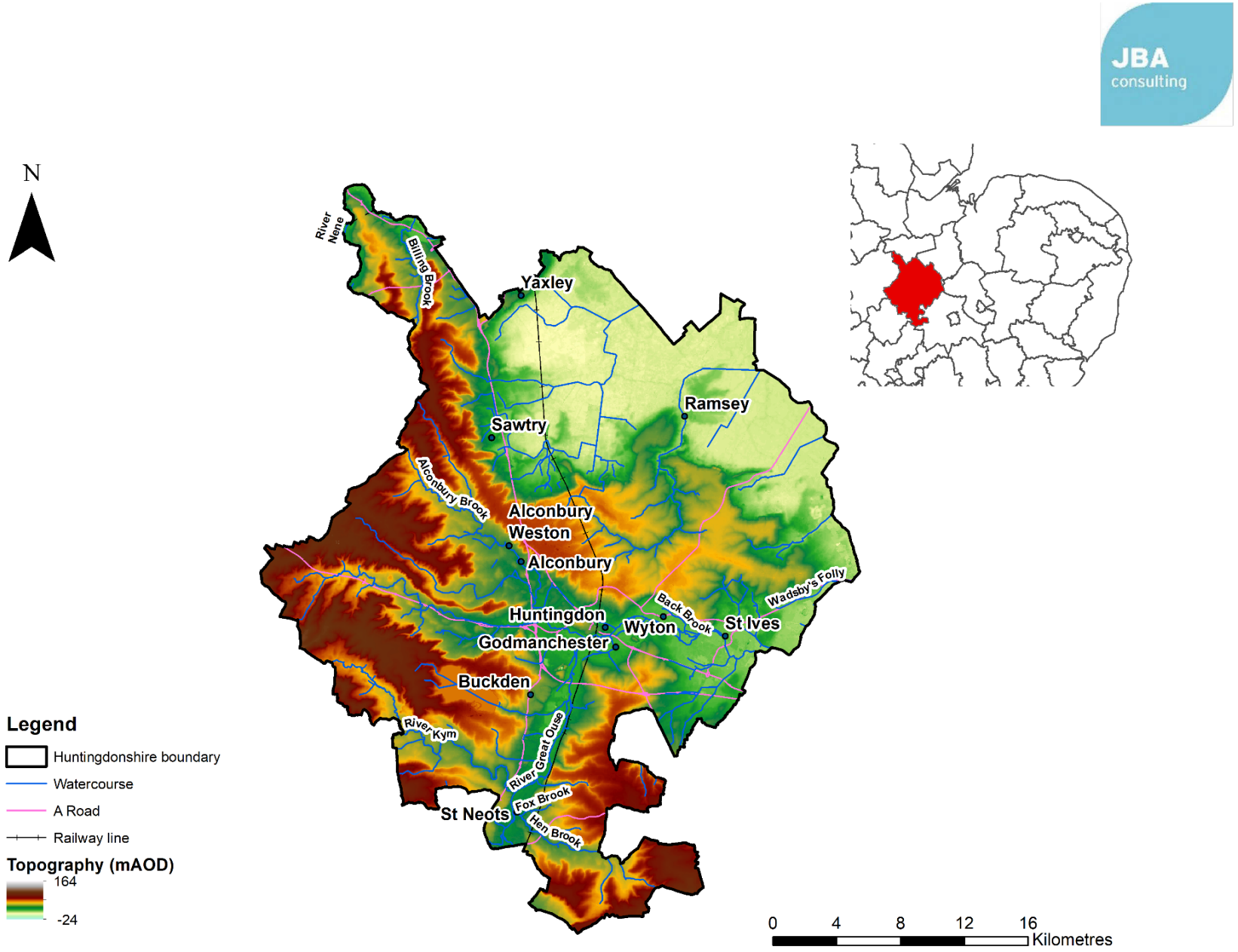


Figure 2-1 Topography and main rivers within Huntingdonshire

2.1 Geology and topography

The underlying geology of Huntingdonshire is largely dominated by mudstones of the Jurassic period. However, to the north of Stilton, in the north west of the district, there is a small area of Oolitic limestone. The mudstones are predominantly overlain by glacial superficial till deposits with fenland peat and gravel deposits dominating the landscape to the north.

Figure 2-1 shows the general topography of Huntingdonshire. The Digital Terrain Model (DTM) shows that there is a general decrease in elevation moving from west to east across the district. In areas to the west and south, elevations reach approximately 75 metres Above Ordnance Datum (mAOD). Lower elevations are observed to the north including some areas of the Fens, which are below sea level.

2.2 Main rivers in Huntingdonshire

The main rivers of note in terms of flood risk and flood risk management activities in Huntingdonshire include:

- Alconbury Brook
- Back Brook
- Billing Brook
- Fox Brook
- Hall Green Brook
- Hen Brook
- River Great Ouse
- River Kym
- River Nene
- Wadsbys Folly

2.3 Ordinary watercourses in Huntingdonshire

The ordinary watercourses of note in terms of flood risk and flood risk management activities in Huntingdonshire include:

- Wintringham Brook
- Duloe Brook
- Colmworth Brook
- Abbotsley Brook
- Barracks Brook
- Conington Brook
- Diddington Brook
- Gallow Brook
- Gransden Brook

- Hen Brook
- Holme Brook
- Holt Brook
- New Dyke
- River Til
- Sawtry Brook
- West Brook

3 Understanding Flood Risk

3.1 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 human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure (including vulnerable services such as hospitals and schools), commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding in Huntingdonshire can occur from many different and combined sources such as fluvial (from main rivers and ordinary watercourses), surface water, direct rainfall, groundwater, sewers or indirectly from infrastructure failure (i.e. defences or reservoir infrastructure), as illustrated in Figure 3-1. An area can be impacted by multiple sources of flooding either sequentially or concurrently, which may lead to greater impacts than when considering each source of flooding independently.

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. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

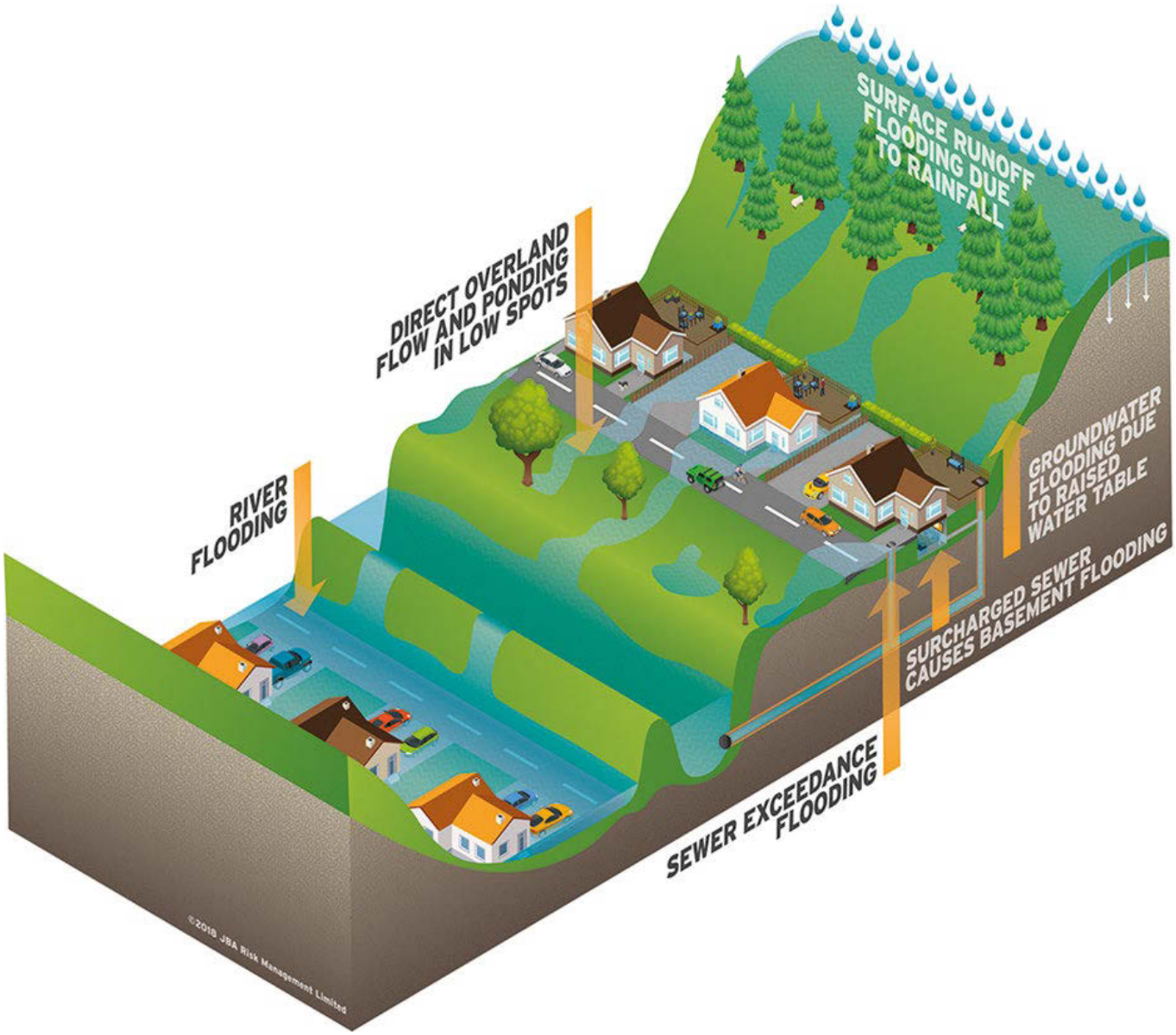


Figure 3-1 Sources of flooding

3.1.1 Rivers

River flooding is the inundation of floodplains from rivers and watercourses; the inundation of areas outside the floodplain due to the influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts or flood channels/corridors.

River flooding is associated with the exceedance of channel capacity during higher flows or as a result of blockage (residual risk). The process of flooding from a watercourse depends on a number of characteristics associated with the catchment including geographical location and variation in rainfall; steepness of the channel and surrounding floodplain; and infiltration and rate of runoff associated with urban and rural catchments.

The EA's Flood Map for Planning (Rivers and Sea) (Section 4.1) is used to assess flood risk from rivers in this Level 1 SFRA. The Flood Map for Planning is presented on the SFRA Maps in Appendix B.

3.1.1.1 Main river

Main rivers are generally major watercourses for which the EA have management responsibility and permissive powers to carry out maintenance, improvement or construction work to manage flood risk, as defined by the Environment Agency. The hydraulic characteristics of the main rivers in Huntingdonshire are generally well understood with computer modelling of flood risk having been carried out over the previous 20 years. The EA also regulates development or works in, on, over, under or within 8 metres of main river watercourses under the Environmental Permitting (England and Wales) Regulation 2016. This also includes within the floodplain if works do not have planning permission and require quarrying or excavation within 16 metres of any main river, flood defence or culvert. The range of activities subject to regulation are listed online via:

Flood risk activities: environmental permits

Whilst the EA has permissive powers to undertake works, the maintenance of main rivers is primarily the responsibility of riparian owners.

3.1.1.2 Ordinary watercourses

Ordinary watercourses are any watercourse that is not designated main river. These watercourses can vary in size considerably and can include rivers, streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows. Ordinary watercourses do not always contain flowing water all year long; there may be times where the watercourses run dry, particularly over prolonged dry spells. Such watercourses can be described as ephemeral watercourses.

Ordinary watercourses generally come under the regulation of the LLFA, which has permissive powers to carry out works, should this be deemed necessary, and has regulatory control over certain development activities within the watercourse channel. However, the responsibility for the maintenance of ordinary watercourses lies with the riparian owner. A riparian owner is anyone who owns a property where there is a watercourse within, under or adjacent to their land boundaries; they are responsible for open or culverted watercourses passing through, under or adjacent to their land[9].

9 Riparian rights and responsibilities, Cambridgeshire County Council

3.1.2 Surface water

Surface water or pluvial flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. In these instances, the volume of water from rural land can exceed infiltration rates in a short amount of time, resulting in the flow of water over land. Within urban areas, this intensity can be too great for the urban drainage network resulting in excess water flowing along roads, through properties and ponding in lower areas or natural depressions. Areas at risk of pluvial flooding can, therefore, lie outside of the fluvial flood zones. An increase in impermeable area as a result of development can make surface water flooding more likely if it is not properly managed. The Stage 2 WCS will contain an assessment of surface water network capacity.

Pluvial flooding within the urban areas of Huntingdonshire will typically be associated with events equal to or greater than the 1 in 30 year (3.3% AEP) design standard of new sewer systems. Some older sewer and highway drainage networks will have a lower capacity than is required to mitigate for the 3.3% AEP event. There is also residual risk associated with these networks due to possible network failures, blockages or collapses.

There are certain locations, generally within the urban areas, where the probability and consequence of pluvial flooding are more prominent due to the complex hydraulic interactions that exist in the urban environment. Urban watercourse connectivity, surface water or combined sewer capacity and the location and condition of highway gullies all have a major role to play in surface water flood risk.

Where combined sewers are present (surface water and foul water conveyed in the same sewer pipe), an increase in surface water can make the operation of combined sewer overflows more likely. This is explained in more detail within Section 4.5 of the WCS. Surface water flooding can be triggered or exacerbated by other forms of flooding i.e. flood locked outfalls. Surface water infrastructure can also be a pathway to flooding where inappropriate/broken infrastructure is present.

Surface water flood risk should be afforded equal standing in importance and consideration as fluvial and groundwater flood risk, given the increase in rainfall intensities due to climate change and the increase in impermeable land use due to development.

SFRAs should address surface water flooding issues by identifying areas of surface water flooding and areas where there may be drainage issues that can cause surface water flooding. The WCS also identifies areas where there may be specific concerns with the surface water sewer network, and where there are poorly performing storm overflows. The EA's Risk of Flooding from Surface Water (RoFSW) map (Section 4.2) along with information within Cambridgeshire's FRM Strategy (see Section A.2.5 of Appendix A) should assist with this and various mitigative measures, i.e., SuDS,

should be identified. Section 5.8 provides guidance on mitigation options and SuDS for developers.

3.1.3 Groundwater

Groundwater water flooding occurs when the water table rises after prolonged rainfall to emerge above ground level remote from a watercourse. It is most likely to occur in low-lying areas underlain by permeable rock (aquifers) and groundwater recovery areas, after pumping for mining or industry has ceased. Warmer, wetter winters due to climate change may have significant impacts on groundwater levels.

Groundwater flooding is caused by the emergence of water from beneath the ground, either at point or diffuse locations. The occurrence of groundwater flooding is usually local and unlike flooding from rivers, does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas and can pose further risks to the environment and ground stability.

There are several mechanisms that increase the risk of groundwater flooding including prolonged rainfall, high in-bank river levels, artificial structures, groundwater rebound and mine water rebound. Properties with basements or cellars or properties that are located within areas deemed to be susceptible to groundwater flooding are at particular risk. Development within areas that are susceptible to groundwater flooding will generally not be suited to infiltration SuDS; however, this is dependent on detailed site investigation and risk assessment at the FRA stage.

JBA's 5m Groundwater Flood Risk Map (Section 4.3) is used to assess potential risk from groundwater in this Level 1 SFRA and is presented on the SFRA Maps in Appendix B.

3.1.4 Sewers

Flooding from the sewer network can occur when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes blocked, or it cannot discharge due to a high water level in the receiving watercourse. Pinch points and failures within the drainage network may also restrict flows causing water to back up through sewers and surcharge through manholes, potentially flooding highways and properties. It must be noted that sewer flooding in 'dry weather' resulting from blockage, collapse or pumping station mechanical failure (for example), is the sole concern of the drainage undertaker.

Combined sewers spread extensively across urban areas serving residential homes, businesses and highways, conveying waste and surface water to treatment works. Combined Sewer Overflows (CSOs) provide an EA consented overflow release from the drainage system into local watercourses or surface water systems during times of high flows. Some areas may also be served by separate waste and surface water

sewers which convey wastewater to treatment works and surface water into local watercourses or combined sewers. CSOs (also referred to as Storm Overflows) are discussed in more detail in Section 4.5.2 of the WCS.

Anglian Water (AW) is the water company responsible for the management of the public sewer drainage network across the district.

SFRAs should consider flood risk from sewers by identifying areas at risk from sewer flooding (see Section 4.4). Areas of surface water flooding and those where drainage issues may lead to surface water flooding should also be identified. The EA's Risk of Flooding from Surface Water (RoFSW) map (Section 4.2) along with information within Cambridgeshire's FRM Strategy (see Section A.2.5 of Appendix A) should assist with this and various mitigative measures, i.e. SuDS, should be identified. Section 5.7 provides guidance on mitigation options and SuDS for developers.

In catchments with a large, planned growth in population and which discharge effluent to a small watercourse, the increase in the discharged effluent might have a negative effect on the risk of flooding. The Stage 2 WCS will assess this risk once potential allocations are available.

3.1.5 Reservoirs

A reservoir can usually be described as an artificial or non-natural lake where water is stored for use. The risk of flooding associated with reservoirs is residual (Section 3.2.3.2) and is associated with failure of reservoir outfalls or dam breaching. This risk is reduced through regular inspection and maintenance by the operating authority. Reservoirs in the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

The EA's Reservoir Flood Map (RFM) shows the locations at risk from reservoir flooding (Section 4.5).

3.2 Likelihood and consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown below. This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. However, it should be remembered that flooding could occur from many different sources and pathways, and can occur concurrently, and not simply those shown in the illustration below.

The principal flood sources in Huntingdonshire include fluvial and surface water; the most common pathways are rivers, drains, sewers, overland flows; and the receptors include people, their property and the environment. All three elements must be present for flood risk to arise. Mitigation, i.e., flood defence, measures have little or no effect on sources of flooding, but they can block or impede pathways or remove receptors.

3.2.1 Likelihood

The 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% AEP (Annual Exceedance Probability) event indicates the flood level that is expected to be reached on average once in a hundred years, i.e., it has a 1% (1 in 100) chance of occurring in any one year, not that it will occur once every one hundred years. Table 3-1 provides an example of the flood probabilities used to describe the flood zones as defined in the FRCC-PPG and as used by the EA in its Flood Map for Planning (Rivers and Sea). Note that the understanding of AEP events change over time as more data is collected.

NOTE: Paragraph 078 of the FRCC-PPG states: - *"flood zones shown on the Flood Map for Planning do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding"*. The Flood Map for Planning is updated quarterly by the Environment Agency, to incorporate any additional flood model outputs.

The Flood Map for Planning can be accessed online via:

Flood map for planning

Table 3-1 NPPF flood zones[10]

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)*
Zone 3a High Probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
Zone 3b Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. LPAs should identify in their SFRAs areas of functional floodplain and its boundaries accordingly. (Not separately distinguished from Zone 3a on the Flood Map for Planning) The function functional floodplain outline used within this Level 1 SFRA has been agreed with the EA.
*Flood Zone 2 will include future areas of Flood Zone 3a risk as a result of climate change	

3.2.2 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 hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, 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

3.2.3 Risk

Flood risk is not static; 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

10 Table 1: Flood Zones, Paragraph 001 of the Flood Risk and Coastal Change Planning Practice Guidance, August 2022

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. It is also clear that risk will increase with climate change.

3.2.3.1 Existing risk

This is the risk 'as is' considering any flood defences that are in place for extreme flood events (typically these provide a minimum Standard of Protection (SoP)). Hence, if a settlement lies behind a fluvial flood defence that provides a 1 in 100-year SoP then the actual risk of flooding from the river in a 1 in 100-year event is generally low. However, the residual risk may be high in that the impact of flood defence failure would likely have a major impact.

Existing risk describes the primary, or prime, risk from a known and understood source managed to a known SoP. However, it is important to recognise that risk comes from many different sources and that the SoP provided will vary within a river catchment. Hence, the existing risk of flooding from the river may be low to a settlement behind the defence but moderate from surface water, which may pond behind the defence in low spots and is unable to discharge into the river during high water levels.

3.2.3.2 Residual risk

Defended areas remain at residual risk as there is a risk of defence failure during significant flood events. Areas behind flood defences are at particular risk from rapid onset of fast-flowing and deep-water flooding, with little or no warning if defences are overtopped or breached.

Whilst the actual risk of flooding to a settlement that lies behind a fluvial flood defence that provides a 1 in 100-year SoP may be low, there will always be a residual risk from flooding if these defences overtopped or failed that must be considered. Because of this, it is never appropriate to use the term "flood free".

Developers must be able to demonstrate that development will be safe for the lifespan of the development. To that end, Paragraph 042 of the FRCC-PPG states:

" *Where residual risk from flood risk management infrastructure affects large areas, the Strategic Flood Risk Assessment will need to indicate the nature, severity and variation in risk within this area, and provide guidance for residual risk issues to be covered in site-specific flood risk assessments. Where necessary, local planning authorities should use information on identified residual risk to state in strategic policies their preferred mitigation strategy for ensuring development will be safe throughout its lifetime in relation to urban form, risk management and where flood mitigation measures are likely to have wider sustainable design implications*".

Residual flood risk from breach or overtopping of defences must be managed for any new development. Residual risk can vary over the lifetime of the development due to climate change or the level of maintenance and repair. It is important to note that for all FRAs that are seeking to develop in areas benefitting from the presence of defences, the protection from defences can only be considered where there is a long term strategy in place. Detailed mitigation must be agreed through site-specific FRAs or through Level 2 SFRAs where it would be necessary to demonstrate site allocations would be safe for their lifetime.

3.3 Climate change

Following on from the UK Climate Projections 2009 (UKCP09), the UK Climate Projections 2018 (UKCP18) delivered a major upgrade to the range of UK climate projection tools designed to help decision-makers assess their risk exposure to our changing climate.

The UKCP18 project used cutting-edge climate science to provide updated observations and climate change projections up to the year 2100 across the UK. The project builds upon UKCP09 to provide the most up-to-date assessment of how the climate of the UK may change over the 21st century.

UKCP18 updates the projections over land and provides a set of detailed future climate projections for the UK at a 12km scale. Models of high impact events such as from localised heavy rainfall in summer the months were created. UKCP18 enables the UK to adapt to the challenges and opportunities presented by climate change.

In relation to flood risk and climate change in the planning system, the NPPF states:

"All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property." (para 167).

Local plans should do this by safeguarding land from development that is required, or likely to be required, for current or future flood management; and to seek opportunities for the relocation of development, including housing, to more sustainable locations from areas where climate change is expected to increase flood risk.

The likely impacts of climate change are well documented and will have a significant impact on flood risk across Huntingdonshire. Increases in duration and intensity of extreme rainfall events as a result of climate change will increase flood risk from multiple sources. The impacts of climate change on each flooding source are outlined throughout Section 4. The impact of climate change on water infrastructure and water quality are discussed in the WCS.

4 Flood risk in Huntingdonshire

4.1 Flood risk from rivers

Figure 4-1 shows the EA's Flood Map for Planning (Rivers and Sea), which identifies a number of areas across Huntingdonshire that are at risk of flooding from rivers. Several of these areas are located within Flood Zone 3 and therefore identified as being at high risk of flooding from rivers.

A significant area of Flood Zone 3 is located along the River Great Ouse as it enters Huntingdonshire from the south and passes through St Neots before flowing in an easterly direction through the towns of Huntingdon, Godmanchester, Wyton and St Ives.

Other key areas identified as being at high risk include an extensive area of fens located to the north-east of the district within the Middle Level catchment. Most of the fens area is at or below sea level, and is dependent on the complex artificial flood defences and water level management system to balance the various water uses and protect it from flooding[11].

Other notable areas within Flood Zone 3 include Alconbury and Alconbury Weston, which are at risk from Alconbury Brook.

Note that the Flood Map for Planning is the best available data however it is not exhaustive, therefore areas may be at risk of flooding but are not within the flood zones.

11 Middle Level Commissioners, 2023

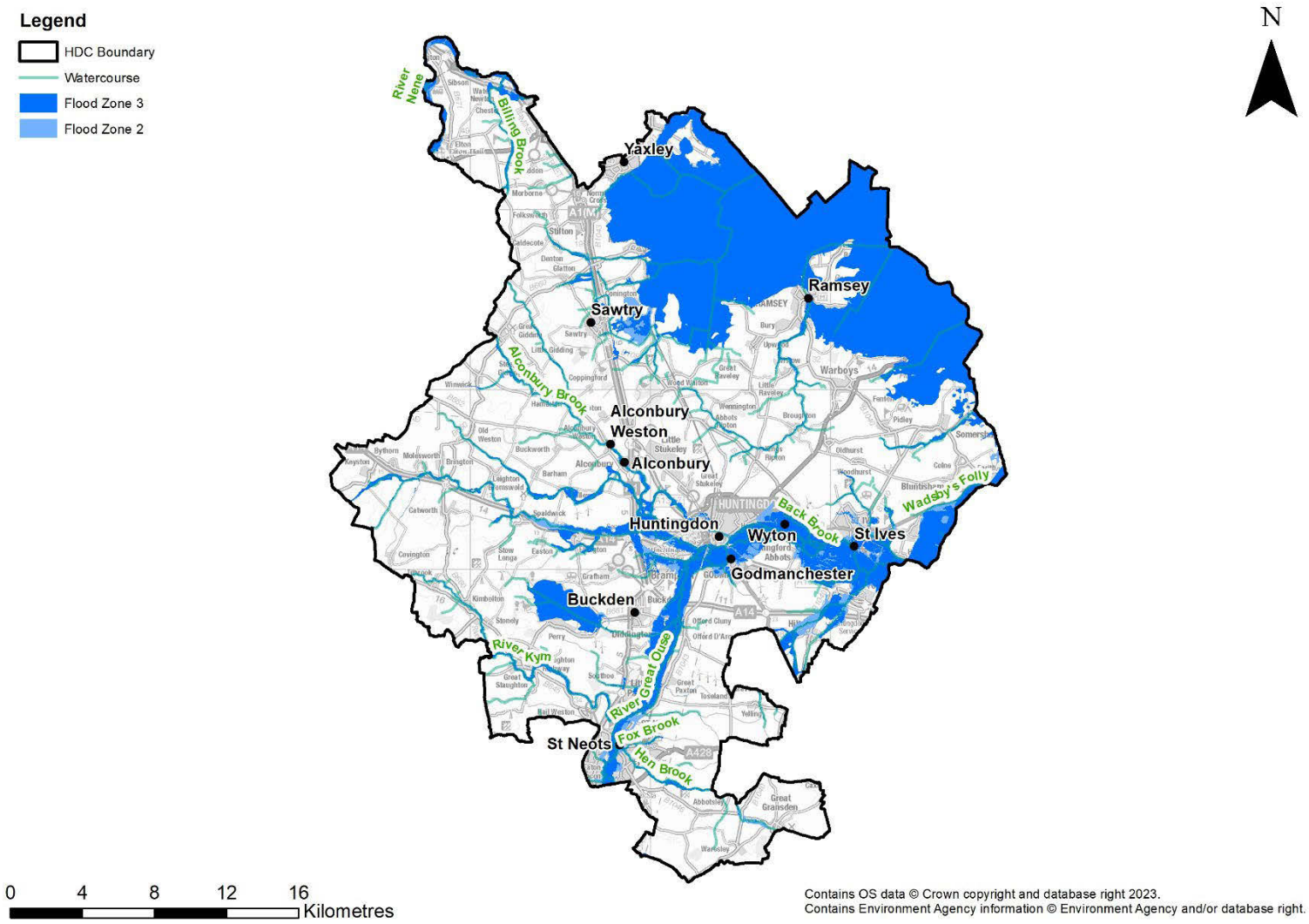


Figure 4-1 Risk of Flooding from Rivers within Huntingdonshire (EA Flood Map for Planning)

4.1.1 EA Flood Map for Planning (Rivers and Sea)

The SFRA Maps in Appendix B present the EA's Flood Map for Planning, which shows the fluvial coverage of flood zones 2 and 3 across the study area at a more detailed scale.

The Flood Map for Planning is the main dataset used by planners for predicting the location and extent of flooding from rivers. This is supported by the CFMPs along with a number of detailed hydraulic river modelling reports which provide further detail on flooding mechanisms.

The Flood Map for Planning provides the flooding from rivers flood extents for the 1 in 100 year (1% AEP) flood event (Flood Zone 3) and the 1 in 1000 year (0.1% AEP) flood event (Flood Zone 2). Flood zones were originally prepared by the EA using a methodology based on the national digital terrain model (NextMap), derived river flows from the Flood Estimation Handbook (FEH) and two-dimensional flood routing. Since their initial release, the EA has regularly updated its flood zones with detailed hydraulic model outputs as part of its national flood risk mapping programme.

The Flood Map for Planning is precautionary in that it does not take account of flood defence infrastructure (which can be breached, overtopped or may not be in existence for the lifetime of the development) and therefore, represents a worst-case scenario of flooding. The flood zones do not consider sources of flooding other than from rivers or the sea and do not take account of climate change. As directed by the FRCC-PPG, this SFRA subdivides Flood Zone 3 into Flood Zone 3a and Flood Zone 3b, also known as the functional floodplain (Section 4.1.2).

This SFRA uses the Flood Map for Planning issued in November 2022 to assess the risk from river flooding within identified priority areas. The Flood Map for Planning is updated by the EA, as and when new modelling data becomes available. The reader should therefore refer to the online version of the Flood Map for Planning to check whether the flood zones may have been updated since February 2023: Flood Map for Planning.

4.1.2 Functional floodplain (Flood Zone 3b)

The functional floodplain forms a very important planning tool in making space for flood waters when flooding occurs. Development should be directed away from these areas.

Table 1, Paragraph 078 of the FRCC-PPG defines Flood Zone 3b as:

"…*land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. 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)".*

Paragraph 078 also explains that:

"*Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency*."

The extent of the functional floodplain is assessed and agreed upon by the LPA and the EA, based on their local knowledge. A technical note is provided in Appendix C which explains the methodology and datasets used in creating the functional floodplain outline.

4.1.3 EA Risk of Flooding from Rivers and Sea map

The Risk of Flooding from Rivers and Sea map (RoFRS) shows the likelihood of flooding from rivers and the sea based on the presence and effect of all flood defences, predicted flood levels and ground levels and is shown on the Appendix B maps. The RoFRS map splits the likelihood of flooding into four risk categories:

- High – greater than or equal to 1 in 30 (3.3% AEP) chance in any given year;
- Medium – less than 1 in 30 (3.3% AEP) but greater than or equal to 1 in 100 (1% AEP) chance in any given year;
- Low – less than 1 in 100 (1% AEP) but greater than or equal to 1 in 1000 flood event (0.1% AEP) chance in any given year; and
- Very Low – less than 1 in 1000 (0.1% AEP) chance in any given year.

The RoFRS map is included on the SFRA maps to act as a supplementary piece of information. This dataset is not suitable for use with any planning application, nor should it be used for the sequential testing of site allocations. The EA's Flood Map for Planning should be used for all planning purposes, as per the FRCC-PPG. At the time of writing, the RoFRS is being updated by the EA and is due for publication late-2024.

4.2 Surface water flood risk

The Risk of Flooding from Surface Water is shown in Figure 4-2 and illustrates several areas of surface water flood risk scattered across Huntingdonshire. Surface water flood risk largely follows the topography similar to that of fluvial water courses. Several areas are identified as being at high risk including Sawtry to the north-west of the district. Other key high-risk areas include Alconbury, Alconbury Weston and Huntingdon towards the centre of the district and St Neots to the south-west.

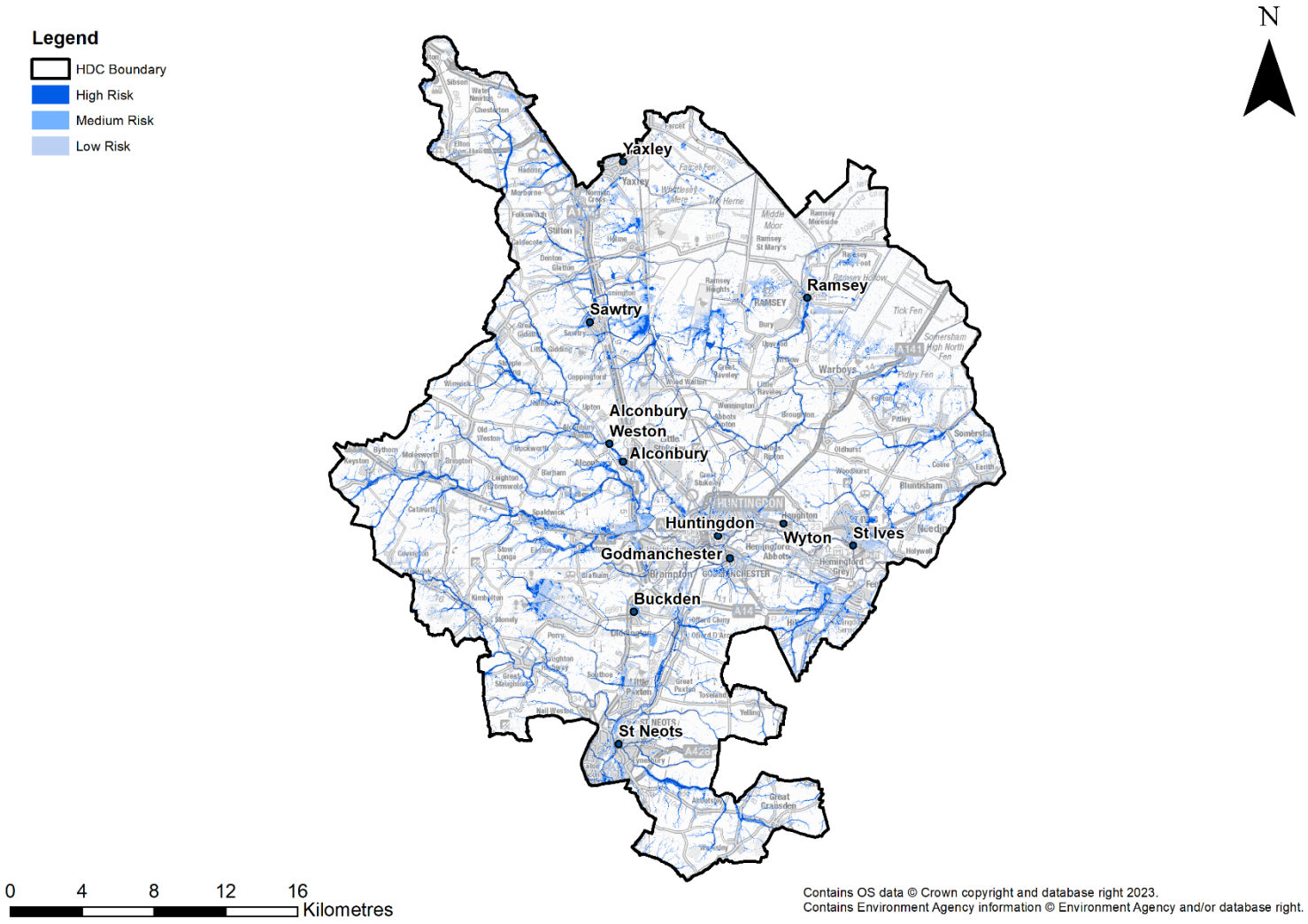


Figure 4-2 Risk of Flooding from Surface Water within Huntingdonshire (EA Risk of Flooding from Surface Water Map)

4.2.1 Risk of Flooding from Surface Water dataset

The Risk of Flooding from Surface Water (RoFSW) is the third-generation national surface water flood map, produced by the EA, aimed at helping to identify areas where localised flooding can cause problems even if the Main Rivers are not overflowing. The RoFSW, used in this SFRA to assess risk from surface water, has proved extremely useful in supplementing the EA Flood Map for Planning by identifying areas in Flood Zone 1, which may have critical drainage problems. The RoFSW can also be used as a proxy for flood risk from ordinary watercourses.

NOTE: EA guidance on the use of the RoFSW states: *"This dataset is not suitable for identifying whether an individual property will flood. It should not be used with basemapping more detailed than 1:10,000 as the data is open to misinterpretation if used as a more detailed scale. Because of the way the map has been produced and the fact that it is indicative, the map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence."*

The RoFSW includes surface water flood outlines, depths, velocities and hazards for the following events:

- 1 in 30 year event (3.3% AEP) – high risk;
- 1 in 100 year event (1% AEP) – medium risk; and
- 1 in 1000 year event (0.1% AEP) – low risk.
- The outlines of the RoFSW are presented on the SFRA maps in Appendix B.

The EA produced a guidance document, updated in April 2019[12], explaining the methodology applied in producing the map. This contains information on the key limitations of the RoFSW.

Note: The national map of surface water flood risk is, at the time of writing, undergoing a significant update. However, the updated map is unlikely to made available until late-2024.

4.2.1.1 Locally agreed surface water information

EA guidance, from within the FWMA[13], on using surface water flood risk information recommends that CCC, as LLFA, should:

"…review, discuss, agree and record, with the Environment Agency, Water Companies, Internal Drainage Boards and other interested parties, what surface water flood data best represents their local conditions. This will then be known as locally agreed surface water information".

12 What is the Risk of Flooding from Surface Water map? Environment Agency, 2019
13 Flood and Water Management Act, 2010

At the time of writing, locally agreed surface water information consists of the national RoFSW map. The RoFSW mapping is not 100% accurate however in recent flood events the flowpaths within the national mapping have typically been found to be relatively accurate. Any undeveloped location that is indicated as having a surface water flow path running through the site should consider the extent of the flow path and the impact that development would have on altering those flows.

4.3 Groundwater flood risk

This SFRA assesses groundwater flood risk through JBA's 5m Groundwater Flood Risk Map, which provides a general broadscale assessment of the groundwater flood hazard. The good practice guide to producing SFRAs[14], developed by the EA and published December 2021, recommends the use of this dataset in SFRAs. The map is categorised by grid code where each code is explained in Table 4-1.

Table 4-1 Groundwater flood hazard classification of JBA groundwater map

Groundwater head difference (m)*	Grid Code	Class label
0 to 0.025	4	Groundwater levels are either at very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	3	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	2	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event.

14 Strategic flood risk assessments A GOOD PRACTICE GUIDE, Report produced using Environment Agency research on 'using flood risk information in spatial planning' (2019-2020), 2021

Groundwater head difference (m)*	Grid Code	Class label
		There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.
>5	1	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	0	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
*Difference is defined as ground surface in mAOD minus modelled groundwater table in mAOD.		

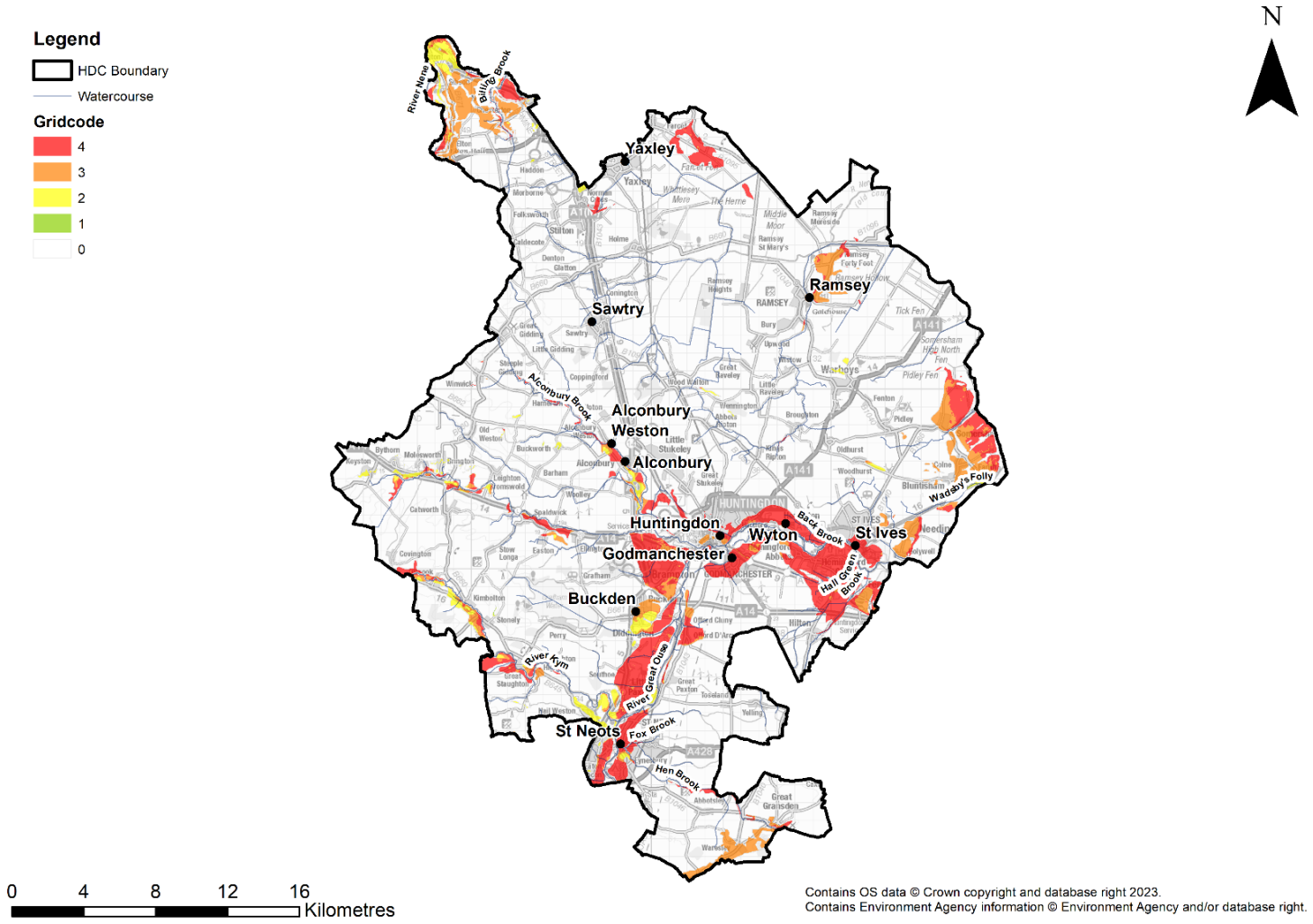


Figure 4-3 Risk of Flooding from Groundwater within HDC

Figure 4-3 shows the groundwater flood risk across HDC. Please refer to Table 4-1 for grid code definitions. The main areas within grid code 4 include Huntingdon, Godmanchester, Wyton and St Ives towards the centre and east of the district and St Neots to the south-west. There are some additional areas of grid code 4 in the north of the district including those to the north-east of Yaxley and adjacent to the district boundary to the east. There are some smaller areas categorised as grid code 3, which are located mainly towards the north and east of the district boundary.

It is important to ensure that future development is not placed at unnecessary risk therefore groundwater flood risk should be considered on a site-by-site basis in development planning.

Groundwater flood risk should be considered particularly when determining the acceptability of SuDS schemes as a way of managing surface water drainage. Developers should consult with the LPA, the LLFA and the EA at an early stage of any site-specific groundwater assessment.

The JBA's 5m groundwater map is shown on the SFRA Maps in Appendix B.

4.4 Flood risk from sewers

As discussed in Section 3.1.4, Anglian Water (AW) is the water company responsible for the management of the public sewer drainage network across Huntingdonshire. AW holds a historic sewer flood event database which is updated as and when a sewer flood event occurs. As this is a historic event dataset, please refer to Section 4.8.

4.5 Flood risk from reservoirs

The EA is the enforcement authority for the Reservoirs Act 1975 in England and Wales, with the FWMA amending this Act. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers. Local authorities are responsible for coordinating emergency plans for reservoir flooding and ensuring communities are well prepared. The LPA should work with other members of the Cambridgeshire and Peterborough Resilience Forum to develop these plans. See Section 5.9.1.1 for more information on the Cambridgeshire and Peterborough Resilience Forum.

Paragraph 046 of the FRCC-PPG states that, in relation to development planning and reservoir dam failure:

" the local planning authority will need to evaluate the potential damage to buildings or loss of life in the event of dam failure, compared to other risks, when considering development downstream of a reservoir. Local planning authorities are also advised to consult with the owners/operators of raised reservoirs, to establish constraints upon safe development."

4.5.1 Reservoir Flood Map (RFM)

The EA has produced Reservoir Flood Maps (RFM) for all large reservoirs that they regulated under the Reservoirs Act 1975 (reservoirs that hold over 25,000 cubic metres of water). The FWMA updated the Reservoirs Act and targeted a reduction in the capacity at which reservoirs should be regulated from 25,000m^3 to 10,000m^3. This reduction is, at the time of writing, yet to be confirmed meaning the requirements of the Reservoirs Act 1975 should still be adhered to.

In November 2021, the EA published the RFM guidance 'Reservoir flood maps: when and how to use them[15]', which provides information on how the maps were produced and what they contain.

To view the RFM, the Defra Data Services Platform can be used to search for specific reservoirs at:

Reservoir Flood Maps

The RFM shows that there are 13 large-raised reservoirs which have the potential to impact Huntingdonshire in the event of a breach. Figure 4-4 highlights the Risk of Flooding from Reservoirs extents across HDC. Seven of these large raised reservoirs are located within the HDC boundary:

- Fen Drayton Lakes
- Grafham Stage 2 Filtered Water Tank
- Grafham Water
- Foxenfield
- Holland Wood
- Ladyseat Reservoir
- Ouse Washes FSA

The following six reservoirs are located outside of the HDC boundary but have the potential to impact Huntingdonshire:

- Blatherwycke Lake - Northamptonshire
- Lower East End Farm - Bedford
- Tythe Farm Reservoir - Bedford
- Sacrewell - Peterborough
- White Water (Stamford) - Peterborough
- Whittlesey (Nene) Washes Flood Storage Area Reservoir - Cambridgeshire

A dry-day, as opposed to a wet-day scenario, assumes the water level in a reservoir is lower than the spillway level and the upstream and downstream watercourses are at normal levels.

15 Reservoir flood maps: when and how to use them – Environment Agency, 2021.

The RFM extent shows the worst credible area that is susceptible to dam breach flooding. The map should be used to prioritise areas for evacuation/early warning. It is worth considering that reservoirs within the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

If development is proposed downstream of a reservoir, there will need to be an assessment of whether work is needed to improve the design or maintenance of the reservoir. Together with the reservoir undertakers, the LPA should look to avoid an intensification of development within the risk areas and/or ensure that reservoir undertakers can assess the cost implications of any reservoir safety improvements required due to changes in land use downstream of these assets.

The LPA will need to evaluate:

- The potential damage to buildings or loss of life in the event of dam failure compared to other risks;
- How an impounding reservoir will modify existing flood risk in the event of a flood in the catchment is location within and/or whether emergency draw-down of the reservoir will add to the extent of flooding; and
- Emergency planning requirements with appropriate officers to ensure safe sustainable development.

Para 046 of the FRCC-PPG provides further information.

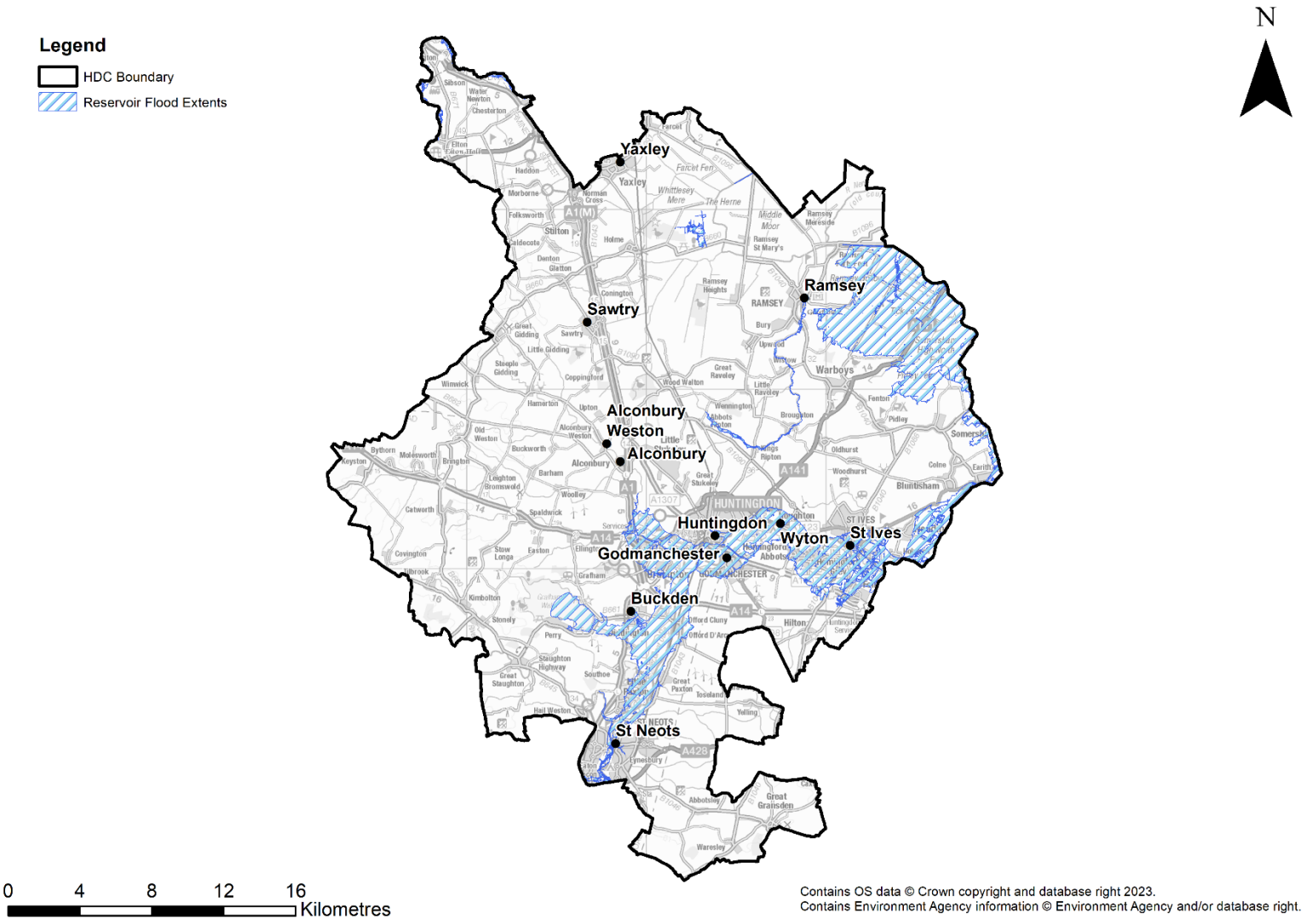


Figure 4-4 Risk of Flooding from Reservoirs within HDC during a dry-day scenario

4.6 Cumulative impacts assessment

The NPPF states that strategic policies…

"…*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*" (para 166).

Previous policies have relied on the assumption that if each individual development does not increase the risk of flooding, the cumulative impact will also be minimal. However, if there is a lot of development occurring within one catchment, particularly where there is flood risk to existing properties or where there are few opportunities for mitigation, or proposed developments of less than 10 dwellings that are not referred to the LLFA for consultation under the Town and Country Planning (Development Management Procedure) Order (DMPO) 2015, the cumulative impact may be to change the flood response of the catchment.

Consideration should be given to the following:

- The importance of phasing development,
- Cross boundary impacts i.e. there should be dialogue between HDC and neighbouring authorities (City of Peterborough, north Northamptonshire, Bedford, Central Bedfordshire, Fenland, East Cambridgeshire and South Cambridgeshire) upstream and downstream of the borough on flood risk management practices and development;
- Leaving space for floodwater by safeguarding land through the Local Plan and utilising greenspace for flood storage and slowing the flow (see Sections 4.6.3 and 4.9.5);
- Ensuring floodplain connectivity; and
- SuDS and containment of surface water onsite as opposed to directing elsewhere (see Section 5.7).

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.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing all new development complies with the latest guidance and legislation relating to flood risk and sustainable drainage, in theory there should not be any increase in flood risk downstream. However, this would assume that all flood mitigation measures are fully maintained to the required condition and standard. In reality this may not be the case. It is therefore good practice to over-mitigate to help provide the net benefit requirement of the NPPF.

Strategic solutions may include upstream flood storage, integrated major infrastructure/Flood Risk Management schemes, new defences and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for Working with Natural Processes and retrofitting of SuDS to existing development. However, such flood alleviation schemes will not be undertaken to facilitate new development through Grant in Aid. Any prospective schemes for new development must be developer-led and funded by the developer, assuming the sequential test has been passed and the exception test where applicable.

Through the Local Plan, HDC should consider the following strategic solutions:

- Use of sustainable flood storage and mitigation schemes to store water and manage surface water runoff in locations that provide overall flood risk reduction as well as environmental benefits;
- In areas where flood risk is being managed effectively, there will be a need in the future to consider increasing flood risk as a result of climate change, for example, changing the standard of protection for defences may be required;
- Assessment of long-term opportunities to move development away from the floodplain and to create blue/green river corridors throughout the HDC area;
- Identification of opportunities to use areas of floodplain to store water during high flows, to reduce long-term dependence on engineered flood defences located both within and outside the HDC area;
- Safeguarding the natural floodplain from development;
- Where possible, changes in land management should look to reduce runoff rates from development whilst maintaining or enhancing the capacity of the natural floodplain to retain water. Land management and uses that reduce runoff rates in upland areas should be supported;
- Development should maintain conveyance of watercourses through hamlets and villages to help reduce the impact of more frequent flood events and to improve the natural environment and WFD targets;
- Use of this SFRA to inform future development and minimise flood risk from all sources;
- Implementation of upstream catchment management i.e. slow the flow and flood storage schemes could be implemented in upper catchments to reduce risk downstream and across neighbouring authority boundaries; and
- Promotion and consideration of SuDS at the earliest stage of development planning through Schedule 3 of the FWMA, when implemented. This should include for designated ownership of assets with clear maintenance regimes in place, including for upgrading assets when required.

According to the NPPF, the LPA should work with neighbouring authorities to consider strategic cross-boundary issues and infrastructure requirements. Local authorities also have a duty to cooperate whereby councils work together on strategic matters and produce effective and deliverable policies on strategic cross boundary matters.

The FWMA requires all RMAs to cooperate with relevant authorities regarding exercising flood and coastal risk management. Huntingdonshire is represented by the Anglian (Great Ouse) Regional Flood and Coastal Committee (RFCC) and Water Resources East (WRE) where cross-boundary resources, projects and data are shared between neighbouring authorities.

The cumulative impact of development on water infrastructure is considered in the WCS.

4.6.1 Hydrological linkages and cross boundary issues

The Main Rivers within the Huntingdonshire boundary originate from outside of HDC. Therefore, major land use changes within neighbouring catchments could have significant impacts on flow regimes and flood risk within Huntingdonshire. Several watercourses that flow through Huntingdonshire enter into neighbouring catchments and local authorities located downstream including the River Great Ouse, which flows into East Cambridgeshire and the River Nene, which flows along the council boundary with the City of Peterborough. Development and responsible land management across Huntingdonshire is crucial to ensuring sustainable development within the downstream authorities.

Figure 4-5 illustrates fluvial hydraulic linkages for the catchments in and around the authority area of HDC. The River Great Ouse enters Huntingdonshire from Bedford to the south, the River Nene from north Northamptonshire to the west and the River Kym from north Northamptonshire and Bedford to the west. Upstream land use changes within these areas could influence flood risk along these watercourses. Close partnerships between HDC and the neighbouring authorities i.e. City of Peterborough, north Northamptonshire, Bedford, Central Bedfordshire, Fenland, East Cambridgeshire and South Cambridgeshire will need to be maintained.

Were the above strategic solutions not considered in upstream development planning, the following issues may occur:

- Reduction in upstream floodplain storage capacity; and
- Increase in impermeable areas leading to a reduction in rainfall infiltration and subsequent increased runoff to the detriment of downstream communities.

The need for consistent regional development policies controlling runoff or development in floodplains within contributing districts is therefore crucial as this would have wider benefits for neighbouring local authorities as well as Huntingdonshire. This should be carried out by the successful implementation of the sequential test.

The authorities of influence upstream and downstream of HDC are:

Upstream

- North Northamptonshire

- Bedford
- Central Bedfordshire

Downstream

- City of Peterborough
- Fenland
- East Cambridgeshire
- South Cambridgeshire

4.6.2 Safeguarding land for flood storage

Where possible, the LPA may look to allocate land designed for flood storage functions through the local plan. Such land can be explored by using this SFRA to assess the flood risk within potential development areas and to ascertain what benefit could be gained by leaving at risk areas undeveloped.

Paragraph 167 of the NPPF states:

'*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 locations may include any current greenfield sites:

- That are considered to be large enough to store floodwater to achieve effective mitigation (modelling would be required);
- With large areas of their footprint at high or medium surface water flood risk (based on the RoFSW);
- 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, contaminated land assessments and the managed adaptation of existing defences.

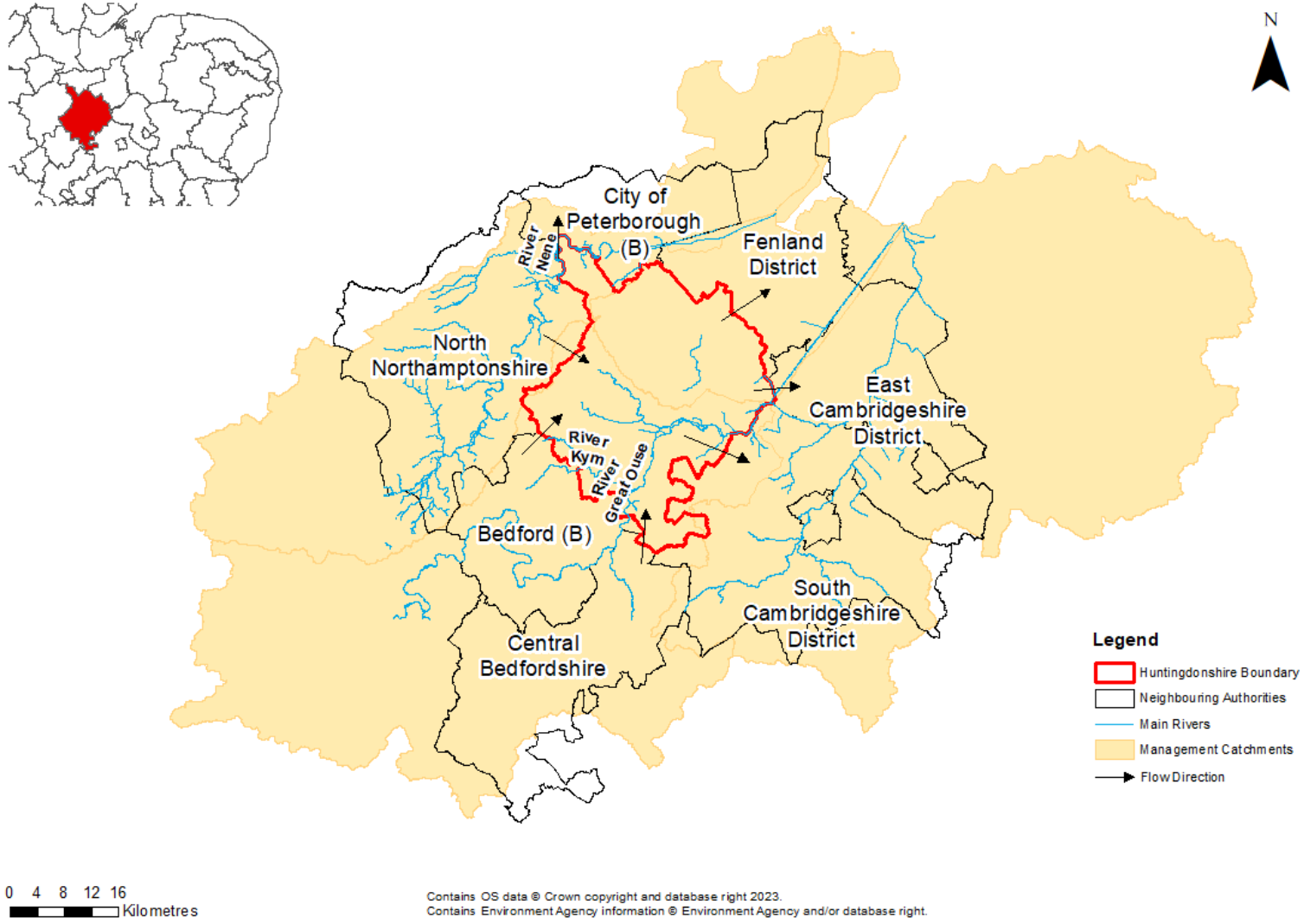


Figure 4-5 Hydrological linkages for catchments in and around Huntingdonshire

4.6.3 Catchment-level assessment of Cumulative Impacts of Development on Flood Risk

Cumulative impacts are defined as the effects of past, current and future activities on the environment. These cumulative impacts may be negative, i.e. development leading to an increase in the existing level of flood risk within the catchment, or positive i.e. surface water management within a development helping to alleviate existing flooding issues within a catchment. A catchment-level assessment has been completed as part of this SFRA to understand the impact of future development on flood risk in Huntingdonshire. Refer to Appendix G which details the method and results of the assessment.

4.7 Climate change

NPPF para 8 states that mitigating and adapting to climate change is an important objective that is key to delivering sustainable development that should be delivered through local plans.

In relation to flood risk and climate change in the planning system, the NPPF states:

"*New development should be planned for in ways that:*

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure". (Para 159).

The Level 1 SFRA should be the starting point for any LPA to assess the effects of climate change on flood risk across the local plan area. At this stage, this Level 1 SFRA has not modelled the impacts of fluvial climate change due to lack of available data from the EA. However, it is recommended that the effects of fluvial climate change on flood risk are modelled for those locations in the district where new development is planned. This should be carried out through the Level 2 SFRA or at the FRA stage of a planning application.

This Level 1 SFRA has assessed the impact of climate change on surface water flooding across Huntingdonshire, outlined in Section 4.7.1.2.

Along with the NPPF, FRCC-PPG and EA guidance, the LPA should refer to the Royal Town Planning Institute and Town & Country Planning Association's new edition of their joint guidance: 'The Climate Crisis – a guide for local authorities on planning for climate change[16] when preparing the local plan.

16 The Climate Crisis – a guide for local authorities on planning for climate change | The Royal Town Planning Institute and Town & Country Planning Association | January 2023

4.7.1 EA climate change allowances

The EA previously revised the climate change allowances for peak river flow allowances in July 2021 and for peak rainfall allowances in May 2022, for use in FRAs and SFRAs and will, at the time of writing, use these revised allowances when providing advice. These updates are based on the release of UKCP18.

4.7.1.1 Peak river flow allowances

Developers should refer to the online peak river flow map[17] for the latest climate change allowances to ensure those outlined in Table 4-2 below are the most up-to-date available.

Peak river flow allowances show the anticipated changes to peak flow by management catchment (see Table 4-2) which are sub-catchments of river basin districts. The Cam and Ely Ouse, Nene, Old Bedford and Middle Level and Upper and Bedford Ouse management catchments are present in Huntingdonshire as shown on Figure 4-6. Both the central and higher central allowances for the 2080s epoch are required to be assessed for SFRAs, as advised by the EA. See Section 4.7.2 for the assessment of climate change for this Level 1 SFRA.

17 Peak river flow map | Environment Agency

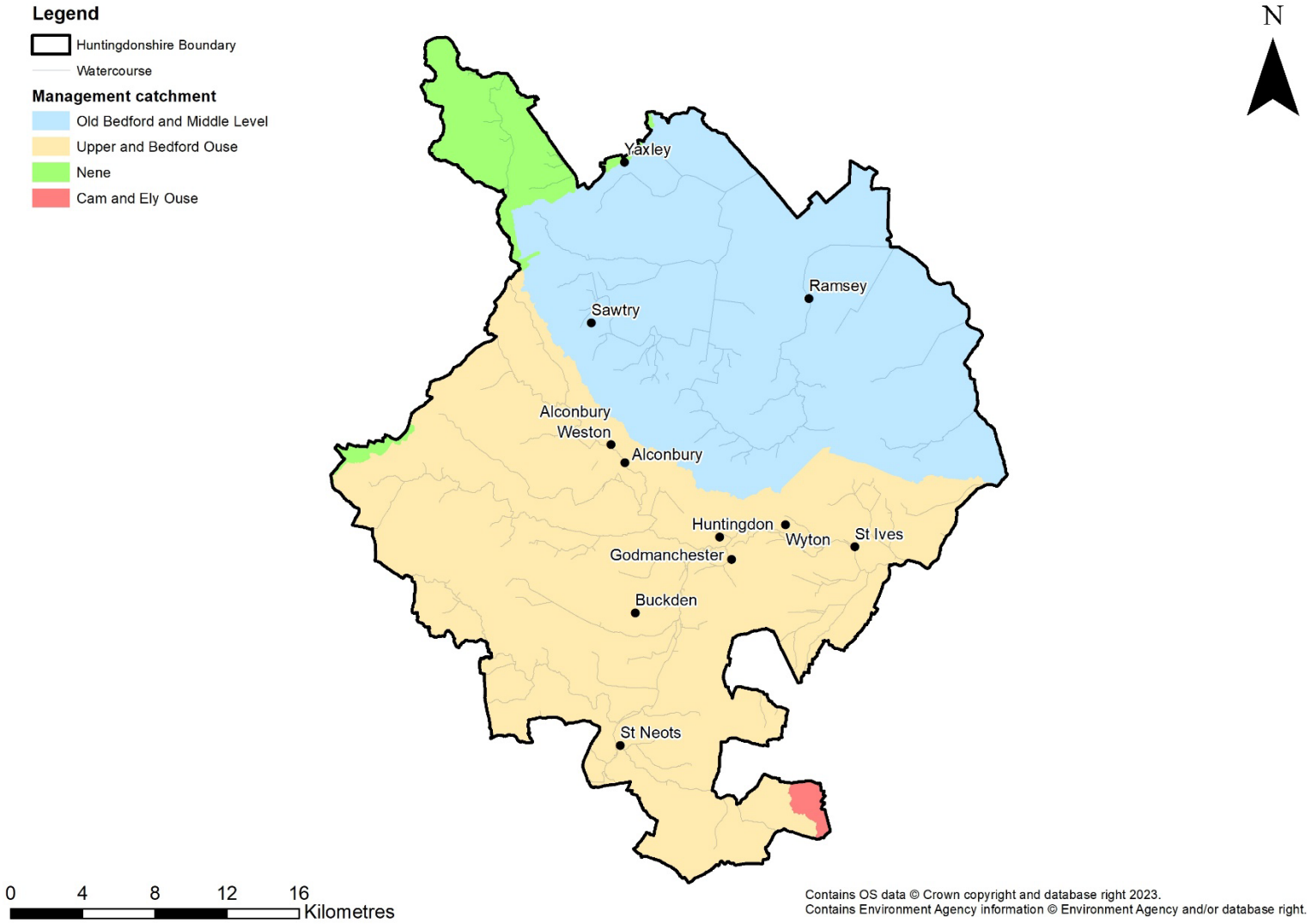


Figure 4-6 Management Catchments within the HDC boundary

Table 4-2 Recommended peak river flow allowances for the Cam and Ely Ouse, Nene, Old Bedford and Middle Level and Upper and Bedford Ouse management catchments

Management catchment	Allowance Category	Total potential change anticipated for peak river flows (based on a 1981 to 2000 baseline)		
		2020s (2015-2039)	2050s (2040-2069)	2080s (2070-2125)
Cam and Ely Ouse	Upper end	21%	22%	45%
	Higher	7%	5%	19%
	Central	2%	-2%	9%
Nene	Upper end	18%	17%	36%
	Higher	4%	0%	13%
	Central	-2%	-7%	4%
Old Bedford and Middle Level	Upper end	23%	22%	39%
	Higher	9%	4%	15%
	Central	3%	-3%	6%
Upper and Bedford Ouse	Upper end	24%	30%	58%
	Higher	10%	11%	30%
	Central	5%	4%	19%

4.7.1.2 Peak rainfall intensity allowances

Increases in rainfall intensities lead to increases in surface water flood risk and the risk of sewer and drainage systems becoming overwhelmed. Developers should refer to the online peak rainfall allowances map[18] which shows anticipated changes in peak rainfall intensity per management catchment (see Table 4-3).

The EA guidance states, for FRAs and SFRAs, the upper end allowances should be used for both the 1% and 3.3% AEP events for the 2070s epoch.

18 Peak rainfall allowances map | Environment Agency

Table 4-3 Peak rainfall intensity allowances for small and urban catchments by Management Catchment in Huntingdonshire

Management Catchment	Allowance Category	Total potential change anticipated for the '2050s' (2022 to 2060)		Total potential change anticipated for the '2070s' (2061 to 2125)	
		30-year return period	100-year return period	30-year return period	100-year return period
Cam and Ely Ouse	Upper end	35%	40%	35%	40%
	Central	20%	20%	20%	25%
Nene	Upper end	35%	40%	35%	40%
	Central	20%	20%	25%	25%
Old Bedford and Middle Level	Upper end	35%	40%	35%	40%
	Central	20%	20%	25%	25%
Upper and Bedford Ouse	Upper end	35%	40%	35%	40%
	Central	20%	20%	25%	25%

4.7.2 Climate change data in Huntingdonshire

Modelled climate change data for peak river flows was not available from the EA for this Level 1 SFRA. Future flood risk as a result of climate change has therefore been assessed using a precautionary and pragmatic approach, whereby Flood Zone 2 has been used as a proxy for Flood Zone 3 in the long term. This approach uses the EA's Flood Zone 2 dataset (0.1% AEP event) to represent the modelled Flood Zone 3 + climate change scenario (1% AEP event + climate change). This approach has been agreed and approved by the Environment Agency.

The effects of climate change on surface water risk i.e. peak rainfall intensities has not been modelled nationally by the EA. This Level 1 SFRA has modelled the impact of climate change on the high and medium risk surface water flood events.

4.8 Historic risk

Records of past flood events can help to build a picture of areas and locations that may be prone to flooding and to help back up or confirm flood modelling outputs. Historic flood events can also help Risk Management Authorities to target where flood risk management or resilience works may be required based on tangible evidence.

The main source of flood risk in Huntingdonshire is from main rivers and ordinary watercourses. According to the HDC SFRA (2017)[19], the main source of flood risk is associated with the River Great Ouse and its tributaries. However, Huntingdonshire has also experienced a number of historic surface water / drainage related flood events caused by a number of mechanisms from insufficient storm and combined drainage capacity to poor surface water management.

4.8.1 Historic fluvial flooding

CCC as LLFA, is required, under the FWMA, to maintain and update its historic flood incidents database as and when any locally significant flood incidents occur. The LLFA has a statutory responsibility to investigate and report upon any 'locally significant' flood events. Details of these events are recorded as Section 19 reports[20] and have been provided by CCC for the purposes of this SFRA. These include:

- Kimbolton, August 2014
- Stibbington, August 2014
- St Ives, August 2020
- St Neots August 2020
- Alconbury and Alconbury Weston, December 2020
- Broughton, December 2020
- Brampton, December 2020
- The Offords, December 2020
- Old Hurst, December 2020
- St Ives, December 2020
- St Neots, December 2020
- Woodwalton, December 2020
- Ramsey, December 2020
- Buckden, December 2020
- Godmanchester, December 2020
- Sawtry, December 2020

The LLFA note that a Section 19 report is currently being undertaken for Earith.

4.8.2 Historic surface water flooding

Surface water has been recorded to have previously contributed to flood events across the district. The Section 19 reports produced by CCC note surface water being a major contributing factor in the following events:

19 Huntingdonshire District Council Level 1 and 2 Strategic Flood Risk Assessment, June 2017

20 Flooding and flood investigations - Cambridgeshire County Council

- 23rd to 24th December 2020 - impacting Alconbury, Broughton, Brampton, Buckden, Godmanchester, Old Hurst, Ramsey, St Ives, St Neots and Woodwalton
- 16th August 2020 - extreme rainfall event impacting St Ives, St Neots
- August 2014 - impacting Kimbolton

It should be noted that although the Section 19 reports highlight key significant events, surface water flooding has also occurred more regularly in the above locations and elsewhere within HDC. It should also be acknowledged that once an area is flooded during a large rainfall event, it is often difficult to identify the route, cause and ultimately the source of flooding without undertaking further site-specific and detailed investigations. No two flood events are the same due to the varying contributing factors.

4.8.3 Historic groundwater flooding

It is difficult to attribute a groundwater flooding event as occurring solely due to groundwater as its source. It may be the case that groundwater flood events have occurred but have not been recorded. The known areas susceptible to groundwater flooding are noted in Section 4.3.

4.8.4 Historic sewer flooding

Anglian Water (AW) keeps a record of flood incidents from its drainage and sewer networks. Many historic flooding incidents from sewers are at the individual property level and therefore considered sensitive information. As such the data has been aggregated and is shown on the interactive GeoPDF mapping in Appendix B. The largest number of recorded sewer flooding incidents have occurred in St Neots, Huntingdon and St Ives.

4.8.5 EA Historic Flood Map and Recorded Flood Outlines

The Historic Flood Map (HFM) is a spatial dataset showing the maximum extent of all recorded historic flood outlines from river, sea and groundwater and shows areas of land that have previously been flooded across England. Records began in 1946 when predecessor bodies to the EA started collecting information about flooding incidents. The HFM accounts for the presence of defences, structures, and other infrastructure where such existed at the time of flooding. It includes flood extents that may have been affected by overtopping, breaches or blockages. It is also possible that historic flood extents may have changed and that some areas would not flood at present i.e., if a flood defence has been built.

The HFM does not contain any information regarding the specific flood source, return period or date of flooding, nor does the absence of the HFM in an area mean that the area has never flooded, only that records of historic flooding do not exist. The Recorded Flood Outlines (RFO) dataset however does include details of flood events.

The difference between the two datasets is that the HFM only contains flood outlines that are 'considered and accepted' by the EA following adequate verification using certain criteria.

In relation to the Huntingdonshire, the HFM and RFO show areas of historic flooding along the River Great Ouse and its tributaries.

The HFM and RFO datasets are shown on the SFRA Maps in Appendix B.

4.9 Flood risk management

The aim of this section of the SFRA is to identify existing flood risk management (FRM) assets and proposed FRM schemes. The location, condition and design standard of existing assets will have a significant impact on actual flood risk mechanisms. Whilst future schemes in high flood risk areas carry the possibility of reducing the probability of flood events and reducing the overall level of risk. Both existing assets and future schemes will have a further impact on the type, form and location of new development or regeneration.

4.9.1 EA inspected assets (Spatial Flood Defences)

The EA maintains a spatial dataset called the Spatial Flood Defences dataset. This national dataset contains such information as:

- Asset type (flood wall, embankment, high ground, demountable defence, bridge abutment);
- Flood source;
- Design standard of protection (SoP);
- Asset length;
- Asset age;
- Asset location; and
- Asset condition.

This dataset does not include flood defence assets on non-main rivers. See Figure 4-7 for condition assessment grades using the EA's Condition Assessment Manual[21] (CAM).

The design standard of protection (SoP) for a flood defence is a measure of how much protection a flood defence gives. If the SoP is 100, the defence is designed to protect against a flood with the probability of occurring once in 100 years (1% AEP event). Note that SoP can very over time as the length of the hydrological record increases.

21 Environment Agency. (2012). Visual Inspection Condition Grades. In: EA Condition Assessment Manual. Bristol: Environment Agency. P9.

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no impact 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 needed.
5	Very Poor	Severe defects resulting in complete performance failure.

Figure 4-7 EA flood defence condition assessment grades

Table 4-4 Major flood defences within Huntingdonshire

Defence Location	Asset Type	Flood Source	Watercourse	Design Standard	Condition Grade
St Neots	2 embankments	Fluvial	River Great Ouse	100 (2)	2 (1) 3 (1)
Godmanchester	3 embankments 30 walls	Fluvial Tidal	River Great Ouse	100 (33)	2 (19) 3 (14)
Houghton and Wyton	1 embankment 2 walls	Fluvial	River Great Ouse	100 (3)	2 (2) 3 (1)
Hemingford Abbots	1 embankment	Fluvial	River Great Ouse	100 (1)	3 (1)
Fenstanton	1 embankment	Fluvial	River Great Ouse	100 (1)	3 (1)
Earith	4 embankments 1 wall	Fluvial Tidal	River Great Ouse	100 (5)	3 (1) N/A (4)
Colne	3 embankments	Fluvial	River Great Ouse	25 (3)	2 (1) 3 (2)
*Number in brackets denotes number of defences					

Table 4-4 lists the major flood defence types and the locations where they are located, namely St Neots, Godmanchester, Houghton and Wyton, Hemingford Abbots, Fenstanton, Earith and Colne.

Along the majority of the main rivers within Huntingdonshire, areas of high ground offer levels of protection from fluvial flooding, rather than robustly engineered defences. The condition grade of the majority of these defences is stated as 2/3, which means 'Good/Fair', as per the EA's Condition Assessment Manual, meaning there are minor defects that will not reduce the overall performance of the assets or defects that could reduce the performance of the asset.

The full Spatial Flood Defences dataset, which displays the defences by condition rating is shown on the interactive GeoPDF mapping in Appendix B.

As well as the ownership and maintenance of a network of formal defence structures, the EA carries out a number of other flood risk management activities that help to reduce the probability of flooding, whilst also addressing the consequences of flooding. These include:

- Maintaining and improving the existing flood defences, structures and watercourses;
- Enforcement and maintenance where riparian owners unknowingly carry out work that may be detrimental to flood risk;
- Identifying and promoting new flood alleviation schemes (FAS), where appropriate;
- Working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is permitted relative to the scale of flood risk;
- Operation of Floodline Warnings Direct and flood warning services for areas within designated Flood Warning Areas (FWA) or Flood Alert Areas (FAA). EA FWAs and FAAs are shown on the SFRA Maps in Appendix B;
- Promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and therefore sufficiently prepared in the event of flooding; and
- Promoting resilience measures for existing properties that are currently at flood risk, or may be in the future as a result of climate change (Property Flood Resilience - see Section 5.8.5).

4.9.2 CCC assets and future flood risk management schemes

CCC (as the LLFA), under the provisions of the FWMA, has a duty to maintain a register of structures or features that have a significant effect on flood risk, including details of ownership and condition as a minimum. The asset register should include those features relevant to flood risk management function including feature type, description of principal materials, location, measurements (height, length, width, diameter) and condition grade. The FWMA places no duty on the LLFA to maintain any third-party features, only those for which the authority has responsibility as land/asset owner. The LLFA should carry out a strategic assessment of structures and features

within the asset register to inform partners capital programmes and prioritise maintenance programmes.

4.9.3 Middle Level Flood Defence Improvement Scheme

The objective of the Middle Level Flood Defence Improvement Scheme is to build up the flood defence banks to a height which delivers a consistent level of flood protection across the Middle Level district. The scheme will span across four Local Authority areas; Huntingdonshire, Fenland, Kings Lynn & West Norfolk, and Peterborough, funded by Flood Defence Grant-in-Aid (FDGiA). The scheme will focus on the main Middle Level drainage channels and their banks and will mainly consist of building up earth banks to increase their height, by up to a metre in some places. Hard engineering is likely to be required in areas where there are no existing earth banks or where they are not suitable for improvement.

4.9.4 Water company assets

The sewerage infrastructure within HDC's administrative area may have a risk of localised flooding associated with the existing drainage capacity and sewer system, as well as an increase in the discharge of treated effluent from new development. Anglian Water is responsible for the management of the adopted sewerage system. This includes surface water and foul sewerage. There may however be some private surface water sewers in the area as only those connected to the public sewer network that were transferred to the water companies under the Private Sewer Transfer in 2011 are likely to have been constructed since this transfer date. Surface water sewers discharging to watercourses were not part of this transfer and would therefore not be under the ownership of AW, unless adopted under a Section 104 adoption agreement.

Water company assets include Water Recycling Centres (WRCs), Combined Sewer Overflows (CSOs), pumping stations, detention tanks, sewer networks and manholes. The location of WRCs, and CSOs is shown within Section 4.6 of the WCS.

4.9.5 Natural Flood Management/Working with Natural Processes

Natural flood management (NFM) or Working with Natural Processes (WwNP) is a type of nature-based flood risk management used to protect, restore and re-naturalise the function of catchments and rivers to reduce flood and coastal erosion risk. WwNP has the potential to provide environmentally sensitive approaches to minimising flood risk, to reduce flood risk in areas where hard flood defences are not feasible and to increase the lifespan of existing flood defences.

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 floodwaters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). WwNP involves taking action to manage flood and coastal erosion risk by protecting, restoring

and emulating the natural regulating functions of catchments, rivers, floodplains and coasts.

The EA is actively encouraging the implementation of WwNP measures within catchments and coastal areas in order to assist in the delivery of environmental protection and national policies. The implementation of WwNP will continue to become a fundamental component of the flood risk management tool kit due to climate change.

WwNP measures can also offer multiple benefits such as an improvement in water quality and reduced sediment. This is explored in more detail in Section 2.4.3 of the WCS.

4.9.5.1 Evidence base for WwNP to reduce flood risk

The EA has produced a WwNP evidence base which includes three interlinked projects:

- Evidence directory;
- Mapping the potential for WwNP; and
- Research gaps.

The evidence base can be accessed online via:

Working with natural processes to reduce flood risk

The evidence base can be used by those planning projects which include WwNP measures to help understand:

- Their potential FCERM benefits and multiple benefits;
- Any gaps in knowledge;
- Where it has been done before and any lessons learnt; and
- Where in a catchment they might be most effective.

A guidance document sits alongside the evidence directory and the WwNP maps which explains how to use them to help make the case for implementing WwNP when developing business cases.

4.9.5.2 Mapping the potential for WwNP

National maps for England make use of different mapping datasets and highlight the potential areas for tree-planting (for three different types of planting), runoff attenuation storage, gully blocking and floodplain reconnection. The maps can be used to signpost potential areas for WwNP and do not take into account issues such as landownership and drainage infrastructure, but they may well help start the conversation and give indicative estimates of, for example, additional distributed storage in upstream catchments.

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 limitations with the maps, however it is a useful tool to help start dialogue with key partners. The maps are provided as spatial data for use in GIS and also interactive GeoPDF mapping format, supported by a user guide and a detailed technical guide.

The WwNP types are listed in Figure 4-8.

WWNP Type	Open data licence details
Floodplain reconnection	• Risk of Flooding from Rivers and Seas (April 2017) • Data derived from the Detailed River Network, which is not displayed, rescinding the licence requirements for displaying the dataset (to be superseded by OS Water Network but not available for project in time). • Constraints data
Run-off attenuation features	• Data derived from Risk of Flooding from Surface Water (Depth 1 percent annual chance and Depth 3.3 percent annual chance) (October 2013). The original data is not displayed, due to licensing restrictions.[2] • Constraints data • Gully blocking potential (a subset of run-off attenuation features on steeper ground) • Data derived from OS Terrain 50 (2016) to classify each run-off attenuation feature based on median slope.
Tree planting (3 categories)	• Floodplain: Flood Zone 2 from Flood Map for Planning (April 2016) and new constraints layer • Riparian: 50m buffer OS water features from Section 2.2.3 with constraints layer • Wider catchment woodland: - Based on slowly permeable soils. - BGS Geology 50,000 Superficial and Bedrock layers (both V8, 2017). Used with new science to derive new 100m gridded open data. This new layer can be used to signpost areas of SLOWLY PERMEABLE SOILS and can be checked in more detail on the BGS portal. - To the north of the line of Anglian glaciation, the presence of till-diamicton has been shown to be a strong predictor of slowly permeable soils. - To the south of this line, particular bedrock geologies have shown a similarly strong spatial relationship to the presence of slowly permeable soils.

Figure 4-8 WwNP measures and data

The WwNP datasets are included on the SFRA Maps in Appendix B and should be used to highlight any sites or areas where the potential for WwNP should be investigated further as a means of flood mitigation:

- Floodplain Reconnection:
  - Floodplain Reconnection Potential – areas of low or very low probability based on the Risk of Flooding from Rivers and Sea dataset (see Section 4.1.3) which are in close proximity to a watercourse and that do not contain properties, are possible locations for floodplain reconnection. It may be that higher risk areas can be merged, depending on the local circumstances.
- Runoff Attenuation Features (Run-off attenuation features are based on the premise that areas of high flow accumulation in the RoFSW) maps are areas where the runoff hydrograph may be influenced by temporary storage if designed correctly):
  - Runoff Attenuation Features 1% AEP
  - Runoff Attenuation Features 3.3% AEP
- Tree Planting
  - Floodplain Woodland Potential and Riparian Woodland Potential – woodland provides enhanced floodplain roughness that can dissipate the energy and momentum of a flood wave if planted to obstruct significant flow pathways. Riparian and floodplain tree planting are likely to be most effective if close to the watercourse in the floodplain, which is taken to be the 0.1% AEP flood extent (Flood Zone 2) and within a buffer of 50 metres of smaller watercourses where there is no flood mapping available. There is a constraints dataset that includes existing woodland; and
  - Wider Catchment Woodland Potential – slowly permeable soils have a higher probability of generating 'infiltration-excess overland flow' and 'saturation overland flow'. These are best characterised by gleyed soils, so tree planting can open up the soil and lead to higher infiltration and reduction of overland flow production.

Limitations

The effectiveness of WwNP measures is site-specific and depends on many factors, including the location and scale at which they are used. It may not always be possible to guarantee that these measures alone will deliver a specified standard of defence. Consequently, flood risk management measures should be chosen from a number of options ranging from traditional forms of engineering through to more natural systems. The research gaps that need to be addressed to move WwNP into the mainstream are identified in the evidence directory.

An interactive map of nature-based flood risk management projects and potential projects can be found at: JBA Trust Mapping

4.9.6 EA flood risk management activities and Flood and Coastal Erosion Risk Management (FCERM) Research and Development

The FCERM Research and Development Programme is run by the EA and Defra and aims to serve the needs of all flood and coastal operating authorities in England. The strategic objectives for research include:

- better understand future flood and coastal erosion risk
- prepare for the scale and frequency of future incidents
- optimise the management of FCERM infrastructure
- improve responsibility and funding for flood and coastal risk
- understand the potential of new technology and innovation
- increase resilience to flood and coastal erosion risk

Completed and ongoing research can be researched online via: FCERM research and development projects

5 Development and flood risk

5.1 Introduction

The information and guidance provided in this chapter summarises the online guidance provided in the NPPF and FRCC-PPG and other government guidance on development and flood risk. Specifically, the basis from which to apply the sequential approach in the development allocation and development management process.

5.2 Sequential approach

The FRCC-PPG provides the basis for the sequential approach. It is this approach, integrated into all stages of the development planning process, which provides the opportunities to reduce flood risk to people, property, infrastructure, and the environment to acceptable levels. Land at the lowest risk of flooding from all sources should be considered for development, following the requirements of the sequential test.

The approach is based around the FRM hierarchy, in which actions to avoid, substitute, control and mitigate flood risk is central. For example, it is important to assess the level of risk to an appropriate scale during the decision-making process, (starting with this Level 1 SFRA). Once this evidence has been provided, positive planning decisions can be made and effective FRM opportunities identified.

Figure 5-1 illustrates the FRM hierarchy with an example of how this may translate into the LPA's development management decisions and actions.

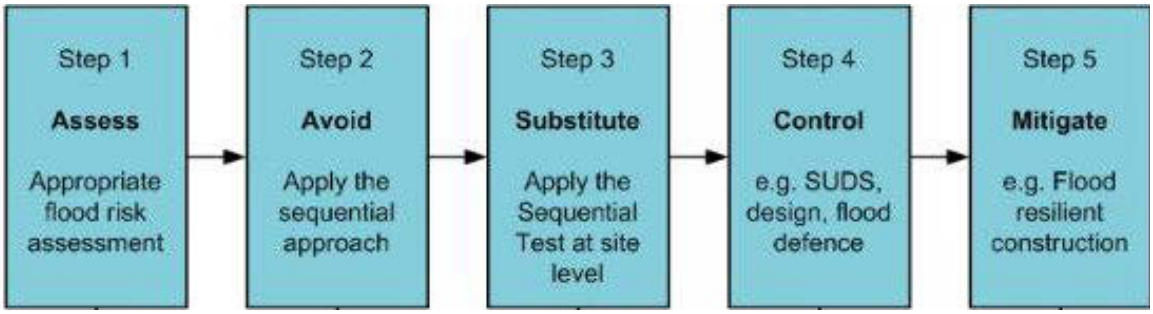


Figure 5-1 Flood risk management hierarchy

There are two different aims in carrying out the sequential test depending on what stage of the planning system is being carried out, i.e., LPAs allocating land in local plans or determining planning applications for development. The LPA will apply the sequential test to strategic allocations for inclusion in the local plan using the whole local planning authority area to increase the possibilities of accommodating development that is not exposed to flood risk, both now and in the future. For other

developments, such as windfall developments, developers must supply evidence to the LPA, with a suitable planning application, that the development has passed the test.

This Level 1 SFRA provides the basis for applying the sequential test. However, the LPA may decide to perform the test as part of the process by which the suitability of sites is tested for plan-making purposes e.g. site assessment reports. Alternatively, it can be demonstrated through a free-standing document, or as part of a Strategic Housing and Economic Land Availability Assessment.

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. Table 2 of the FRCC-PPG[22] defines the flood risk vulnerability and flood zone 'incompatibility' of different development types to flooding, as shown in Figure 5-2.

Flood Zones	**Flood Risk Vulnerability Classification**				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✔	✔	✔	✔	✔
Zone 2	✔	Exception Test required	✔	✔	✔
Zone 3a †	Exception Test required †	X	Exception Test required	✔	✔
Zone 3b *	Exception Test required *	X	X	X	✔ *

Key:

✔ Exception test is not required

X Development should not be permitted

Figure 5-2 FRCC-PPG flood risk vulnerability and flood zone 'incompatibility'

22 Flood risk and coastal change - UK Government, 2022

Notes to Table 2 of the FRCC-PPG

- This table does not show the application of the Sequential Test which should be applied first to guide development to the lowest flood risk areas; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to those developments set out in National Planning Policy Framework footnote 56. The Sequential and Exception Tests should be applied to 'major' and 'non major' development;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.
- "†" In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.
- "*" In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to remain operational and safe for users in times of flood, result in no net loss of floodplain storage, and not impede water flows and not increase flood risk elsewhere.

5.3 The sequential test for local plan preparation

The FRCC-PPG, para 024, states the aim of the sequential test is:

"…*to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account."*

The LPA should seek to avoid inappropriate development in areas at risk from any source of flooding by directing development away from areas at highest risk and ensuring that all development does not increase risk and where possible can help reduce risk from flooding to existing communities and development.

Paragraph 027 of the FRCC-PPG states that allocated sites do not need to apply the sequential test *"provided the proposed development is consistent with the use for which the site was allocated and provided there have been no significant changes to the known level of flood risk to the site, now or in the future which would have affected the outcome of the test".*

At a strategic level, this should be carried out through the Local Plan using this Level 1 SFRA by:

1. Applying the sequential test and if the sequential test is passed, applying and passing the exception test, if required;
2. Safeguarding land from development that is required for current and future flood management (i.e. using potential for WwNP data as a starting point);
3. Using opportunities offered by new development to reduce the causes and impacts of flooding through effective mitigation i.e., SuDS;
4. Identifying where flood risk is expected to increase with climate change so that existing development may be made sustainable in the long term through Property Flood Resilience measures; and
5. Seeking opportunities to facilitate the relocation of development including housing to more sustainable locations, where feasible.

Figure 5-3 presents Diagram 2 of the FRCC-PPG (para 026), which illustrates the sequential test process for plan preparation. The Test can be applied using the information provided in this Level 1 SFRA, particularly the sites assessment in Appendices C and E and the SFRA maps in Appendix B.

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 Appendix C.

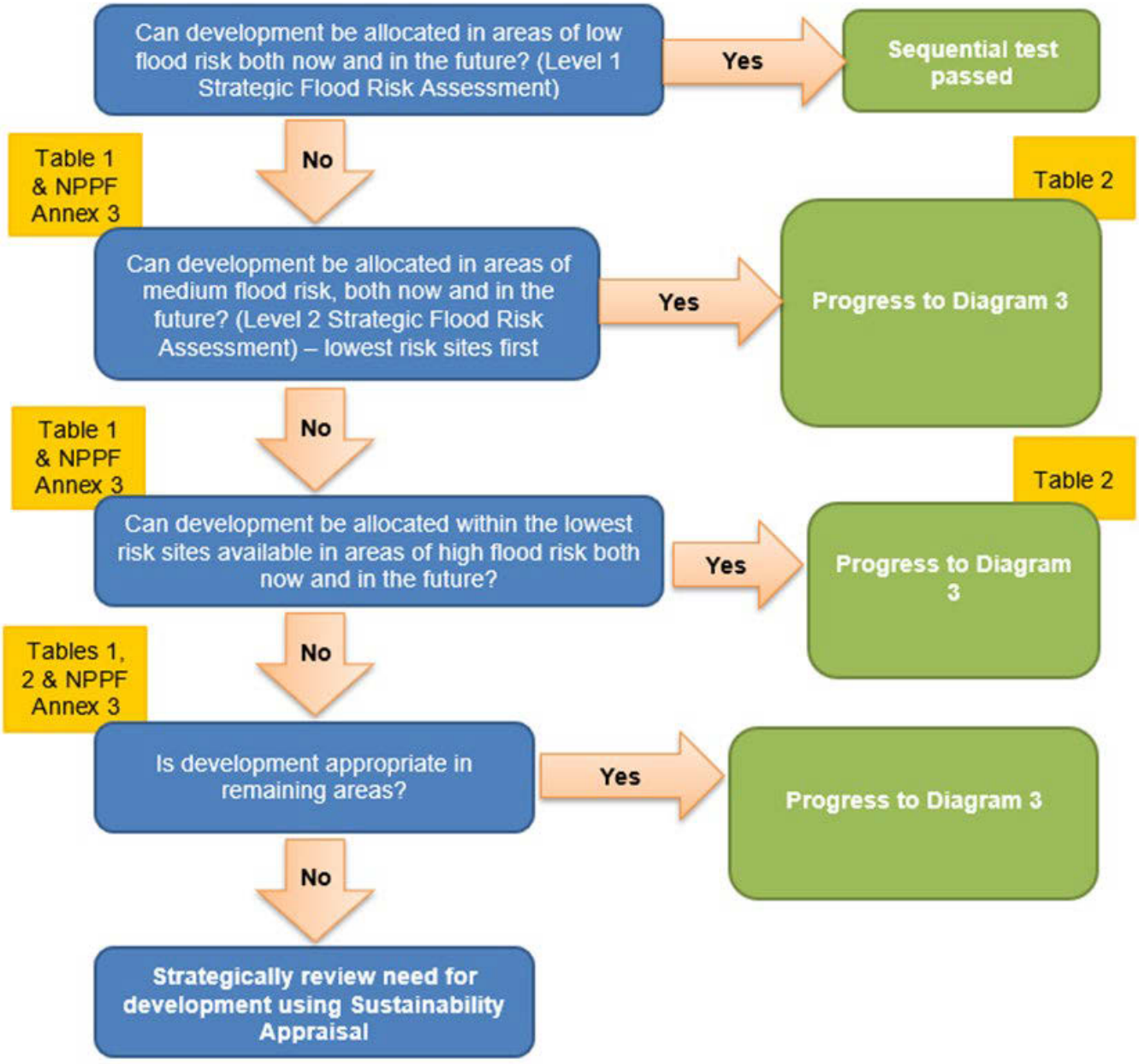


Figure 5-3 Application of the sequential test for plan preparation (Diagram 2)[23]

Notes on Diagram 2:

- 'Tables 1 and 2' refer to the flood zone and flood risk tables of the FRCC-PPG Paragraphs 078-079
- 'Areas of low flood risk' include:
  - Areas within Flood Zone 1 (rivers),
  - Areas within the low risk surface water flood event extent of the Risk of Flooding from Surface Water map,

23 Flood risk and coastal change: paragraph 25, UK Government, 2022

- Areas not at additional risk from climate change.

- ‘Areas of medium flood risk’ include:
  - Areas within Flood Zone 2 (rivers),
  - Areas within the medium risk surface water flood event extent of the Risk of Flooding from Surface Water map,
  - Areas at risk from Flood Zone 2 plus climate change,
- ‘Areas of high flood risk’ include:
  - Areas within Flood Zone 3 (rivers),
  - Areas within the high risk surface water flood event extent of the Risk of Flooding from Surface Water map
  - Areas at risk from Flood Zone 3 plus climate change.

Sources of flooding other than fluvial and surface water also need to be considered. However, the available datasets for other sources of flooding in this Level 1 SFRA, namely groundwater (Section 4.3), sewers (Section 4.4), and reservoirs (Section 4.5.1), are not considered to be of the required robustness to base the sequential test on. Any site shown to be at risk from one or more of these flood sources, as show on the SFRA maps in Appendix B, should be investigated further by the developer at the planning application stage through an appropriate FRA.

The approach shown in Figure 5-3 provides an open demonstration of the sequential test being applied in line with the NPPF and the FRCC-PPG. The LPA should agree a locally specific approach to application of the sequential test, based on the available evidence and circumstances. The EA would not be required to approve the locally specific approach taken by the LPA. However, the LPA can consult the EA regarding proposed sites and any local information or consultations with the LLFA should also be taken into account.

This Level 1 SFRA provides the main evidence required to carry out this process. The process also enables those sites that have passed the sequential test and may require the exception test, to be identified. *The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3 of the NPPF* (para 163). For sites that do not require the exception test, it will still need to be demonstrated that it can be safe without increasing the risk to others (NPPF para 159).

5.4 The exception test for local plan preparation

The NPPF, para 164, states:

“*To pass the exception test it should be demonstrated that:*

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) 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."

Both elements of the test must be passed to enable allocation in the local plan. A Level 2 SFRA would normally inform on whether the second part of the exception test can be passed, notwithstanding the requirement for a site-specific FRA at the planning application stage. However, as stated in para 166 of the NPPF, the test may need to be reapplied if relevant aspects of the planning proposal had not been considered when the test was first applied to allocate the site in the local plan, or if more recent information about existing or potential flood risk is available and should be accounted for.

Figure 5-4 presents Diagram 2 of the FRCC-PPG (para 033), which illustrates the application of the exception test for allocating sites in the local plan. This process should be informed by a Level 2 SFRA.

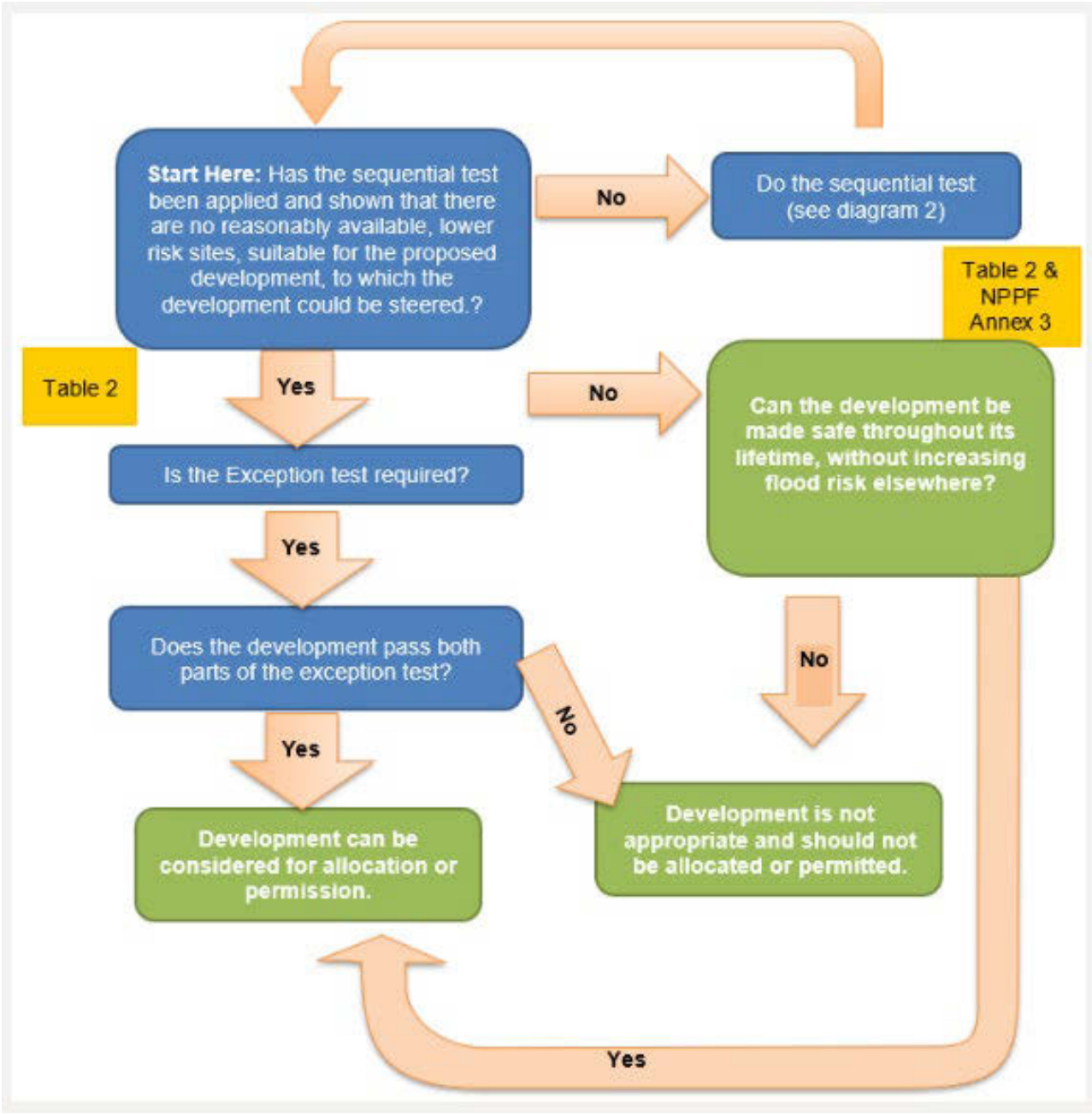


Figure 5-4 Application of the exception test to plan preparation (Diagram 3)

Where it is found to be unlikely that the exception test can be passed due to few wider sustainability benefits (part a), the risk of flooding being too great (part b), or the viability of the site being compromised by the level of flood risk management work required, then the LPA should consider avoiding the site altogether.

Once this process has been completed, the LPA should then be able to allocate appropriate development sites through the local plan as well as prepare flood risk policy, including the requirement to prepare site-specific FRAs for all allocated sites that remain at risk of flooding or that are greater than one hectare in area.

5.5 Development management sequential and exception testing

5.5.1 Sequential testing for developers

HDC, with advice from the EA, is responsible for considering the extent to which sequential testing considerations have been satisfied.

Developers are required to apply the sequential test to all available potential development sites, unless a site is:

- A strategic allocation and the test has already been carried out by the LPA through the SFRA and local plan process, or
- A change of use (except to a higher vulnerability classification)24, or
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m^2), or
- A development in Flood Zone 1 unless there are other flooding issues in the area of the development (i.e., surface water, groundwater, sewer flooding, residual risk).

This Level 1 SFRA contains information on all sources of flooding, to the extent that information was made available. This should be considered when a developer undertakes the sequential test, including the consideration of reasonably available sites at lower flood risk. The impacts of climate change on all sources of flood risk, where feasible, should be robustly accounted for, i.e., through appropriate modelling, in the next update of this Level 1 SFRA.

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 LPA should be consulted before deciding on the appropriate search area.

The sources of information on reasonably available sites may include:

- Site allocations in the local plan
- Sites with planning permission but not yet built
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/ five-year land supply/ authority monitoring reports
- Locally listed sites for sale

24 *"This includes… 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.",* NPPF footnote 60

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

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

5.5.2 Exception testing for developers

If, following application of the sequential test it has been agreed with the LPA that it is not possible for the development to be in areas with a lower probability of flooding, the exception test must then be applied if required (as set out in Table 3 of the FRCC-PPG). 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 by:

- Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk (part a).
- 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 (part b).
- Referring to wider sustainability objectives in the Sustainability Appraisal. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.
- Demonstrating 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, including operation and maintenance
  - Availability of dry access and escape routes during a flood
  - Design of the development to manage and reduce flood risk wherever possible i.e., through SuDS, including for designated ownership and maintenance procedures
  - Resident awareness through appropriate emergency plans and signposting / signage
  - Emergency planning and flood warning and evacuation procedures, including whether the development would increase the pressure on emergency services to rescue people during a flood event; and
  - Any funding arrangements required for implementing mitigation measures, maintenance procedures.

Detailing 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, contributing to the local economy, providing community facilities, infrastructure that benefits the wider area, etc.

5.6 Site-specific Flood Risk Assessment

The principal aims of an FRA are to determine the level of flood risk to a site and to confirm that suitable flood management measures can be developed to control flooding, and safeguard life and property, without increasing risk to the surrounding area.

Once the site has been sequentially tested and has been identified as being likely to pass the exception test through a Level 2 SFRA, a site-specific FRA should be undertaken. The LPA, LLFA and EA should be consulted to determine the content and scope of the FRA.

The production of a site-specific FRA can be seen as an iterative process by subdividing the FRA into three stages:

- Stage 1 is a screening study used to identify whether there are any flood risk issues that need to be considered further i.e., reviewing the SFRA outcomes. This should include a review of the evidence base and whether it is fit for purpose. The applicant should obtain the relevant model and model report for review. Note that no EA is model is deemed fit for purpose for a site specific FRA;
- Stage 2 is a scoping study that should be undertaken if the Stage 1 FRA indicates that there are flood risk issues that need further consideration; and
- Stage 3 is a detailed study where further quantitative analysis is required to fully assess flood issues and confirm that effective mitigation measures can be implemented to control flood risk and that the second part of the exception test can be passed.

It is appropriate to review the level of risk present and assess whether development is appropriate and achievable at each stage of the assessment.

The SFRA is an assessment of flood risk at a strategic level. This information can be used to provide evidence for Stages 1 and 2 of the FRA. Where a more detailed FRA is required (Stage 3), then a developer should undertake a detailed assessment of the flood risk at the site, which would likely include appropriate flood modelling.

Significant consultation with the LPA and key consultees and stakeholders that are relevant to the site will be required for major[25] development proposals. However, all

25 As defined by the Town and Country Planning (Development Management Procedure) (England) Order 2015 (Article 2).

developments at risk will need to include flood mitigation measures and compensatory storage.

Together with appropriate consultation, accepted FRA guidance should be followed by developers including:

- Find out when you need to do an FRA as part of a planning application, how to complete one and how it's processed:
  - Flood risk assessments if you're applying for planning permission[26]
  - Flood risk assessment in flood zones 2 and 3[27]
  - Flood risk assessment in flood zone 1 and critical drainage areas[28]
- EA standing advice:
  - Preparing a flood risk assessment: standing advice[29]

In summary, the FRA should address the following:

1. Development description and location
   a. What is the type of development and where will it be located?
   b. What is the vulnerability classification (Table 2 of FRCC-PPG) of the current and future building use?
   c. Has the development been assessed in the SFRA? If so, has the sequential test been carried out? Has the exception test (if applicable) been applied and passed previously?
2. Access and escape routes
   a. Can safe access and escape routes be achieved during a flood event?
   b. Safe access and escape routes should be explicitly identified as part of an agreed emergency plan
3. Definition of flood hazard
   a. What are the sources of flooding at the site?
   b. For each source how would flooding occur? Referencing any historical records
   c. What existing surface water drainage infrastructure is present on the site? Consultation required with LPA, LLFA, EA and water companies
4. Probability
   a. Confirm the flood zone designation for the site (refer to the Flood Map for Planning: Flood Map for planning)

26 Flood risk assessments if you're applying for planning permission, UK Government, 2017
27 Flood risk assessment in flood zones 2 and 3, UK Government, 2017
28 Flood risk assessment in flood zone 1 and critical drainage areas, UK Government, 2017
29 Preparing a flood risk assessment: standing advice, UK Government, 2022

b. Determine the actual and residual risks at the site (refer to the SFRA maps and EA modelled depth and hazard information)

c. What are the discharge rates and volumes generate by the existing site and proposed development?

5. Climate change
   a. How is flood risk at the site likely to be affected by climate change? Check appropriate allowances (see Section 4.7.1) [30]
6. Flood Risk Management measures
   a. How will the site be protected from flooding, including the potential impacts of climate change, over the lifetime of the development?
7. Residual risks
   a. What are the consequences to the site of flood defence failure? Breach/overtopping scenarios should be modelled.
   b. What are the consequence to the site of asset blockage? Culvert, bridge blockage scenarios should be modelled.
   c. Is there residual risk from reservoirs? If so, how can this be mitigated and does the emergency plan address such risk? Reference the EA's Reservoir Flood Map[31]
   d. Is there residual risk from canals? If so, how can this be mitigated and does the emergency plan address such risk? Consultation required with the EA, LLFA and Canal & River Trust. Breach/overtopping scenarios should be modelled.
   e. What flood-related risks will remain after mitigation measures have been implemented?
   f. How, and by whom, will these risks be managed over the lifetime of the development?
8. Offsite impacts
   a. How will the proposed development make sure there are no impacts to other development downstream or nearby?
   b. What measures will be implemented to control surface water runoff? SuDS? What arrangements are in place for SuDS ownership, maintenance?
9. Groundwater
   a. This mechanism of flooding should be considered particularly when determining the acceptability of SuDS schemes as a way of managing surface water drainage. Developers should consult with the LPA, LLFA and EA at an early stage of the assessment.
10. Sewer systems

30 Flood risk assessments: climate change allowances, UK Government, 2022
31 Reservoir Flood Maps, Environment Agency, 2023

a. Where the SFRA has identified a risk of surface water flooding, any water that escapes from the sewer system would tend to follow similar flow paths and pond in similar locations. The SFRA should also contain historical evidence to refer to.

b. Where required, liaison with the relevant water company should be undertaken at an early stage in the assessment process to confirm localised sewer flooding problems that could affect the site.

c. Future development should be designed so that it does not exacerbate existing sewer capacity problems. Developers should check with the LPA whether a Water Cycle Study has been developed. A Stage 1 Water Cycle Study has been developed for HDC alongside the Level 1 SFRA as part of this IWMS.

5.7 Surface water management and Sustainable Drainage Systems

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and consequently a potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts, and other drainage infrastructure. Managing surface water discharges from new development is therefore crucial in managing and reducing flood risk to new and existing development downstream. Carefully planned development can also play a role in reducing the number of properties that are directly at risk from surface water flooding as well reducing pressure on water infrastructure.

The planning system has a key role to play in setting standards for sustainable drainage from new developments and ensuring that developments are designed to take account of the risk from surface water flooding. Sustainable drainage plays an important part in reducing flows in the sewer network and in meeting environmental targets, alongside investment in maintenance by the water companies on their assets. Water companies plan their investment on a five-year rolling cycle, in consultation with key partners, including the EA and local authorities. The WCS contains a more detailed explanation of how the water industry in the UK is organised.

The Department for Levelling Up, Housing and Communities (DLUHC) (formally the Department for Communities and Local Government (DCLG)) announced, in December 2014, that the LPA, in consultation with the LLFA, should be responsible for delivering SuDS[32] through the planning system. Changes to planning legislation gave provisions for major applications of ten or more residential units or non-residential development of new floorspace of 1,000 square metres or more, or a site of 1 hectare or more to require sustainable drainage within the development proposals in accordance with the 'non-statutory technical standards for sustainable drainage systems[33], published in

32 Sustainable drainage systems, UK Parliament, 2014
33 Sustainable drainage systems, Defra, 2015

March 2015. A Practice Guidance[34] document has also been developed by the Local Authority SuDS Officer Organisation (LASOO) (now ASA (Association of SuDS Authorities)) to assist in the application of the non-statutory technical standards.

Developers should be aware of Schedule 3 of the FWMA (see Appendix A), which, at the time of writing, is expected to be implemented in 2024. The FWMA, which incorporates recommendations from the 2008 Pitt review includes the implementation of new SuDS standards and the removal of the automatic rights for developers to connect to public sewers.

The Design and Construction Guidance (DCG) for sewers became the regulated sewerage guidance on 1 April 2020. This allows water and sewerage companies to adopt SuDS components that meet the criteria of the DCG. Details on the sewerage sector guidance can be found online[35].

5.7.1 HDC Sustainable Drainage

To manage flood risk, all development, regardless of development type, flood zone and development size, must give priority use to SuDS. Particularly for major developments, there is a requirement to assess and include SuDS for managing surface water at the development unless it is demonstrated during the assessment that it is inappropriate for the site, i.e., due to high groundwater levels not allowing for infiltration SuDS.

To satisfy the NPPF, applicants must demonstrate that priority has been given to the use of SuDS in their development proposals. SuDS should be provided by default unless demonstrated to be inappropriate. Where priority use of SuDS cannot be achieved, applicants must justify this by submitting robust and acceptable evidence.

At the time of writing, HDC has adopted CCC's 'Cambridgeshire Flood and Water Supplementary Planning Document'[36]. The document discusses how effective SuDS can be incorporated into the overall design of a development proposal.

5.7.2 SuDS and the NPPF

The NPPF, para 169, states:

"Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a. Take account of advice from the lead local flood authority;

b. Have appropriate proposed minimum operational standards;

34 Non-Statutory Technical Standards for sustainable drainage, LASOO, 2016
35 Sewerage Sector Guidance, Water UK, 2020
36 Cambridgeshire Flood and Water Supplementary Planning Document, 2017

c. Have maintenance arrangements, in place to ensure an acceptable standard of operation for the lifetime of the development; and

d. Where possible, provide multifunctional benefits".

All developments, both major and minor, are to include SuDS, providing multiple benefits that contribute to many other NPPF policies, including climate change, biodiversity net gain, amenity, and water quality improvements. Where site conditions may be more challenging, the SuDS components used will need to accommodate the site's opportunities and constraints. At a strategic level, this should mean identifying opportunities for a variety of SuDS components according to geology, soil type, topography, groundwater/mine water conditions, their potential impact on site allocation, and setting out local SuDS guidance and opportunities for in perpetuity adoption and maintenance.

Maintenance options must clearly identify who will be responsible for maintaining SuDS and funding for maintenance should be fair for householders and premises occupiers and set out a minimum standard to which the SuDS must be maintained.

Sustainable drainage should form part of an integrated design methodology secured by detailed planning conditions to ensure that the SuDS to be constructed is maintained to a minimum level of effectiveness.

5.7.3 SuDS hierarchy

The runoff destination should always be the first consideration when considering design criteria for SuDS including the following possible destinations in order of preference:

1. To ground through infiltration;
2. To surface waterbody;
3. To surface water sewer; or
4. To combined sewer.

However, it should be noted that following the implementation of Schedule 3 of the FWMA (see Appendix A), which is expected to be implemented in 2024, the right to connect to public sewers will be conditional upon the drainage system being approved prior to the commencement of construction work.

Effects on water quality should be investigated when considering runoff destination in terms of the potential hazards arising from development and the sensitivity of the runoff destination.

The EA may also look at the potential impact of an outfall structure through the planning consultation and Environmental Permitting Regulation[37] process. An outfall structure is the outlet of a smaller watercourse or drain that discharges into a larger

37 Environmental permits: detailed information | Environment Agency

watercourse or the sea. It should be noted that detailing modelling will not be available for all outfalls therefore developers should carry out their own investigations whilst referring to the non-statutory technical standards for sustainable drainage systems (March 2015)[38].

The non-statutory technical standards for sustainable drainage systems sets out appropriate design criteria based on the following:

1. Flood risk outside the development;
2. Peak flow control;
3. Volume control;
4. Flood risk within the development;
5. Structural integrity;
6. Designing for maintenance considerations; and
7. Construction.

Many different SuDS techniques can be implemented. As a result, there is no one standard correct drainage solution for a site. In most cases, using the Management Train principle (see Figure 5-5), will be required, where source control is the primary aim. Source control includes interception of the first 5mm of rainfall and water quality treatment should be as near to source as possible.

In February 2021, Defra published its research project to review and provide recommendations to update the current non-statutory technical standards for sustainable drainage systems[39]. Defra will use this research to inform its drainage policy development. Based on the research findings, recommendations have been made to replace the current standards 1 to 7 with a new suite of six standards to cover the following:

1. Runoff destinations
2. Everyday rainfall
3. Extreme rainfall
4. Water quality
5. Amenity
6. Biodiversity

38 Sustainable drainage systems: non-statutory technical standards, UK Government, 2015

39 Defra (2021) Recommendations to Update Non-Statutory Technical Standards for Sustainable Drainage Systems (SuDS) - WT15122

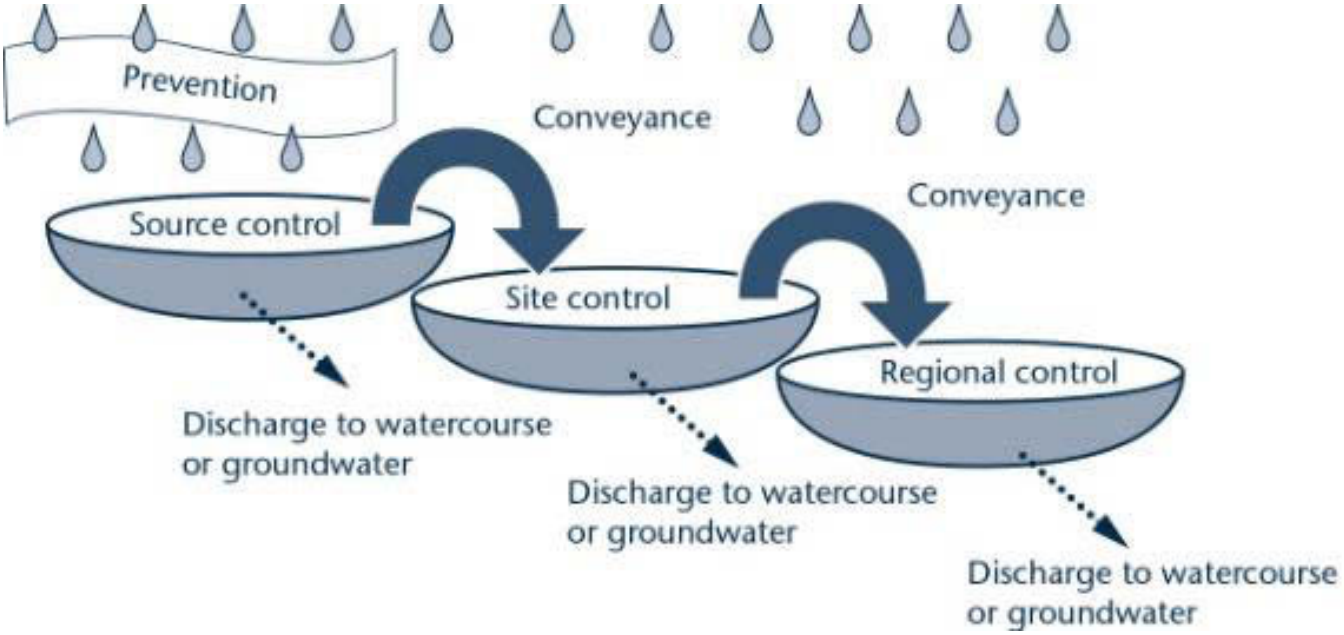


Figure 5-5 SuDS management train principle[40]

The effectiveness of a flow management scheme within a single site is heavily limited by land use and site characteristics including (but not limited to) topography, geology, and soil (permeability) and available area. Potential ground contamination associated with urban and former industrial sites should be investigated with concern being placed on the depth of the local water table and potential contamination risks that will affect water quality. The design, construction and ongoing maintenance regime of any SuDS scheme must be carefully defined through a drainage strategy as part of a site-specific FRA. A clear and comprehensive understanding of the catchment hydrological processes (i.e., nature and capacity of the existing drainage system) is essential for successful SuDS implementation.

In addition to the national standards, the LPA may set local requirements for planning permission that include more rigorous obligations than the non-statutory technical standards. More stringent requirements should be considered where current greenfield sites lie upstream of high-risk areas. This could include improvements on greenfield runoff rates. The LPA should always be contacted with regards to its local requirements at the earliest opportunity in development planning.

The CIRIA SuDS Manual[41] 2015 should also be consulted by the LPA and developers. The SuDS manual (C753) is highly regarded and incorporates the latest research, industry practice, technical advice, and adaptable processes to assist in the planning, design, construction, management, and maintenance of good SuDS. The SuDS

40 CIRIA (2008) Sustainable Drainage Systems: promoting good practice – a CIRIA initiative
41 CIRIA (2008), CIRIA SuDS Manual

Manual complements the non-statutory technical standards and goes further to support the cost-effective delivery of multiple benefits.

SuDS allow the management of diffuse pollution generated by urban areas through the sequential treatment of surface water reducing the pollutants entering lakes and rivers, resulting in lower levels of water supply and wastewater treatment being required. This treatment of diffuse pollution at source can contribute to meeting WFD water quality targets, as well as national objectives for sustainable development.

This is usually facilitated via a SuDS Management Train (see Figure 5-5) providing a range of treatment processes delivering gradual improvement in water quality and providing an environmental buffer for accidental spills or unexpected high pollutant loadings from the site. Considerations for SuDS design for water quality are summarised in the WCS (see Section 8.4.1).

5.7.4 Overland flow paths

Underground drainage systems have a finite capacity and regard should always be given to larger events when the capacity of the network will be exceeded. Hence there is a need to design new developments with exceedance in mind. This should be considered alongside any surface water flows likely to enter a development site from the surrounding area.

Masterplanning should make sure that existing overland flow paths are retained within the development. As a minimum, the developer should investigate, as part of a site-specific FRA, the likely extents, depths, and associated hazards of surface water flooding on a development site, as shown by the RoFSW dataset. This is considered to be an appropriate approach to reduce the risk of flooding to new developments. Green/blue infrastructure should be used wherever possible to accommodate such flow paths. EA standing advice states that floor levels should always be set a minimum of 300mm above ground level (or 300mm freeboard above the design flood level) to reduce the consequences of any localised flooding, unless local guidance states otherwise.

The effectiveness of a flow management scheme within a single site is heavily limited by site constraints including (but not limited to) topography; geology and soil (permeability); development density; existing drainage networks both on-site and in the surrounding area; adoption issues; and available area. The design, construction and ongoing maintenance regime of such a scheme must be carefully defined at an early stage and a clear and comprehensive understanding of the catchment hydrological processes (i.e., nature and capacity of the existing drainage system) is essential.

5.8 Mitigation measures

Whilst the sequential approach to development and flood risk should always be followed, there are certain instances where development must occur in areas of flood

risk. This section details the generic mitigation measures that are available for new development and for existing developments at flood risk.

5.8.1 Site layout and design

Flood risk should be considered at the first stage in planning the layout and design of a site to provide an opportunity to reduce flood risk and offsite runoff.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from areas of flood risk for example to higher ground, while more flood-compatible development (e.g., vehicular parking, recreational space) can be in higher risk areas that may be on lower ground. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazards, having appropriate evacuation procedures, and the availability of flood warnings and / or alerts.

Waterside areas, or areas alongside known flow routes, can be used for blue/green infrastructure, providing multiple benefits for recreation, social and amenity, and environmental and ecological purposes whilst allowing the preservation of flow routes and areas of flood storage Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

5.8.2 Sustainable Drainage Systems

SuDS provide a means of dealing with the quantity and quality of surface water and can also 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.

The developer is responsible for ensuring the design, construction and future/ongoing maintenance of any SuDS scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential. Developers should ensure they are familiar with the new SuDS standards associated with Schedule 3 of the FWMA (see Appendix A), which is expected to be implemented in 2024.

5.8.3 Modification of ground levels

Any proposal for the modification of ground levels will need to be assessed as part of a detailed FRA.

Modifying ground levels to raise 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 floodwaters. 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 through modelling 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 (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). Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624[42].

Where proposed development results in a change in building footprint, the developer should make sure 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 through appropriate modelling to make sure that it would not cause increased ponding or build-up of surface runoff on third party land.

5.8.4 Raised floor levels

If raised floor levels are proposed, these should be agreed with HDC and the EA. The minimum Finished Floor Level (FFL) may change dependent upon the vulnerability and flood risk to the development.

The EA advises that minimum FFLs should be set 300mm above the 1% AEP plus climate change peak river flood level, where the latest climate change allowances have been used (see Section 4.7.1 for the climate change allowances). The 1% AEP fluvial flood event plus an allowance for climate change is considered to be the 'design flood event' for new development (para 002 FRCC-PPG). An additional allowance may be required because of risks relating to blockages to the channel, culvert or bridge structures and should be considered as part of an FRA.

Allocating the ground floor of a building for less vulnerable, non-residential, 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 rapid rise of water (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route from the development to safe areas.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 and areas at high or medium risk of surface water flooding should not be

42 CIRIA January 2004, CIRIA Report 624: Development and Flood Risk - Guidance for the Construction Industry

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.

5.8.5 Property Flood Resilience

Para 167 of the NPPF explains that development must only be allowed in areas at flood risk where, following the sequential and exception tests and supported by an FRA, the development is appropriately flood resistant and resilient.

Flood resilience and resistance measures are mainly designed to mitigate flood risk and reduce damage and adverse consequences to existing property. Such measures may aim to help residents and businesses recover more quickly following a flood event.

The 'Code of practice for property flood resilience', published by CIRIA in 2021[43], defines active PFR measures as *'…measures which are not permanently installed into the property and will require deployment before a flood event (e.g. a door guard)*'. Passive PFR measures are defined as '…*measures which are installed into the property and do not require further deployment or activation before a flood event (e.g. a flood door or automatic airbrick cover)*'.

Research[44] carried out by the then DCLG (now DLUHC) and the EA recommended that the use of PFR measures should generally be limited to a nominal protection height of 600 mm above ground level, the lowest point of ground abutting the external property walls. This is because the structural integrity of the property may be compromised above this level. The EA recommends that advice from a structural engineer should be sought for any measures to resist a depth of 600 mm or more.

It should be noted that it is not possible to completely prevent flooding to all communities and businesses. Also, PFR measures would not be expected to cause an increase in flood risk to other properties or other parts of the local community. They will help mitigate against flood risk but, as with any flood alleviation scheme, flood risk cannot be removed completely. Emergency plans should, therefore, be in place that describe the installation of measures and residual risks.

As the flood risk posed to a property cannot be removed completely, it is recommended that PFR products are deployed in conjunction with pumps of a sufficient capacity. Pumps help manage residual flood risks not addressed by PFR measures alone such as rising groundwater.

5.8.5.1 Definitions

43 CIRIA (2021) Code of practice for property flood resilience (C790F)

44 DCLG & EA (2007) Improving the Flood Performance of New Buildings - Flood Resilient Construction

Flood resilience measures aim to reduce the damage caused by floodwater entering a property. Flood resilience measures are based on an understanding that internal flooding may occur again and when considering this eventuality, homes and businesses are encouraged to plan for flooding with an aim of rapid recovery and the return of the property to a habitable state.

For example, tiled floors are easier to clean than carpets, raised electricity sockets and high-level wall fixings for TVs/computers may mean that that power supply remains unaffected. Raising kitchen or storage units may also prevent damage that may not require replacement after a flood. There is a lot of information available about what items get damaged by floodwater and features that are considered to provide effective resilience measures that can be installed at a property.

Flood resistance measures aim to reduce the amount of floodwater entering the property. Obvious inflow routes, such as through doors and airbricks may be managed, for example, by installing bespoke flood doors, door flood barriers and automatic closing airbricks. However, the property's condition and construction are also key to understanding how floodwater may enter and move between buildings. For example, floodwater can also flow between properties through connecting cavity walls, cellars, beneath suspended floors and through internal walls. Flood resistance measure alone may not keep floodwater out. Building condition is a critical component of any flood mitigation study.

5.8.5.2 Property mitigation surveys

To define the scale and type of resistance or resilience measures required, a survey will need to be undertaken to pick up property threshold levels, air brick levels, doorways, historic flood levels and several ground spot levels required to better understand the flood mechanisms for floodwater arriving at the property (e.g., along roads and pavements). The depth of flooding recorded at a property will help guide the selection of the most appropriate PFR measures. Surveys will need to include:

- Detailed property information i.e., structure, presence of air bricks, cellars, outlet pipes, floor levels, door and window levels, manhole and grid locations;
- An assessment of flood risk, including property (cross) threshold levels;
- Routes of water ingress (fluvial, ground and surface water flooding);
- An assessment of the impact of floodwaters;
- A schedule of recommended measures to help to reduce risk;
- Details of recommendations (including indicative costs);
- Advice on future maintenance of measures; and
- Advice on flood preparedness and emergency planning.

All sources of flooding will need to be considered, including a comprehensive survey of openings (doors, windows, and air bricks), as well as potential seepage routes through

walls and floors, ingress through service cables, pipes, drains and identification of possible weaknesses in any deteriorating brickwork or mortar.

5.9 Emergency planning

The provisions for emergency planning for local authorities as Category 1 responders are set out by the Civil Contingencies Act, 2004[45] and the National Flood Emergency Framework for England, December 2014[46]. This framework is a resource for all involved in emergency planning and response to flooding from rivers, surface water, groundwater, and reservoirs. The framework sets out Government's strategic approach to:

- Ensuring all delivery bodies understand their respective roles and responsibilities when planning for and responding to flood related emergencies;
- Giving all those involved in an emergency flooding situation a common point of reference, which includes key information, guidance and key policies;
- Establishing clear thresholds for emergency response arrangements;
- Placing proper emphasis on the multi-agency approach to managing flooding events;
- Providing clarity on the means of improving resilience and minimising the impact of flood events;
- Providing a basis for individual responders to develop and review their own plans; and
- Being a long-term asset that will provide the basis for continuous improvement in flood emergency management.

Along with the EA flood warning systems, there are a range of flood plans at a local level, outlining the major risks from flooding and the strategic and tactical response framework for key responders. The EA and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT) have produced guidance on flood risk emergency plans for new development (September 2019)[47]. It would however be for the LPA to review and approve flood risk emergency plans with their emergency planners or through the Local Resilience Forum (see Section 5.9.1.1).

This SFRA contains useful data to allow emergency planning processes to be tailored to the needs of the area and be specific to the flood risks faced. The SFRA Maps in Appendix B and accompanying GIS layers should be made available to emergency planners to help prepare for any flood event and throughout the planning process.

45 Civil Contingencies Act, UK Government, 2004
46 The national flood emergency framework for England, UK Government, 2014
47 Flood Risk Emergency Plans for New Development, ADEPT/EA, September 2019

5.9.1 Civil Contingencies Act

Under the Civil Contingencies Act (CCA, 2004)[48], HDC as LPA are classified as Category 1 responders and thus have duties to assess the risk of emergencies occurring, and use this to:

- Inform contingency planning;
- Put in place emergency plans;
- Put in place business continuity management arrangements;
- Put in place arrangements to make information available to the public about civil protection matters;
- Maintain arrangements to warn, inform and advise the public in the event of an emergency;
- Share information with other local responders to enhance coordination; and
- Cooperate with other local responders to enhance coordination and efficiency and to provide advice and assistance to businesses and voluntary organisations about business continuity management.

During an emergency, such as a flood event, the local authority must co-operate with other Category 1 responders (such as the emergency services and the EA) to provide the core response.

5.9.1.1 Cambridgeshire and Peterborough Local Resilience Forum[49]

The aim of the resilience forum is to legally deliver the duties stated in the CCA within a multi-agency environment. The resilience forum is a group of organisations that work together to prepare and respond to emergencies in Cambridgeshire and Peterborough. The resilience forum involves local authorities, emergency services, health agencies, EA and local businesses.

The resilience forum's common objectives are to:

- Save lives
- Prevent disaster getting worse
- Relieve suffering
- Restore normality as soon as possible
- Protect property
- Facilitate criminal investigation and judicial process if necessary.

48 The Civil Contingencies Act, UK Government, 2013
49 Cambridgeshire and Peterborough Local Resilience Form

The resilience forum's main roles include:

- Assessing the impacts of the risk and providing this information to the public in a Community Risk Register
- Creating emergency plans
- Responding together in a coordinated way
- Training and testing for preparedness
- Learning the lessons from incidents and exercises.

5.9.1.2 Community Risk Register[50]

The resilience forum produces the Community Risk Register (CRR) which lists possible risks, the probability of occurring and potential impact. The CRR provides information on the biggest emergencies that happen in Cambridgeshire and Peterborough, together with an assessment of how likely they are to happen and the impacts if they do include impacts to people, houses, the environment, and local businesses. Each identified risk is then analysed and given a rating according to how likely the risk is to lead to an emergency and their potential impact on safety and security, health, economy, environment, and society.

5.9.1.3 Community Emergency Plan[51]

Communities may need to rely on their own resources to minimise the impact of an emergency, including a flood, before the emergency services arrive. Many communities already help each other in times of need, but experience shows that those who are prepared cope better during an emergency. Communities with local knowledge, enthusiasm and information are a great asset and a Community Emergency Plan can help. Details on how to produce a community emergency plan, including a toolkit and template, are available from the Government's website[52].

5.9.1.4 Local flood plans

This SFRA provides several flood risk data sources that should be used when producing or updating flood plans. It is not the LPA's responsibility to write flood plans for new developments at flood risk. Developers should write their own. Generally, owners with individual properties at risk should write their own individual flood plans, however larger developments or regeneration areas, such as retail parks, hotels and leisure complexes, should consider writing one collective plan for the assets within an area.

50 Community Risk Register, Cambridgeshire and Peterborough Local Resilience Forum
51 Emergency Planning
52 Resilience in society: infrastructure, communities and businesses, UK Government, 2014

This SFRA can help to:

- Update these flood plans if appropriate;
- Inform emergency planners in understanding the possibility, likelihood and spatial distribution of all sources of flooding;
- Identify safe evacuation routes and access routes for emergency services;
- Identify key strategic locations to be protected in flooding emergencies, and the locations of refuge areas that are capable of remaining operational during flood events;
- Provide information on risks in relation to key infrastructure, and any risk management activities, plans or business continuity arrangements;
- Raise awareness and engage local communities;
- Support emergency responders in planning for and delivering a proportionate, scalable and flexible response to the level of risk; and
- Provide flood risk evidence for further studies.

The guidance written by the EA and ADEPT[53] is aimed at LPAs to help assist in setting up their own guidelines on what should be included in flood risk emergency plans.

CCC's Local Flood Risk Management Strategy explains how local flood risk is managed in Cambridgeshire. This strategy is available online[54].

5.10 Flood warning and evacuation plans

Developments that include areas that are designed to flood (e.g., amenity greenspace areas) or have a residual risk associated with them (e.g., located behind a flood defence), will need to contain appropriate flood warning and instructions so users and residents are safe in the event of a flood. This will include both physical warning signs and written flood warning and evacuation plans. Those using any new development should be made aware of any evacuation plans.

In relation to a new development, it is up to the LPA to determine whether the flood warning and evacuation plans, or equivalent procedures, are sufficient or not. If the LPA is not satisfied, considering all relevant considerations, that a development can be considered safe without the provision of safe access and escape routes, then planning permission should be refused.

Whilst there is no statutory requirement on the EA or the emergency services to approve evacuation plans, LPAs are accountable under their Civil Contingencies duties, via planning condition or agreement, to make sure that plans are suitable. This should be done in consultation with development management officers and emergency planners. Given the cross-cutting nature of flooding, it is recommended that further discussions are held internally to the LPA between emergency planners and policy

53 ADEPT/EA Flood Risk Emergency Plans for New Development, 2019
54 Cambridgeshire Flood Risk Management Strategy

planners/development management officers, the LLFA, drainage engineers and to external stakeholders such as the emergency services, the EA, AW, and Internal Drainage Boards (if applicable).

It may be useful for both the LLFA and spatial planners to consider whether, as a condition of planning approval, flood evacuation plans should be provided by the developer that aim to safely evacuate people out of flood risk areas, using as few emergency service resources as possible. It may also be useful to consider how key parts of agreed flood evacuation plans could be incorporated within local development documents, including in terms of protecting evacuation routes and assembly areas from inappropriate development.

Once the development receives planning permission, it will be the requirement of the plan owner (developer) to make sure the plan is put in place, and to liaise with the LPA and LLFA regarding maintenance and updating of the plan.

At the time of writing there are 26 EA Flood Warning Areas within Huntingdonshire, which are located primarily along the River Great Ouse and its tributaries, where risk from rivers is greatest. These have been identified using the EA's Flood Warnings Areas dataset[55].

5.10.1 What should a flood warning and evacuation plan include?

Flood warning and evacuation plans should include the information stated in Table 5-1. Advice and guidance on plans are accessible from the EA website and plan templates are available for businesses and local communities.

Table 5-1 Flood warning and evacuation plans

Consideration	Purpose
Availability of existing flood warning system	The EA offers a flood warning service that currently covers designated Flood Warning Areas in England. In these areas, they can provide a full flood warning service.
Rate of onset of flooding	The rate of onset is how quickly the water arrives and the speed at which it rises, which, in turn, will govern the opportunity for people to effectively prepare for and respond to a flood. This is an important factor within Emergency Planning in assessing the response time available to the emergency services.
How flood warning is given and occupant's awareness of the likely	Everyone eligible to receive flood warning should be signed up to the EA

55 Environment Agency Flood Warning Areas

Consideration	Purpose
frequency and duration of flood events	flood warning service. Where applicable, the display of flood warning signs should be considered. Particularly sites that will be visited by members of the public daily, such as sports complexes, car parks, retail stores. It is envisaged that the responsibility should fall upon the developers and should be a condition of the planning permission. Information should be provided to new occupants of houses concerning the level of risk and
The availability of site staff, occupants, or users to respond to a flood warning and the time taken to respond to a flood warning	The plan should identify roles and responsibilities of all responders. The use of community flood wardens should also be considered.
Designing and locating safe access routes, preparing evacuation routes and the identification of safe locations for evacuees	Dry routes will be critical for people to evacuate as well as emergency services entering the site. The source, extent, depth, and flood hazard rating, including allowance for climate change, should be
Vulnerability of occupants	Vulnerability classifications associated with development as outlined in the FRCC-PPG. This is closely linked to its occupiers i.e., elderly, less able, children are more vulnerable.
How easily damaged items will be relocated, and the expected time taken to re-establish normal use following an event	The impact of flooding can be long lasting well after the event has taken place affecting both the property which been disrupted. The resilience of the community to get back to normal will be important including time taken to
Mental health	Exposure to a flood event i.e., having your home flooded can have sever effects on the mental health of those affected. There should be guidance on how to get help with mental issues.

5.10.2 EA Flood Warning Areas (FWA) and flood awareness

The EA monitors river levels within the main rivers affecting the authority area and based upon weather predictions provided by the Met Office, assesses the anticipated

maximum water level that is likely to be reached within the proceeding hours (and/or days). Where these predicted water levels are expected to result in inundation of a populated area, the EA will issue a series of flood warnings within defined FWAs, encouraging residents to take action to avoid damage to property in the first instance.

More information on flood warnings is provided by the EA online,[56] Including live information on flood warning and flood alerts.[57]

Emergency planners may also use the outputs from this SFRA to raise awareness within local communities. This should include raising awareness of flood risk, roles, responsibilities and measures that people can take to make their homes more resilient to flooding from all sources whilst also encouraging all those at fluvial flood risk to sign up to the EA's Flood Warning Service.[58]

It is also recommended that Category 1 responders are provided with appropriate flood response training to help prepare them for the possibility of a major flood with an increased number of people living within flood risk areas, to make sure that adequate pre-planning response and recovery arrangements are in place.

56 Flood warnings: what they are and what to do, UK Government, 2014
57 Check for flooding in England, UK Government, 2023
58 Sign up for flood warnings, UK Government

6 Conclusions and recommendations

6.1 Conclusions

This Level 1 SFRA provides a single repository planning tool relating to flood risk and development in Huntingdonshire. Key flood risk stakeholders namely the EA, LLFA and AW were consulted to collate all available and relevant flood risk information on all sources into one comprehensive high-level assessment. Together with this report, this SFRA also provides a suite of interactive GeoPDF maps (Appendix B) illustrating the level of risk to the district. Appendices C and E present a flood risk screening assessment of all potential local plan site allocations to enable the LPA to perform the sequential test.

Whilst the aim of the sequential approach is the avoidance of development in areas of high and / or medium flood risk areas, where HDC is looking for continued growth and/or regeneration, this may not always be possible. This SFRA therefore provides the necessary links between spatial development, wider flood risk management policies, local strategies, and plans and on the ground works by combining all available flood risk information together into one single repository. However, as this is a strategic study, detailed local information on flood risk is not fully accounted for.

The data and information used throughout the SFRA process is the most up-to-date data available at the time of writing. Once new, updated, or further information becomes available, the LPA should look to update this SFRA. The Level 1 SFRA should be maintained as a 'live' entity that is updated as and when required (when new modelling or flood risk information becomes available or national changes in policy). The LPA can decide to update the SFRA and the EA and LLFA as statutory consultees on local plans can also advise on when an update is required to inform the local plan evidence base.

EA model updates to account for the latest climate change allowances are not available at this stage. Fluvial climate change modelling will be required through the Level 2 SFRA or a future update of this Level 1 SFRA. Recommendations for further work are provided in Section 6.2.

6.2 Recommendations for further work

The SFRA process has developed into more than just a planning tool. Sitting alongside the Sustainability Appraisal and Local Flood Risk Management Strategy, it can be used to provide a much broader and inclusive vehicle for integrated, strategic and local flood risk management and delivery.

There are several studies listed in Table 6-1 that may be of benefit to the LPA, in developing their flood risk evidence base to support the delivery of the Local Plan, or to

the LLFA to help fill critical gaps in flood risk information that have become apparent through the preparation of this Level 1 SFRA.

Table 6-1 Plans and assessments beneficial to developing the flood risk evidence base

Type	Study	Reason	Timeframe
Understanding of local flood risk	Level 1 SFRA update	When there are changes to: the predicted impacts of climate change on flood risk; detailed flood modelling - such as from the EA or LLFA; the local plan, spatial development strategy or relevant local development documents; local flood management schemes; flood risk management plans; local flood risk management strategies; and national planning policy or guidance. Or after a significant flood event.	As required
	Level 1 SFRA update; Level 2 SFRA; site-specific FRA	Potential development sites should be assessed against all flood risk information for inclusion in the Level 1 SFRA. Reviewing of EA flood zones in those areas not covered by existing detailed hydraulic models i.e., the Flood Map for Planning does not cover every watercourse such as those <3km^2 in catchment area or Ordinary Watercourses. If a watercourse or drain is present on OS mapping but is not covered by the Flood Map for Planning, this does not mean there is no potential flood risk. A model may therefore be required to ascertain the flood risk, if any, to any nearby sites.	Short term
	Level 2 SFRA	Further, more detailed assessment of flood risk to high and medium risk sites as notified by this Level 1 SFRA.	Short term

Type	Study	Reason	Timeframe
	Preliminary site-screening FRAs/ outline drainage strategy	Further, more detailed assessment of larger strategic sites, if the LPA feels this is prudent.	Short term
	SWMP/ detailed surface water modelling	CCC developed a county wide Level 1 SWMP in August 2015. There is a detailed SWMP in place for St Neots. The LLFA may wish update the SWMPs based on more up to date surface water flood risk information and climate change allowances.	Short term
	Climate change assessment for Level 1 update / part of Level 2 SFRA	Modelling of climate change, using EA's most up-to-date allowances across all watercourses within Huntingdonshire.	Short term
Flood storage and attenuation	Working with Natural Processes	Further assess WwNP options in upper catchments to gauge possible areas for Natural Flood Management. Promote creation of floodplain and riparian woodland, floodplain reconnection and runoff attenuation features where the research indicates that it would be beneficial within the district.	Short term
Data collection	Flood Incident data	CCC should continue to record flood events including such information as date, location, weather, flood source (if apparent without an investigation), impacts (properties flooded or number of people affected) and response by any Risk Management Authority.	Ongoing
	FRM Asset Register	The LLFA should continue to update and maintain its asset register as per FWMA	Ongoing

Type	Study	Reason	Timeframe
		requirements.	
Risk assessment	Asset inspection	The LLFA may arrange with the EA to carry out inspections of critical assets (see Section 4.9.2) and those defences with condition grades of 4 (see Section 4.9.1). It is not the responsibility of the LLFA to inspect critical assets.	Short term
Capacity	SuDS review / guidance	The LLFA should clearly identify its requirements of developers for inclusion of SuDS in new developments in line with the forthcoming enactment of Schedule 3 of the FWMA. Internal capacity, within HDC and / or the LLFA, should be in place to deal with SuDS applications, set local specification and set policy for adoption and future maintenance of SuDS.	Short term
Partnership	Anglian Water	The LPA and LLFA should continue to collaborate with AW on sewer and surface water projects to ensure their assets can remain operational and resilient at all times across the catchment and that capacity for new development is appropriate.	Ongoing
	EA	HDC should continue to work with the EA on fluvial flood risk management projects. Potential opportunities for joint schemes to tackle flooding from all sources should be identified.	Ongoing
	Community	Continued involvement with the community through HDC's existing flood risk partnerships.	Ongoing

A Appendix A - The Planning Framework and Flood Risk Policy

This section contains information relating to the planning and framework flood risk policy and provides a background to the flood risk policy documents that are relevant to HDC.

B Appendix B - Interactive GeoPDF maps

The SFRA Maps consist of all flood risk information used within the SFRA, by way of interactive GeoPDF mapping. Open the Index Map in Adobe Acrobat. The Index Map includes a set of grid squares; clicking on one of these squares will open up one of the Detailed Maps of the area.

Within the detailed maps, use the zoom tools and the hand tool to zoom in/out and pan around the open detailed map. In the legend on the right-hand side of the detailed maps, layers can be switched on and off when required by way of a dropdown arrow.

C Appendix C – Development site assessment spreadsheet

Excel spreadsheet containing an assessment of flood risk to the potential development sites based on Flood Zones 2, 3a and 3b, as delineated through this SFRA and accounting for climate change, and the Risk of Flooding from Surface Water (RoFSW), also accounting for climate change. Each site is assigned a strategic recommendation based on risk and developability.

D Appendix D – Functional floodplain delineation

Technical note explaining the methodology behind the delineation of the functional floodplain (Flood Zone 3b) for this SFRA.

E Appendix E – Strategic Recommendations of the proposed sites

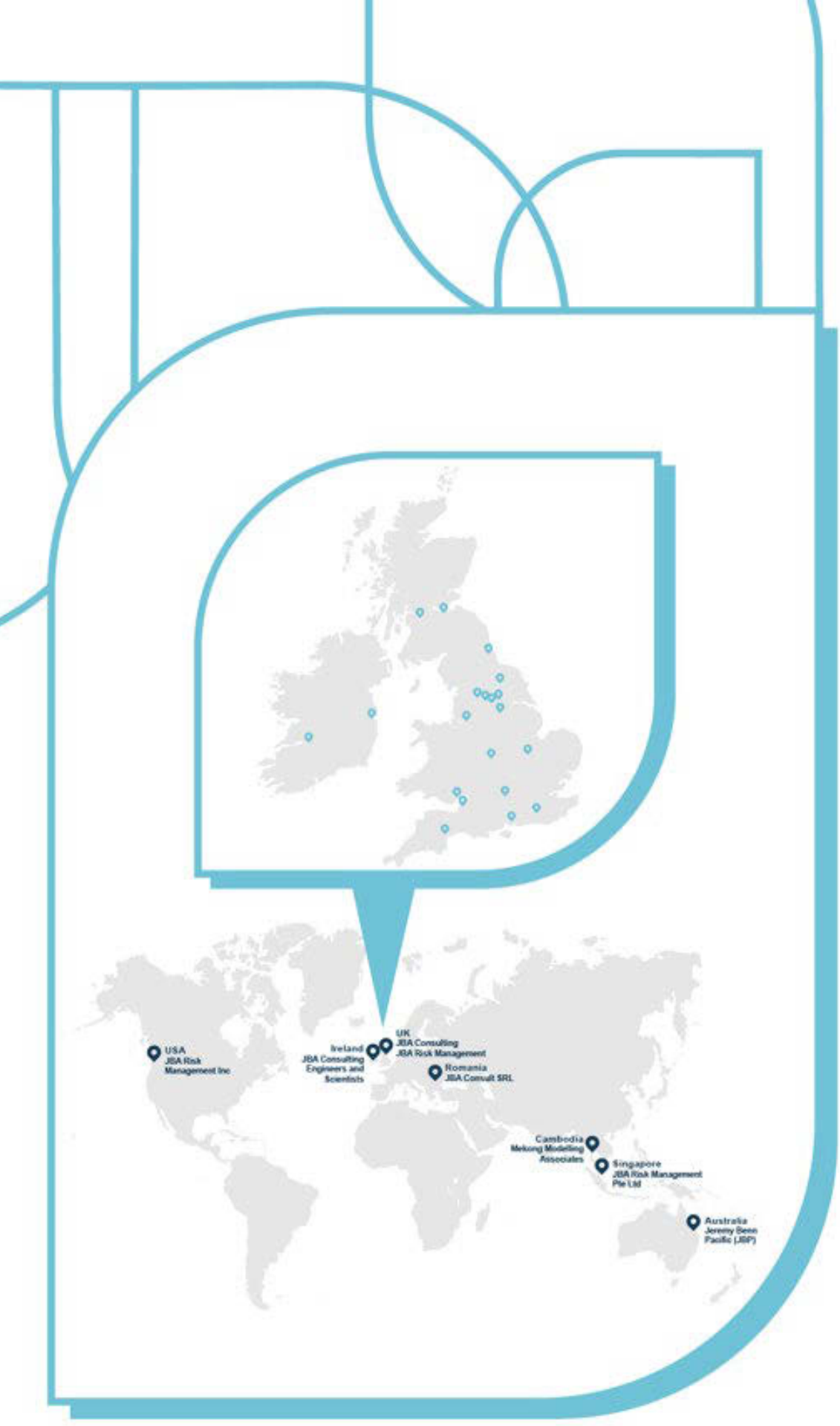
Summarises the outcomes of the Sites Assessment process recorded in Appendix C.

F Appendix F – Huntingdonshire Level 1 SFRA User Guide

A support document to provide guidance on the use of the Level 1 SFRA to developers, spatial planners, development management, flood risk management and emergency planners.

G Appendix G - Catchment-level assessment of Cumulative Impacts of Development on Flood Risk

Outlines the methodology and results of the detailed cumulative impact assessment.



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