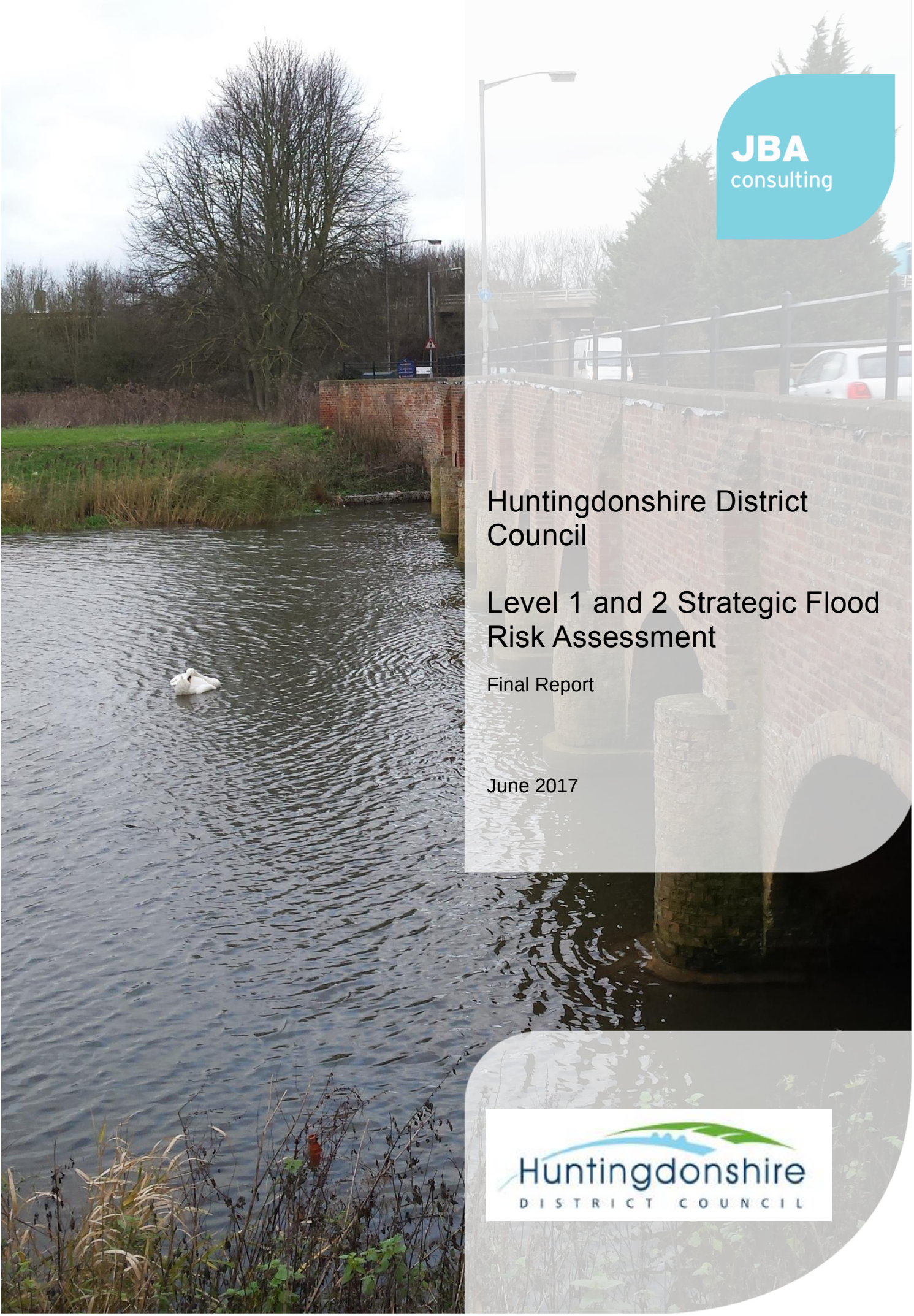

Huntingdonshire District Council

Level 1 and 2 Strategic Flood Risk Assessment

Final Report

June 2017

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Contract

This report describes work commissioned by Huntingdonshire District Council. The Council's representative for the contract was James Campbell. Andrew Waite of JBA Consulting carried out this work.

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Purpose

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Executive Summary

Introduction

This Strategic Flood Risk Assessment (SFRA) document replaces the Level 1 SFRA update originally published by Huntingdonshire District Council in April 2010. The original SFRA was completed and published in October 2004. The main purpose of the SFRA is to inform selection of options for Local Plan allocations and support determination of planning applications.

SFRA objectives

The key objectives of the SFRA are:

- To provide up to date information and guidance on flood risk for Huntingdonshire, taking into account the latest flood risk information and the current state of national planning policy
- To determine the variations in risk from all sources of flooding in Huntingdonshire
- Identify the requirements for site-specific flood risk assessments
- Determine the acceptability of flood risk in relation to emergency planning capability
- Consider opportunities to reduce flood risk to existing communities and developments

SFRA outputs

Level one outputs

- Assessment of all potential sources of flooding
- Mapping of location and extent of functional floodplain
- Assessment of standard of protection provided by existing flood risk management infrastructure
- Assessment of the potential impact of climate change on flood risk
- Assessment of locations where additional development may increase flood risk elsewhere
- Identification of critical drainage areas and recommendations on potential need for Surface Water Management Plans
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.
- Guidance for developers including requirements for site specific flood risk assessments and the process for flood map challenges.
- A suite of maps has been produced for the SFRA including
    - Appendix B: Watercourses in Huntingdonshire
    - Appendix C: Environment Agency Flood Zone 2 and 3 Mapping
    - Appendix D: Climate Change Mapping
    - Appendix E: Surface Water Mapping
    - Appendix F: Groundwater Mapping
    - Appendix G: Flood Warning Coverage
- A check list for site-specific flood risk assessments has also been included as an appendix.

Level two outputs

The content of the Level Two SFRA includes:

- Assessment of flood risk, including from extreme (0.1% AEP) events
- Assessment of protection provided by defences and where improvements may be required in the future
- Assessment of existing flood warning and emergency planning procedures
- Assessment of the effect of land use and natural and man-made structures
- Recommendations on the requirements for drainage control and impact mitigation such as Sustainable Drainage Systems (SuDS) and design solutions that could reduce flood risk

- Assessment of any catchment wide or strategic solutions, e.g. upstream balancing, to mitigate against the risk of flooding during a 1% AEP event

This information is presented in Appendix A in detailed site summary tables for each site taken forward to the Level 2 assessment.

Summary of Level 1 Assessment

Sources of flood risk

- Flood history shows that Huntingdonshire has been subject to flooding from several sources of flood risk, with the principal risk from fluvial sources.
- The key watercourse flowing through the study area is the River Great Ouse and its tributaries. The River Nene flows through a small area in the north of the district; however, the level of risk in the district from the River Nene is relatively low as it flows through a predominantly rural area. The majority of recorded fluvial flood events are associated with the River Great Ouse and its tributaries but there are numerous ordinary watercourses and awarded watercourses also within Huntingdonshire, with which recorded fluvial flood events are associated.
- The primary fluvial flood risk is associated with the River Great Ouse and its tributaries. The main urban areas are located along the River Great Ouse corridor; however, they are afforded some protection by flood defences.
- Watercourses in Internal Drainage Board (IDB) districts are managed for water level and flood risk management. They aim to provide a general standard of protection against flooding of 1% (Middle Level Commissioner watercourses) and 2-3% AEP (other IDBs), although there may be areas where the standard of protection is lower due to local circumstances.
- Huntingdonshire has 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. The update Flood Map for Surface Water (uFMfSW) further shows a number of prominent overland flow routes; these predominantly follow topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas. In addition, a number of these follow local road infrastructure.
- The sewers are managed by Anglian Water. The DG5 register of recorded historical sewer flooding was requested but not provided at the time of publication.
- The risk of inundation to the Huntingdonshire District as a result of reservoir breach or failure of a number of reservoirs within the area was assessed as part of the National Inundation Reservoir Mapping (NIRIM) study. Five reservoirs are located within the Huntingdonshire District, including Grafham Water; however, there are also reservoirs outside of the area whose inundation mapping is shown to affect the district.
- There are no records of flooding from reservoirs impacting properties inside the study area. The level and standard of inspection and maintenance required under the Reservoir Act 1975 means that the risk of flooding from reservoirs is relatively low.

Key flood risk strategic documents and policies

There are a number of relevant regional and local flood risk strategic documents and policies which have been considered within the SFRA, such as the Cambridgeshire Flood and Water Supplementary Planning Document (SPD), Catchment Flood Management Plan (CFMP), River Basin Flood Risk Management Plan (FRMP), the Preliminary Flood Risk Assessment (PFRA) and Local Flood Risk Management Strategy (LFRMS). Other policy considerations have also been incorporated, such as sustainable development principles, climate change and flood risk management.

Development and flood risk

The Sequential and Exception Test procedures for both Local Plans and Flood Risk Assessments (FRAs) have been documented, along with guidance for planners and developers. Links have been provided for various guidance documents and policies published by other Risk Management Authorities such as the Lead Local Flood Authority (LLFA) and the Environment Agency.

Defences

A high-level review of existing flood defences was undertaken and found a number of formal defences in the study area. Defences mainly consist of flood walls and embankments with the majority providing

protection against a 1% AEP event. Defences are mainly located along the River Great Ouse at Houghton and the Hemingfords, Godmanchester, Holywell to Earith and St Neots. A Property Level Resilience scheme has also been implemented at Alconbury and Alconbury Weston.

Level 1 site screening

Potential development sites within the study area were screened against flood risk information to identify sites which would potentially need to be taken forward to a Level 2 SFRA. The screening also identified sites where additional modelling would be required, for example, sites where there is a watercourse that is not included in the Environment Agency's Flood Zone 2 and 3 coverage, or where Flood Zones 2 and 3a exist but further modelling was required to identify Flood Zone 3b and climate change as well as depth, velocity and hazard information. Additional 2D modelling was then undertaken for these sites for the purposes of the SFRA. For all other sites, results from Environment Agency hydraulic models were used.

On completion of the modelling, the sites were screened again to provide a summary of risk to each site including: the proportion of the site in each Flood Zone, the proportion of the site at risk from surface water and reservoir inundation, and whether the site is within, or partially within, the Environment Agency's Historic Flood Map.

Of the 87 potential development sites provided by Huntingdonshire District Council for assessment, 18 were at risk in Flood Zones 3b, 3a and 2, 11 were at risk in Flood Zones 3a and 2, and nine were at risk in Flood Zone 2. Of the remaining sites, all but six were shown to be at risk of surface water flooding. It should be noted that the proportion of the site at risk varied. Full details are provided in Table 12-1.

Where sites are shown to be in Flood Zones 2 and 3, flood risk to the sites has been assessed and summarised in more detail in a series of detailed summary tables as part of the Level 2 SFRA

Summary of Level 2 Assessment

Assessment methods

As part of the Level 2 SFRA, detailed site summary tables have been produced for each of the potential development sites taken forward from the Level 1 assessment. These sites are ones which are shown to be at risk of fluvial flood risk from watercourses running either through or adjacent to the site.

The summary tables set out the flood risk to each site, including maps of extent, depth and velocity of flooding as well as hazard mapping. Each table also sets out the flood risk implications for the site as well as guidance for site-specific FRAs. A broad scale assessment of possible SuDS constraints has also been provided giving an indication where there may be constraints to certain sets of SuDS components.

Flood risk information for the sites is largely from Environment Agency detailed hydraulic models, with the exception of the following sites, for which additional 2D modelling was undertaken for the SFRA to provide the level of detail required.

- St Neots East
- Alconbury Weald
- East of Silver Street, Buckden
- Lodge Farm, Huntingdon
- North East of Alconbury Airfield 2
- Cromwell Road North, St Neots
- North of Clyde Farm, Godmanchester

Strategic flood risk solutions

- It is preferential that developments take a sequential approach to site layout, with the development being placed furthest away from the source of flood risk where sites are shown to be in Flood Zones 2 and 3.
- The construction of upstream storage schemes on watercourses within the District may provide one potential strategic solution to flood risk. Watercourses which are rural in their upper reaches but have high levels of flood risk to urban areas in the downstream reaches are potential candidates, as the open land in the upper reaches can potentially provide the space for an attenuation area, providing benefit to the urban area downstream. However, site assessments have shown that the majority of sites are too small, or are on urbanised watercourses, to provide storage. Further studies would be required to assess the feasibility, whether there is any benefit and, if so, whether the benefits would outweigh the costs.
- Floodplain restoration is one option which could benefit the District on a strategic level. De-culverting may help reduce flood risk by removing constrictions that lead to a build-up of flood water

Recommendations

Development control

Sequential approach to development

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

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

Sequential and Exception tests

The SFRA has identified that areas of Huntingdonshire are at high risk of flooding from both fluvial and surface water sources. Therefore, a large number of proposed development sites will be required to pass the Sequential and, where necessary, Exception Tests in accordance with the NPPF. Huntingdonshire District Council should use the information in this SFRA when deciding which development sites to take forward in their Local Plan.

Developers should consult with Huntingdonshire District Council, Cambridgeshire County Council, the Environment Agency, Anglian Water and, where necessary, relevant IDBs at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

Site-specific flood risk assessments

The Level 2 SFRA is not intended to replace site-specific FRAs. Site specific FRAs are required by developers to provide a greater level of detail on flood risk and any protection provided by defences and, where necessary, demonstrate the development passes part b of the Exception Test.

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), inform development zoning within the site and prove, if required, whether the Exception Test can be passed. Where a site specific FRA has produced modelling outlines which differ from the Flood Map for Planning then a full evidence based review would be required; where this is acceptable to the EA then amendments to the Flood Map for Planning may take place. Where the watercourses are embanked, the effect of overtopping and breach must be considered an appropriately assessed.

All new development within the 1% AEP flood extent including an allowance for climate change (for the lifetime of the development) must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage. Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water, and seek opportunities to provide floodplain betterment. Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain should be provided to ensure that the total volume of the floodplain storage is not reduced.

Planning applicants should also consult with the Environment Agency, LLFA, relevant IDB (if in IDB district) and Anglian Water at an early stage to discuss FRA and/or consent requirements.

Drainage strategies and SuDS

- Planners should be aware of the conditions for surface water management and ensure development proposals and applications are compliant with policy. SuDS are approved as part of the planning application for a development. It is the Local Planning Authority's (LPA) responsibility to ensure that the design submitted as part of either an outline or full planning application is robust and contains adequate detail to ensure that the SuDS are appropriate for the development and will be adequately maintained throughout their lifetime. The LPA may also seek expert advice from the LLFA as part of this process.
- A surface water drainage strategy is required to be submitted with a planning application which should contain details of the SuDS. Its scope should be commensurate with the size of development and can range from a paragraph describing the proposed drainage measures with a discharge location for residential extension, to extensive hydrological modelling accompanied by a full report with drawings for a larger site. Section 6.7 of the Cambridgeshire Flood and Water **SPD** provides further information on developing a surface water drainage strategy.
- The residual risk and maintenance of sustainable drainage and surface water systems must be clearly set out as part of a drainage strategy. Initial agreements should be in place to cover management funding for the lifetime of the development. Section 6.9 of the Cambridgeshire Flood and Water **SPD** provides further information on adoption and maintenance of SuDS.
- SuDS should be designed by a competent design team that works together from the outset to deliver a successful scheme. In many cases, overall costs savings can be realised where multiple benefits such as improved open spaces, recreational areas and surface water drainage function in one area. Principles governing SuDS design in Huntingdonshire are discussed in Section 6.3 of the Cambridgeshire Flood and Water **SPD**.

Windfall sites

The acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms.

In the event of there being no windfall policy, it may be possible for the local authority to apply the Sequential Test taking into account reasonably available sites, historic windfall rates and their distribution across the district relative to Flood Zones.

Council review of planning applications

The Council should consult the Environment Agency's 'Flood Risk Standing Advice (FRSA) for Local Planning Authorities', last updated 15 April 2015, when reviewing planning applications for proposed developments at risk of flooding, as well as the Cambridgeshire Flood and Water SPD. The Council will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases, also contact non-statutory consultees (e.g. IDBs or Anglian Water) that have an interest in the planning application.

Infrastructure and Access

Safe access and egress

Safe access and egress will need to be demonstrated at all development sites; the development should be above the 1% AEP event plus an allowance for climate change, and emergency vehicular access should be possible during times of flood. Finished Floor Levels should be above the 1% AEP event plus an allowance for climate change and an appropriate allowance for freeboard.

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

Future flood management in Huntingdonshire

Flood defences

Developers should include an assessment of the residual risk where developments are located in areas benefitting from defences. They should consider both the impact of breach, including the effect on safe access and egress, as well as potential for flood risk to increase in the future due to overtopping. Any improvements to defences should ensure they are in keeping with wider catchment policy.

Strategic solutions

- The construction of new upstream storage schemes as part of upstream catchment-based approaches is one possible solution. Watercourses which are rural in their upper reaches but have high levels of flood risk to urban areas in the downstream reaches are potential candidates, as the open land in the upper reaches can potentially provide the space for an attenuation area, providing benefit to the urban area downstream.
- Floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, for example by bank stabilisation, re-naturalisation, structure removal/ modification and enhancing outfalls in the riparian environment.

Use of SFRA data

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

This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

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

The SFRA should be **periodically updated** when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by Huntingdonshire District Council, Cambridgeshire County Council (in its role as LLFA), the Highways Authority, IDBs, Anglian Water and the Environment Agency. It is recommended that the SFRA is reviewed internally on an annual basis, allowing a cycle of review, followed by checking with the above bodies for any new information to allow a periodic update.

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Using this document

Hyperlinks

Hyperlinks have been provided where there are useful reference points. These are shown as **green bold text.**

Abbreviations and Glossary of Terms

Term	Definition
1D model	One-dimensional hydraulic model
2D model	Two-dimensional hydraulic model
AEP	Annual Exceedance Probability
Areas Benefitted from Defences	Areas that benefit from flood defences in the event of a river flood with a 1% chance of happening in any one year
Awarded watercourse	Awarded watercourses are those whose maintenance responsibility lies with the relevant local authority
Brownfield	Previously developed parcel of land
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CDA	Critical Drainage Area - A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Defra	Department for Environment, Food and Rural Affairs
Designated Feature	A form of legal protection or status reserved for certain key structures or features that are privately owned and maintained, but which make a contribution to the flood or coastal erosion risk management of people and property at a particular location.
DG5 Register	A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
FEH	Flood Estimation Handbook
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Flood and Water Management Act (2010)	Part of the UK Government's response to Sir Michael Pitt's report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FRA	Flood Risk Assessment - A site specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FWMA	Flood and Water Management Act
FZ	Flood Zones
Greenfield	Undeveloped parcel of land
Ha	Hectare

Term	Definition
HELAA	Housing and Economic Land Availability Assessment. A technical piece of evidence to support local plans and Sites & Policies Development Plan Documents (DPDs). Its purpose is to test the in-principle suitability of sites proposed to HDC for housing or economic development
IDB (Internal Drainage Board)	A type of operating authority which is established in areas of special drainage need in England and Wales with permissive powers to undertake work to secure clean water drainage and water level management within drainage districts
Indicative Flood Risk Area	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
LFRMS	Local Flood Risk Management Strategy
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
mAOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
Major development	Residential development: 10 dwellings or more, or site area of 0.5 hectares or more if dwelling numbers are unknown. Non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more, or where the flood area is not yet known, a site area of one hectare or more.
NPPF	National Planning Policy Framework
NRD	National Receptor Database
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
OS NGR	Ordnance Survey National Grid Reference
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity.
PPG	National Planning Policy Guidance
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SHLAA	Strategic Housing Land Availability Assessment - The Strategic Housing Land Availability Assessment (SHLAA) is a technical piece of evidence to support local plans and Sites & Policies Development Plan Documents (DPDs). Its purpose is to demonstrate that there is a supply of housing land in the District which is suitable and deliverable.
SFRA	Strategic Flood Risk Assessment

Term	Definition
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event AEP. For example, a flood embankment could be described as providing a 1% AEP standard of protection.
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
uFMfSW	Updated Flood Map for Surface Water
WFD	Water Framework Directive

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1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

> ***"Local Plans should be supported by a strategic flood risk assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as Lead Local Flood Authorities and Internal Drainage Boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change".*** (National Planning Policy Framework, paragraph 100)

This Strategic Flood Risk Assessment (SFRA) 2016 document replaces the Level 1 SFRA update originally published by Huntingdonshire District Council in April 2010. The original SFRA was completed and published in October 2004. The SFRA study area is shown in Figure 1-1. The main purpose of the SFRA is to inform the selection of options for Local Plan allocations and support determination of planning applications.

The key objectives of the 2016 SFRA are:

- To provide up to date information and guidance on flood risk for Huntingdonshire, taking into account the latest flood risk information and the current state of national planning policy
- To determine the variations in risk from all sources of flooding in Huntingdonshire
- Identify the requirements for site-specific flood risk assessments
- Determine the acceptability of flood risk in relation to emergency planning capability
- Consider opportunities to reduce flood risk to existing communities and developments

1.2 Levels of SFRA

The Planning Practice Guidance advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

1. Level One: where flooding is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test.
2. Level Two: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all the necessary development creating the need to apply the NPPF's Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This report fulfils both Level One and Level Two SFRA requirements.

1.3 SFRA outputs

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

1.3.1 Level one outputs

- Assessment of all potential sources of flooding
- Mapping of location and extent of functional floodplain
- Assessment of standard of protection provided by existing flood risk management infrastructure
- Assessment of the potential impact of climate change on flood risk
- Assessment of locations where additional development may increase flood risk elsewhere
- Identification of critical drainage areas and recommendations on potential need for Surface Water Management Plans
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.

- Guidance for developers including requirements for site specific flood risk assessments and the process for evidence based reviews (flood map challenges).

1.3.2 Level two outputs

The content of the Level Two SFRA includes:

- Assessment of flood risk, including from extreme (0.1% AEP) events
- Assessment of protection provided by defences and where improvements may be required in the future
- Assessment of existing flood warning and emergency planning procedures
- Assessment of the effect of land use and natural and man-made structures
- Recommendations on the requirements for drainage control and impact mitigation such as Sustainable Drainage Systems (SuDS) and design solutions that could reduce flood risk
- Assessment of any catchment wide or strategic solutions, e.g. upstream balancing, to mitigate against the risk of flooding during a 1% AEP event

Detailed site summary tables have been produced for each site taken forward to the Level 2 assessment. These tables include the following information

- Site area
- Proportion of the site in each Flood Zone
- NPPF and Exception Test guidance
- Mapping including Flood Zones, climate change and surface water
- Depth, hazard and velocity mapping
- A broad scale assessment of suitable SuDS components and considerations
- The presence of any flood defences
- Whether the site is covered by a flood warning service
- Whether there are any access and egress issues for the site
- The potential impacts of climate change in the future
- Advice on the preparation of site-specific FRAs and considerations for developers

1.4 SFRA user guide

Table 1-1: SFRA report contents

Section	Contents
1. Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultation performed.
2. The Planning Framework and Flood Risk Policy	Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study.
3.The Sequential, risk based approach	Describes the Sequential Approach and application of Sequential and Exception Tests.
4. Climate change	Outlines climate change guidance and the implications for Huntingdonshire.
5. Sources of information used in preparing the SFRA	Outlines what information has been used in the preparation of the SFRA
6. Understanding flood risk in Huntingdonshire	Gives an introduction to the assessment of flood risk and provides an overview of the characteristics of flooding affecting the district. Provides a summary of responses that can be made to flood risk, together with policy and institutional issues that should be considered.
7. Internal Drainage Boards	Discussion of the role of Internal Drainage Boards in the District.

Section	Contents
8. Flood defences	Assessment of residual risk from flood defences, including future protection from climate change.
9. FRA requirements and flood risk management guidance	Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Provides guidance for developers and outlines conditions set by the LLFA that should be followed.
10. Surface water management and SuDS	Advice on managing surface water run-off and flooding
11. Flood warning and emergency planning	Outlines the flood warning service in the Huntingdonshire District and provides advice for emergency planning, evacuation plans and safe access and egress.
12. Strategic Flood Risk Solutions	Summary of strategic flood risk solutions.
13. Level 1 assessment of potential development sites	Summarise the flood risk from all sources to all sites supplied by Huntingdonshire District Council for assessment in the SFRA. Outlines which sites have been taken forward to the Level 2 assessment.
14. Level 2 Assessment of potential development sites	Detailed assessment of specific sites to determine variations in flood risk across the site and identify any site-specific flood risk assessment requirements.
15. Summary	Review of the Level 1 and Level 2 SFRA.
16. Recommendations	Identifies recommendations for the council to consider as part of Flood Risk Management policy.
Appendix A: Detailed Site Summary Tables	Detailed Level 2 assessments for proposed development sites that are shown to be at flood risk.
Appendix B: Watercourses	Locations of Main Rivers and Ordinary Watercourses
Appendix C: Flood map for Planning	District-wide maps of Flood Zones
Appendix D: Climate change fluvial flood risk mapping	District-wide maps of the 2080s climate change allowances (to be updated following climate change modelling completion).
Appendix E: Surface water flood risk mapping	District-wide maps of the updated Flood Map for Surface Water.
Appendix F: Areas Susceptible to Groundwater Flooding	District-wide maps of the Areas Susceptible to Groundwater Flooding dataset.
Appendix G: Flood Warning Coverage	Maps showing the extent of the Environment Agency's Flood Warning Service.
Appendix H Site Specific FRA Checklist	Check list to assist developers and planners with site specific flood risk assessments, with links back to the main SFRA report.

1.5 Consultation

The following parties (external to Huntingdonshire District Council) have been consulted during the preparation of this version of the SFRA:

- Environment Agency
- Cambridgeshire County council (as Lead Local Flood Authority)
- Anglian Water
- Internal Drainage Boards
- Neighbouring local authorities

1.6 Use of SFRA data

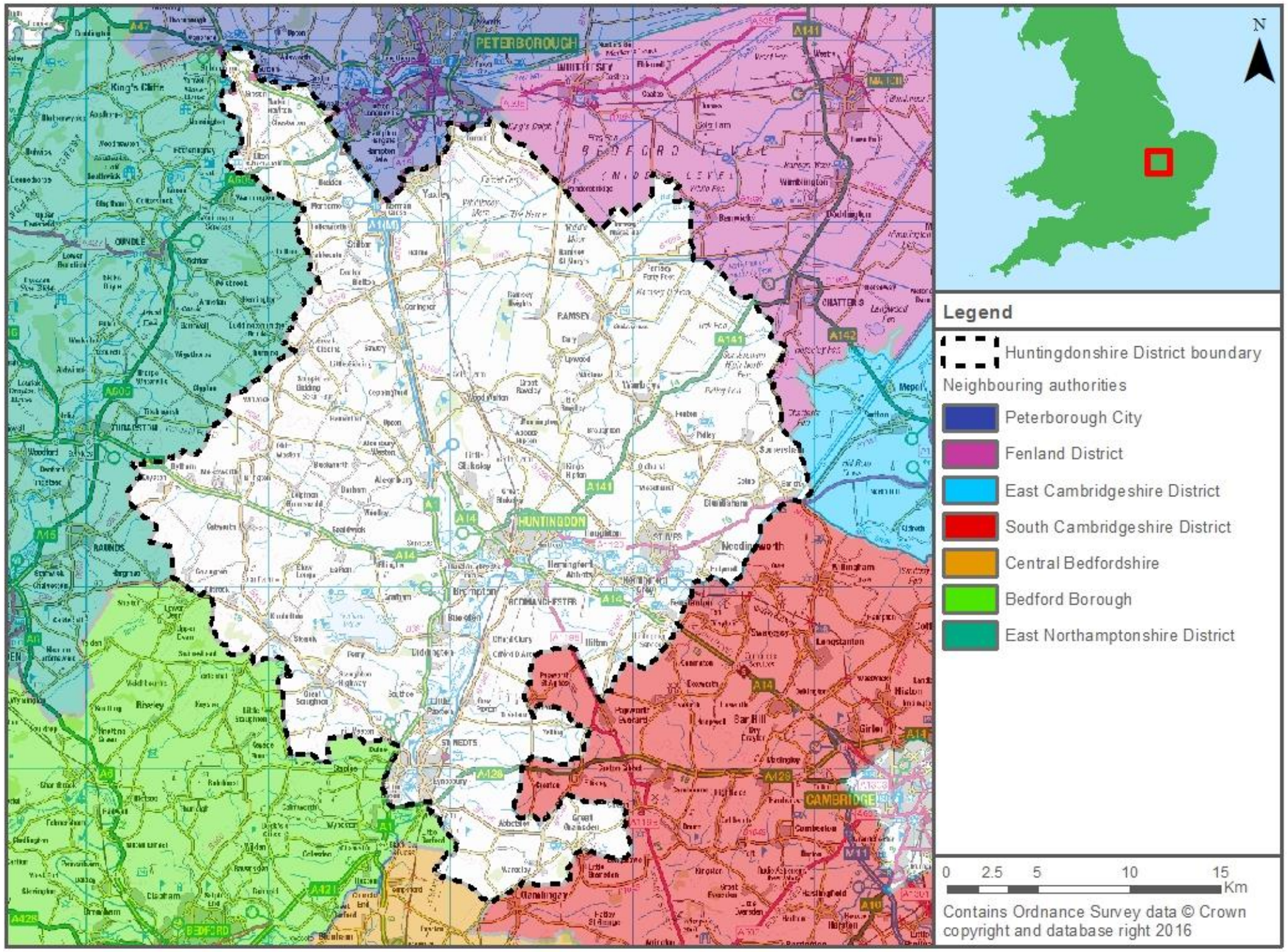
It is important to recognise that SFRAs are high level strategic documents and, as such, do not go into detail on an individual site-specific basis. The SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

New information on flood risk may be provided by Huntingdonshire District Council, the Highways Authority, Cambridgeshire County Council, IDBs, Anglian Water and the Environment Agency. Such information may be in the form of:

- New hydraulic modelling results
- Flood event information following a flood event
- Policy/ legislation updates
- Environment Agency flood map updates
- New flood defence schemes etc.

The Environment Agency regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed Flood Risk Assessment.

Figure 1-1: Study area



2 The Planning Framework and Flood Risk Strategic documents

2.1 Introduction

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is taken into account at every stage of the planning process. This section of the SFRA provides an overview of the planning framework, flood risk policy and strategic documents and flood risk responsibilities.

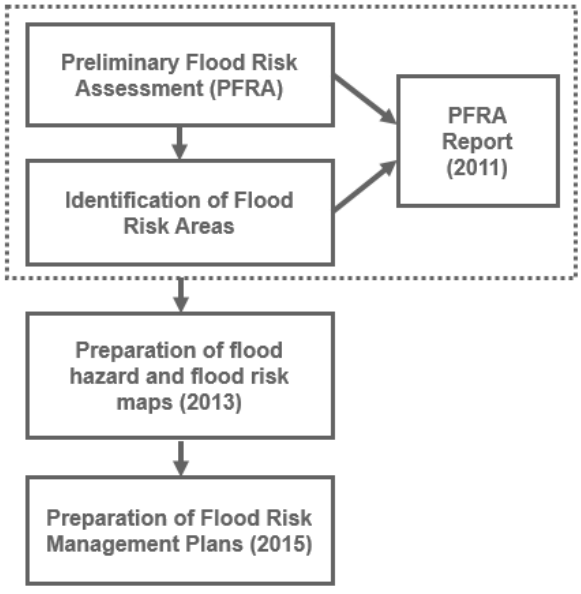
2.2 Flood Risk Regulations (2009) and Flood and Water Management Act (2010)

2.2.1 Flood Risk Regulations, 2009

The Flood Risk Regulations (2009) translate the current EU Floods Directive into UK law and place responsibility upon all Lead Local Flood Authorities (LLFAs) to manage localised flood risk. Under the Regulations, the responsibility for flooding from rivers, the sea and reservoirs lies with the Environment Agency; however, responsibility for local and all other sources of flooding rests with LLFAs. In the instance of this SFRA, the LLFA is Cambridgeshire County Council. Detail on the responsibilities of LLFAs is provided in Section 2.11.

Figure 2-1 illustrates the steps were taken to implement the requirements of the EU Directive in the UK via the Flood Risk Regulations.

Figure 2-1: Flood Risk Regulation Requirements



The next cycle of the Flood Risk Regulations has now begun (2015 – 2021).

2.2.2 Preliminary Flood Risk Assessments (PFRAs)

Under this action plan and in accordance with the Regulations, LLFAs had the task of preparing a Preliminary Flood Risk Assessment (PFRA) report.

PFRAs report on significant past and future flooding from all sources except from Main Rivers and reservoirs, which are covered by the Environment Agency, and sub-standard performance of the adopted sewer network (covered under the remit of Anglian Water). PFRAs are a high-level screening exercise and consider floods which have significant harmful consequences for human health, economic activity, the environment and cultural heritage. The **PFRA document** that covers the study area was published by Cambridgeshire County Council in 2011. The Regulations require the LLFA to identify significant Flood Risk Areas. The threshold for designating significant Flood Risk Areas is defined by Defra and the PFRA is the process by which these locations can be identified.

Of the ten national indicative Flood Risk Areas that were identified by the Defra/Environment Agency, none encroach on the administrative area of Huntingdonshire District Council and the indicative designations have been accepted.

No Flood Risk Areas have been identified based on critical infrastructure/access routes, sewer/surface water problems and areas prone to significant ponding.

The PFRA will be reviewed as part of the new cycle of the Flood Risk Regulations. The new / reviewed PFRA will be prepared for June 2017 and is due to be submitted to the European Union (EU) in December 2017. More accurate modelling of surface water (the updated Flood Map for Surface Water) has been made available since the 2011 PFRA was published, which means there is more potential for surface water related Flood Risk Areas.

2.2.3 Flood Risk Management Plans (FRMPs)

Under the Regulations the Environment Agency exercised an 'Exception' and did not prepare a PFRA for risk from rivers, reservoirs and the sea. Instead they had to prepare and publish a FRMP. The FRMP summarises the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations. The final **Anglian River Basin District Draft Flood Risk Management Plan** (FRMP) was issued in March 2016 and covers the period of 2015 to 2021. The FRMP draws on policies and actions identified in Catchment Flood Management Plans (section 0) and also incorporates information from Local Flood Risk Management Strategies (Section 0). The Plan will be updated as part of the new cycle of the Flood Risk Regulations and is due to be published in December 2021.

2.2.4 Flood and Water Management Act (FWMA), 2010

Following the 2007 floods, Sir Michael Pitt was appointed to chair an independent review into the floods. The **final report** was published in June 2008. The **Flood and Water Management Act** (2010) implements Sir Michael Pitt's recommendations and aims to create a simpler and more effective means of managing both flood risk and coastal erosion.

The FWMA established Lead Local Flood Authorities (LLFAs). Cambridgeshire County Council is the LLFA for the Huntingdonshire District. Further information on the LLFA role and responsibilities are provided in Section 2.11.2.

2.2.5 Cambridgeshire Local Flood Risk Management Strategy (2015)

Cambridgeshire County Council is responsible for developing, maintaining, applying and monitoring a **LFRMS** for Cambridgeshire, which covers Huntingdonshire. The Strategy is used as a means by which the LLFA co-ordinates Flood Risk Management on a day to day basis. The Strategy also sets measures to manage local flood risk i.e. flood risk from surface water, groundwater and Ordinary Watercourses.

The high-level objectives proposed in the Strategy for managing flood risk are:

1. Understanding flood risk in Cambridgeshire
2. Managing the likelihood of flooding
3. Helping Cambridgeshire's citizens to manage their own risk
4. Ensuring appropriate development in Cambridgeshire
5. Improving flood prediction, warning and post flood recovery

The Strategy also sets out an action plan of how the LLFA intends to achieve these objectives. The Strategy should be updated regularly or when key triggers are activated. An example of a key trigger would be issues such as amendments to partner responsibilities, updates to legislation, alterations in the nature or understanding of flood risk or a significant flood event.

2.2.6 The National Flood and Coastal Erosion Risk Management Strategy for England (2011)

The **National Flood and Coastal Erosion Risk Management Strategy for England** provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. It was prepared by the Environment Agency with input from Defra.

The Strategy builds on existing approaches to flood and coastal risk management and promotes the use of a wide range of measures to manage risk. It describes how risk should be managed in a co-ordinated way within catchments and along the coast and balance the needs of communities, the economy and the environment.

The strategy encourages more effective risk management by enabling people, communities, business, infrastructure operators and the public sector to work together to:

- ensure a clear understanding of the risks of flooding and coastal erosion, nationally and locally, so that investment in risk management can be prioritised more effectively;
- set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the remaining risk;
- manage flood and coastal erosion risks in an appropriate way, taking account of the needs of communities and the environment;
- ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond effectively to flood forecasts, warnings and advice;
- help communities to recover more quickly and effectively after incidents.

2.3 National Planning Policy and Guidance

The **National Planning Policy Framework** (NPPF) was issued in 2012 to replace the previous documentation as part of reforms to make the planning system less complex and more accessible, and to protect the environment and promote sustainable growth. It replaces most of the Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs) that were referred to in the previous version of the SFRA. The NPPF sets out the Government's requirements for the planning system and provides a framework within which local people and councils can produce distinctive local and neighbourhood plans to reflect the needs and properties of their communities. The NPPF must be taken into account by local planning authorities when preparing Local Plans and for applicants preparing planning submissions.

National Planning Practice Guidance (NPPG) was published in 2014 and sets out how the NPPF should be implemented. **NPPG: Flood Risk and Coastal Change** advises on how planning can account for the risks associated with flooding and coastal change in plan making and the application process. It sets out Flood Zones, the appropriate land uses for each zone, flood risk assessment requirements, including the Sequential and Exception Tests and the policy aims for developers and authorities regarding each Flood Zone. Further details on Flood Zones and associated policy is provided in Table 3-1 and throughout this report. The Sequential and Exception tests are covered in greater detail in Sections 3.2 to 3.4.

The Sequential Test

"The Sequential Test ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The flood zones, as refined in the Strategic Flood Risk Assessment for the area, provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required".

(National Planning Practice Guidance, paragraph 019)

The Exception Test

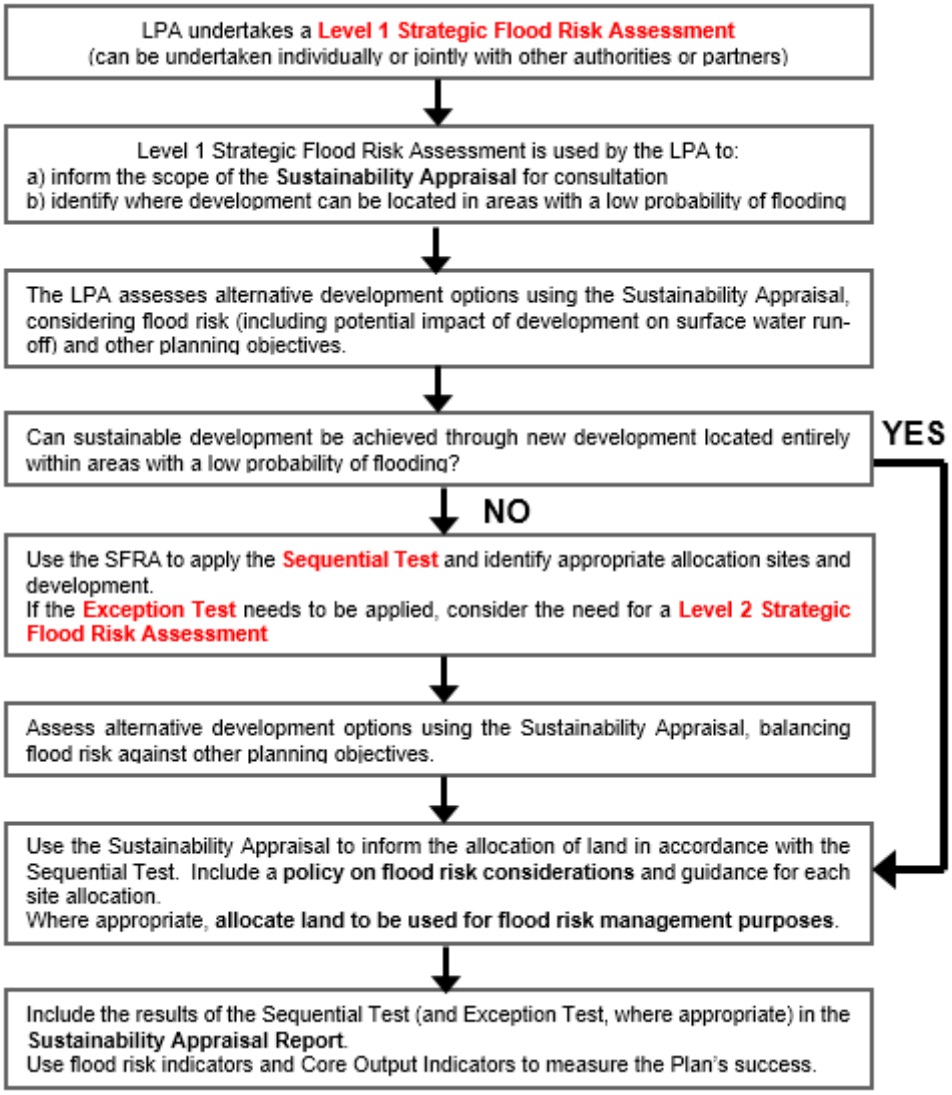
"The Exception Test, as set out in paragraph 102 of the NPPF, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

Essentially, the two parts to the Test require proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.".

(National Planning Practice Guidance, paragraph 023)

A description of how flood risk should be taken into account in the preparation of Local Plans is outlined in Diagram 1 contained within the Planning Practice Guidance (Figure 2-2).

Figure 2-2: Flood risk and the preparation of Local Plans†



† Diagram 1 of NPPG: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-005-20140306) March 2014

2.4 Cambridgeshire Flood and Water Supplementary Planning Document (SPD)

Supplementary Planning Documents (SPDs) are intended to expand upon policy or provide further detail to policies in adopted Development Plan Documents (DPDs). When adopted, SPDs form part of the Local Development Framework.

The Cambridgeshire Flood and Water SPD has been prepared by Cambridgeshire County Council (as the Lead Local Flood Authority) in conjunction with the other Cambridgeshire local planning authorities, and other relevant stakeholders to support the implementation of flood risk and water related policies. Huntingdonshire District Council intend to formally adopt the SPD in 2017.

The SPD provides guidance on the approach that should be taken to design new developments to manage and mitigate flood risk and include sustainable drainage systems. It is a material consideration when considering planning applications. It does not introduce new policy but rather it is intended to elaborate on, and be consistent with, existing and emerging local plan policies.

The SPD contains chapters containing guidance for applications on managing flood risk and the water environment in and around new developments within Cambridgeshire.

- **Chapter 1 Introduction**

  An introduction into the background of the SPD and how it should be used by applicants, consultants, design teams, development management officers and other interested parties
- **Chapter 2 Setting the Scene**

  Overview of European and national context on flood risk and water management, as well as further details on the local plans and policies associated with Cambridgeshire
- **Chapter 3 Working together with Water Management Authorities**

  Details of the key water management authorities that may need to be consulted by the applicant during the planning application, including pre-application and planning application stages.
- **Chapter 4 Guidance on managing flood risk**

  Provides specific advice on how to address flood risk issues within the planning process, including the application of the 'sequential approach' to flood risk and producing site specific flood risk assessments
- **Chapter 5 Managing and mitigating risk**

  Covers ways in which risk can be appropriately addressed through good site design
- **Chapter 6 Surface water and SuDS**

  Looks at a number of design methods and how they can be incorporated into SuDS that form part of a proposed development. Further guidance in given on the adoption and maintenance of SuDS.
- **Chapter 7 Water Environment**

  Discusses the water environment in more detail in relation to Water Framework Directive (WFD) requirements for the protection and improvement of water quality, water habitats, geomorphology and biodiversity.

The SPD should be used by

- Applicants when considering new sites for development
- Applicants when preparing the brief for their design team to ensure drainage and water management schemes are sustainably designed
- Consultants when carrying out site specific flood risk assessments
- Design teams preparing masterplans, landscape and surface water drainage schemes
- Development management officers and their specialist consultees when determining delegated planning applications, selecting appropriate planning conditions, making recommendations to committees and drawing up S106 obligations that include contributions for SuDS
- Other interested parties (e.g. Local Members) who wish to better understand the interaction between development, flooding and drainage issues

2.5 Planning, surface water and SuDS

On 18 December 2014 a **Written Ministerial Statement** laid by the Secretary of State for Communities and Local Government set out changes to the planning process that would apply for major development from 6 April 2015.

Major developments are defined as

- residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known; and
- Non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of 1 hectare or more.

When considering major planning applications, Local Planning Authorities should consult the LLFA on the management of surface water in order to satisfy that:

- the proposed minimum standards of operation are appropriate

- there are clear arrangements for on-going maintenance over the development's lifetime, through the use of planning conditions or planning obligations.

In March 2015 the LLFA was made a statutory consultee which came into effect on 15 April 2015. As a result, Cambridgeshire County Council, is required to provide technical advice on surface water drainage strategies and designs put forward for new major developments.

2.5.1 Defra Non-Statutory Technical Standards for SuDS

On March 23 2015, the Department for Environment, Food and Rural Affairs (Defra) published the **Non-Statutory Technical Standards for SuDS**. The standards should be used in conjunction with the NPPF and NPPG. These standards cover the following

- Flood risk outside the development
- Peak flow control
- Volume control
- Flood risk within the development
- Structural integrity
- Designing for maintenance considerations
- Construction

2.5.2 Cambridgeshire County Council's Surface Water Guidance

This **document** is designed to break down the technical requirements of any surface water drainage scheme into small pieces which relate the application of SuDS to various stages of the planning process.

SuDS Concept: the key concepts involved in the application of SuDS.

Planning Application Guidance: this mainly concerns applications for outline planning permission which should detail one workable solution of managing surface water.

Discharge of Surface Water Condition: guidance on the minimum requirement of Cambridgeshire County Council in order to recommend that the LPA discharges a surface water planning condition. As well as listing the points covered within the requirements for outline planning permission it also sets out points that would need to be addressed to remove a surface water planning condition.

2.5.3 Cambridgeshire County Council's Drainage Proforma

This **document** acts as a checklist for developers wishing to submit a surface water management strategy for consideration by the LLFA. It is suggested that this proforma is completed and sent to the LPA to help streamline the process in assessing surface water drainage proposals and ensure that the correct information is submitted as part of the planning application.

The process of the LPA review of the strategy is detailed as the following:

- Stage 1 – Assess the principles of sustainable drainage by identifying what methods are proposed to manage surface water drainage. This will involve assessing whether water is discharged by the most appropriate means (e.g. infiltration, a surface water body or sewer system).
- Stage 2 – Assess the technical detail of the application against the relevant standards. This relates to elements such as runoff rates, runoff volumes and residual risk.
- Stage 3 – Assess whether enough information is provided to ensure adoption and whether long term maintenance is viable.

2.5.4 C753 CIRIA SuDS Manual (2015)

The **C753 CIRIA SuDS Manual** (2015) replaces and updates the previous version (C697) providing up to date guidance on planning, design, construction and maintenance of SuDS. The document is designed to help the implementation of these features into new and existing developments, whilst maximising the key benefits regarding flood risk and water quality. The manual is divided into five sections ranging from a high level overview of SuDS, progressing to

more detailed guidance with progression through the document. It is recommended that developers and the LPA utilise the information within the manual to help design SuDS which are appropriate for a development.

2.6 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments.

2.6.1 Cambridgeshire County Council SWMP – Countywide Update (2014)

The update to the **Cambridgeshire SWMP** (2014) focussed on building on the methods and information of the previous SWMP and a number of recommendations were made following the analysis

- Revisit the approach of weighting historic flooding incidents since it has an important part in the overall ranking of wet spots.
- For wet spots with a high frequency of historic flood incidents it is important that Cambridgeshire County Council continue to collate and review information to inform future decisions on maintenance programs.
- Cambridge County Council to undertake discussions with 3rd party asset owners to determine ongoing resilience and mitigation measures and inform decisions on critical infrastructure.
- Action a proactive prioritisation of the outputs of the study to help Cambridgeshire County Council and its partners demonstrate effective flood resilience planning.

2.6.2 St Neots SWMP (2012)

The **St Neots SWMP** was conducted in response to findings of the original countywide SWMP which identified St Neots as a priority wet spot. This document provides information on how to best deal with flood issues in this area.

A number of engineering options were tested and assessed in terms of flood risk and economic benefits. These engineering solutions were designed to improve local flood risk rather than improve flood risk for the whole of St Neots. Additionally, a number of recommendations have been put forward for further investigation and consideration following the outputs of the study.

2.6.3 Godmanchester SWMP

A SWMP also exists for Godmanchester but a copy was not available at the time of preparing this report.

2.7 Water Cycle Studies

Climate Change is predicted to present unprecedented new challenges, such as more frequent and extreme rainfall events and rising global temperatures, which are expected to exert greater pressure on the existing infrastructure. Planning for water management therefore has to take these potential challenges into account. A large number of new homes for instance may cause the existing water management infrastructure to be overwhelmed which would result in adverse effects on the environment, both locally and in wider catchments.

Water Cycle Studies assist Local Authorities to select and develop sustainable development allocations so that there is minimal impact on the environment, water quality, water resources, and infrastructure and flood risk. This can be achieved in areas where there may be conflict between any proposed development and the requirements of the environment through the recommendation of potential sustainable solutions.

A **Water Cycle Study** for Huntingdonshire District Council was completed in 2008. Phase 1 of the Water Cycle Study identified no unsurmountable technical constraints to the proposed level of growth within the study area. However, it did identify a number of important issues which need to be further investigated in Phase 2 of the Water Cycle Study. These include the following:

- Develop an integrated drainage strategy / Surface Water Management Plan
- Detailed analysis of flow regime to develop detailed technical solutions and costings to mitigate increased flood risk in Swavesey Drain.
- Investigate the viability of achieving water neutrality via detailed cost benefit analysis to determine practical achievability of the aspirational suggested in the study.

A detailed (Stage 2) Water Cycle Study was completed in 2012 and an **update** published in 2014. The 2014 Water Cycle Study was undertaken to account for additional growth over a longer plan period to 2036. The study looked at waste water treatment capacity, ecological impacts and flood risk implications, sewer capacities, the water supply strategy and surface water drainage management. It goes on to provide a number of recommendations relating to development phasing, discharge and capacity issues, water efficiency, water quality and biodiversity enhancement.

2.8 Catchment Flood Management Plans

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

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

The six national policies are:

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

2.8.1 Great Ouse CFMP (2011)

The study area is covered by the **Great Ouse CFMP**. The primary policy unit for Huntingdonshire is 'Sub Area 7'. The area is covered by Policy Option 3, which is for areas of low to moderate flood risk where the Environment Agency are generally managing existing flood risk effectively. The proposed actions to implement this policy are the following:

- Continue with the current flood risk management.
- Investigate options to provide local property-level flood mitigation for Huntingdon and Brampton to reduce flood risk in low magnitude flood events.
- Continue with improvements to the flood warning service by extending the current Flood Warnings Direct Service.
- Ensure any policies within the Local Development Framework, or any revisions, are in line with the CFMP policy.
- Work with partners to develop emergency response plans for critical infrastructure, community facilities and transport links at risk from flooding.
- Continue with, and implement, the recommendations from the Cambridgeshire County Surface Water Management Scoping Study.

2.9 River Basin Management Plans

River Basin Management Plans (RBMPs) are prepared under the Water Framework Directive (WFD) and assess the pressure facing the water environment in River Basin Districts. Huntingdonshire area falls within the Anglian River Basin District.

The updated 2015 **Anglian RBMP** identified a number of pressures on the water environment and significant water management issues.

The RBMP describes how development and land-use planning needs to consider a number of issues relevant to the RBMP including sustainable drainage systems, green and blue infrastructure, sewage treatment options (tertiary phosphate treatments), water efficiency measures, infrastructure and development locations and the reduction of nutrients from diffuse pollution. The RBMP provides a summary of measures to protect and improve the water environment in the river basin district. One action relevant to flood risk is the need to renaturalise heavily modified watercourses, to restore natural floodplains, remove obstructions and slow down the rate of flow. Further information on renaturalisation is provided in Section 11.3.

2.10 Riparian ownership

A riparian owner is the person who owns the land on which, or adjacent to, a watercourse flows through. The law presumes, in the absence of any other evidence, that the land adjoining the watercourse includes the watercourse to its mid-point; therefore, there may be more than one riparian owner of a watercourse.

Anyone with a watercourse in or adjacent to their land has rights and responsibilities as a riparian owner. The Environment Agency, LLFA and other risk management authorities have permissive powers to work on watercourses under their jurisdiction, however, they are not required to do so.

Under land drainage law, watercourses cannot be obstructed and the riparian owner must accept water flowing onto their land.

Further information on the rights and responsibilities of riparian owners has been provided in a **guidance document** prepared by Cambridgeshire County Council.

2.11 Roles and responsibilities of Risk Management Authorities in Huntingdonshire

The roles and responsibilities of Risk Management Authorities (RMAs) in Huntingdonshire are summarised below.

2.11.1 Huntingdonshire District Council

As a Local Planning Authority, Huntingdonshire District Council assess, consult on and determine whether or not development proposals are acceptable, ensuring that flooding and other, similar, risks are effectively managed.

The council will consult relevant statutory consultees as part of planning application assessments and may, in some cases, also contact non-statutory consultees, such as IDBs and Anglian Water, that have an interest in the planning application.

Huntingdonshire District Council also have a responsibility to maintain ‘awarded’ watercourses, as well as having statutory powers to modify or remove inappropriate structures within channels on ordinary watercourses, along with other flood protection responsibilities they have powers to take action against those whose actions increase flood risk or make management of that risk more difficult. A map of awarded watercourses is provided in Appendix B.2.

2.11.2 Cambridgeshire County Council

As a LLFA Cambridgeshire County Council duties include:

- Local Flood Risk Management Strategy (LFRMS): LLFAs must develop, maintain, apply and monitor a LFRMS to outline how they will manage flood risk, identify areas vulnerable to flooding and target resources where they are needed most.
- Flood Investigations: When appropriate and necessary LLFAs must investigate and report on flooding incidents (Section 19 investigations).

- Register of Flood Risk Features: LLFAs must establish and maintain a register of structures or features which, in their opinion, are likely to have a significant effect on flood risk in the LLFA area.
- Designation of Features: LLFAs may exercise powers to designate structures and features that affect flood risk, requiring the owner to seek consent from the authority to alter, remove or replace it.
- Consenting: When appropriate LLFAs will perform consenting of works on ordinary watercourses.

Cambridgeshire County Council is also the Local Highway Authority and manages highway drainage, carrying out maintenance and improvement works on an on-going basis, as necessary, to maintain existing standards of flood protection for highways, making appropriate allowances for climate change. It also has the responsibility to ensure road projects to no increase flood risk.

2.11.3 Environment Agency

The Environment Agency is responsible for protecting and enhancing the environment as a whole and contributing to the government's aim of achieving sustainable development in England and Wales. The Environment Agency has powers to work on Main Rivers to manage flood risk. These powers are permissive, which means they are not a duty, and they allow the Environment Agency to carry out flood and coastal risk management work and to regulate the actions of other flood risk management authorities on main rivers and the coast.

The EA also has powers to regulate and consent works to Main Rivers. Prior written consent is required from the Environment Agency for any work in, under, over or within nine metres of a Main River or between the high water line and the secondary line of defence e.g. earth embankment. The Environment Agency also has a strategic overview role across all types of flooding as well as other types of water management matters

2.11.4 Internal Drainage Boards

IDBs are local public authorities that manage water levels. They are an integral part of managing flood risk and land drainage within areas of special drainage need in England and Wales. IDBs are predominantly associated with the Fen area. However, they do exist in other landscapes extending into The Fens, the Fen Margin and the Central Claylands. The following IDBs operate within Huntingdonshire District

- Middle Level Commissioners (MLC)

  The MLC exercise jurisdiction over the major rivers of the Middle Level Area, such as the Forty Foot River, Ramsey High Lode, Great Raveley Drain, Middle Level Catchwater Drain, Monks Lode, New Dike and Old River Nene.

  As well as their role as an IDB, the MLC also provide an engineering, planning and environmental consultancy service to the IDBs within and adjacent to their area. These IDBs include
  - Benwick
  - Bluntisham
  - Conington and Holme
  - Ramsey First
  - Ramsey Forth
  - Ramsey, Upwood and Great Raveley
  - Sawtry
  - Sutton and Mepal
  - Warboys, Somersham and Pidley

  The IDBs within the Middle Level Area look after the smaller arterial watercourses within their drainage districts. Most of these watercourses are pumped and discharge runoff into the Middle Level watercourses.

  Although the MLC are not, technically, an IDB, the term IDB has been used broadly to refer to all relevant IDBs under its jurisdiction.
- Ramsey IDB

Ramsey IDB formed from an amalgamation of two drainage boards, the Ramsey 2nd (Stocking Fen) IDB and the Ramsey 5th (Lodes End) IDB.

- Whittlesey Consortium of IDBs

  The Whittlesey Consortium of IDBs currently look after four separate boards, of which the following three cover parts of Huntingdonshire
  - Holmewood and District IDB
  - Whittlesey and District IDB
  - Woodwalton IDB
- Bedford Group of Internal Drainage Boards
  - The Bedfordshire Group of Internal Drainage Boards (BGoIDBs) is split into three drainage districts; of the three, the Alconbury and Ellington Board covers part of Huntingdonshire

Roles and responsibilities for IDBs include the following

- IDBs have permissive powers to undertake work to provide water level management within their Internal Drainage District. They undertake works to reduce flood risk to people and property and manage water levels for local needs, this includes the maintenance of rivers, drainage channels, outfalls and pumping stations

They input into the planning system by facilitating the drainage of new and existing developments within their districts and advising on planning application. However, they are not a statutory consultee to the planning process

- In some cases, a development meeting the following criteria may be required to submit an FRA to the IDB to support any consent applications
  - Development within or adjacent to a drain/watercourse, and/or flood defence structure within the area of an IDB
  - Development within the channel of any ordinary watercourse within an IDB area
  - Where direct discharge of surface water or treated effluent is proposed into an IDB catchment
  - Any development proposal affecting more than one watercourse in an IDBs area and having possible strategic implications
  - Development in an IDB that is an area of known flood risk
  - Development within the maintenance access strips provided under the IDBs bylaws
  - Any other application that may have material drainage implications.
- Some IDBs have other duties, powers and responsibilities under specific legislation. For example, Middle Level Commissioners is also a navigation authority.

Further information on IDBs in Huntingdonshire are provided in Section 6.4.4.

2.11.5 Water and wastewater providers

Anglian Water is the sewerage undertaker for Huntingdonshire. They have the responsibility to maintain surface, foul and combined public sewers to ensure the area is effectively drained. When flows (foul or surface water) are proposed to enter public sewers, Anglian Water will assess whether the public system has the capacity to accept these flows as part of their pre-application service. If there is not available capacity, they will provide a solution that identifies the necessary mitigation. Anglian Water also comments on the available capacity of foul and surface water sewers as part of the planning application process. Further information can be found on their **website**.

Two different water service providers, Cambridge Water and Anglian Water, supply potable water to Huntingdonshire. Consent, prior to commencing work, is required from the relevant provider if installing water systems, or altering existing systems, is intended.

2.12 When to consult water management authorities

The Cambridgeshire Flood and Water SPD sets out when key water management authorities should be consulted.

Key authority	When to consult
Huntingdonshire District Council	Pre-application consultation is recommended to identify the range of issues that may affect the site and, following on from the Sequential and, if necessary, Exception Test, determine whether the site is suitable for its intended use. Should be consulted where an awarded watercourse runs within or adjacent to proposed development consultation
Environment Agency	Should be **consulted** on development, other than minor or as defined in the Environment Agency's Flood Risk Standing Advice document within Flood Zone 2 or 3, or in Flood Zone 1 where critical drainage problems have been notified to the LPA. Consultation will also be required for any development projects within 20m of a Main River or flood defence, and other water management matters.
Cambridgeshire County Council (LLFA)	Where the proposed work will either affect or use an ordinary watercourse or require consent permission, outside of an IDB's rateable area. As of the 15th April 2015 the LLFA should be consulted on surface water drainage proposal for all major developments
Cambridgeshire County Council (Local Highway Authority)	Where the proposed development will either involve a new access to the local highway network or increase or change traffic movements
Highways England	When the quality and capacity of the **Highways England** (strategic) road network could be affected.
Historic England	Whilst Historic England are not a WMA, they should be consulted where proposals may affect heritage assets and their settings.
Natural England	**Natural England** has mapped 'risk zones' to help developers and LPAs determine whether consultation is required. This is likely where water bodies with special local or European designations (e.g. SSSI or Ramsar) exists
Anglian Water	**Where** connection to surface water sewers is required, or where the flow to public sewerage system may be affected Where new connections to the water supply network are required or if any alterations are made to existing connections
Cambridge Water	Where new connections to the water supply network are required or if any alterations are made to existing connections
Ramsey IDB	Where proposed development is in, or in close proximity to, an IDB district
Whittlesey Consortium of IDBs	
Bedford Group of IDBs	
IDBs represented by Middle Level Commissioners	

3 The sequential, risk based approach

3.1 Flood Zones

Table 1 of NPPG Flood Risk and Coastal Change identifies the following Flood Zones. These apply to both Main River and Ordinary Watercourses. Flood risk vulnerability and flood zone compatibility is set out in **Table 3** of the NPPG. Table 3-1 summarises this information and also provides information on when an FRA would be required.

Table 3-1: Flood Zone descriptions

Zone	Probability	Description
Zone 1	Low	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
		All land uses are appropriate in this zone.
		For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment.
Zone 2	Medium	This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (0.1% - 1%) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.1% – 0.5%) in any year.
		Essential infrastructure, water compatible infrastructure, less vulnerable and more vulnerable land uses (as set out by NPPF) are appropriate in this zone. Highly vulnerable land uses are allowed as long as they pass the Exception Test.
		All developments in this zone require an FRA.
Zone 3a	High	This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding (>1.0%) or a greater than 1 in 200 annual probability of flooding from the sea (>0.5%) in any year. Developers and the local authorities should seek to reduce the overall level of flood risk, relocating development sequentially to areas of lower flood risk and attempting to restore the floodplain and make open space available for flood storage.
		Water compatible and less vulnerable land uses are permitted in this zone. Highly vulnerable land uses are not permitted. More vulnerable and essential infrastructure are only permitted if they pass the Exception Test.
		All developments in this zone require an FRA.
Zone 3b	Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify, in their SFRA, areas of functional floodplain, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances.
		Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. They must also be safe for users and not increase flood risk elsewhere. Essential Infrastructure will only be permitted if it passes the Exception Test.
		All developments in this zone require an FRA.

3.2 The sequential, risk-based approach

This approach is designed to ensure areas with little or no risk of flooding (from any source) are developed in preference to areas at higher risk, with the aim of keeping development outside of medium and high flood risk areas (Flood Zones 2 and 3) and other sources of flooding, where possible.

The sequential approach can be applied both between and within Flood Zones.

When drawing up a local plan, it is often the case that it is not possible for all new development to be allocated on land that is not at risk from flooding. In these circumstances the Flood Zone maps

(that show the extent of inundation assuming that there are no defences) are too simplistic and a greater understanding of the scale and nature of the flood risks is required.

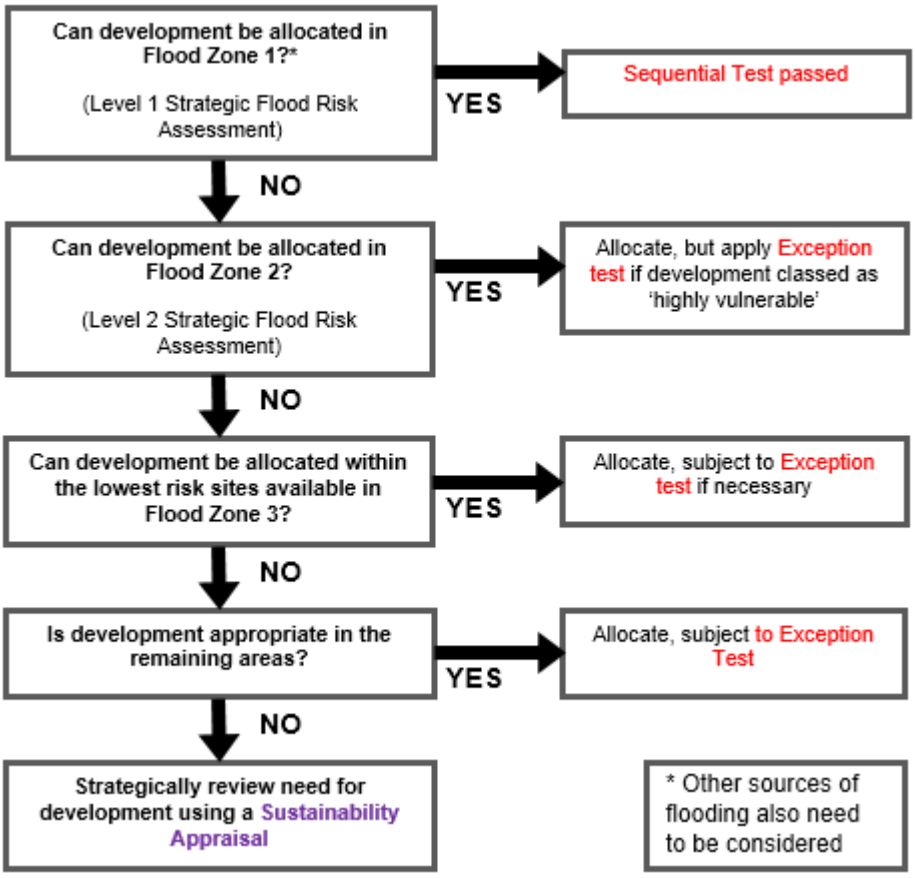
Section 4 of the **Cambridgeshire Flood and Water SPD** provides more detail on the sequential, risk based approach.

3.3 Applying the Sequential Test and Exception Test in the preparation of a Local Plan

When preparing a Local Plan, the Local Planning Authority should demonstrate it has considered a range of site allocations, using SFRAs to apply the Sequential and Exception Tests where necessary.

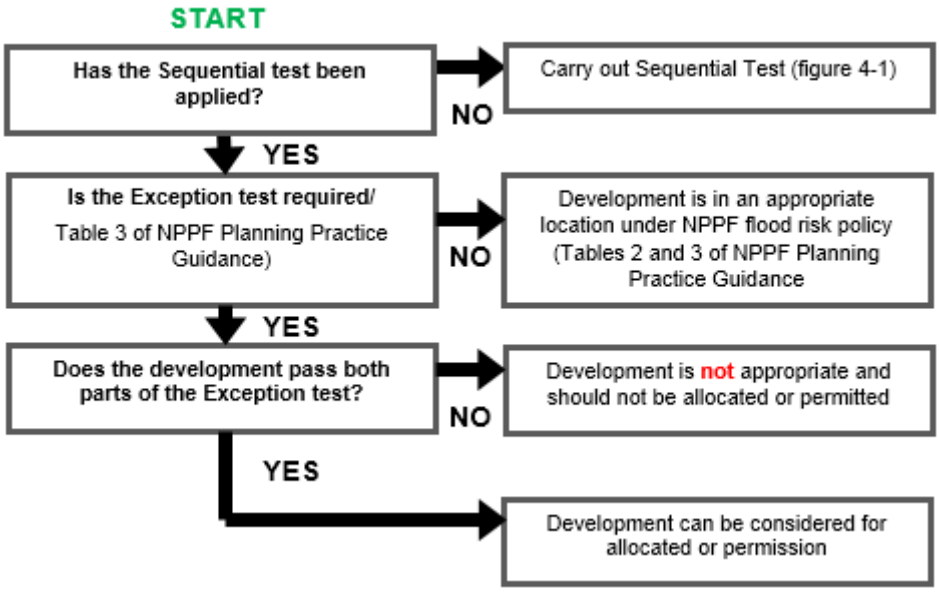
The Sequential Test should be applied to the whole Local Planning Authority area to increase the likelihood of allocating development in areas not at risk of flooding. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of strategic housing land or employment land availability assessments. NPPG for Flood Risk and Coastal Change describes how the **Sequential Test should be applied in the preparation of a Local Plan** (Figure 3-1).

Figure 3-1: Applying the Sequential Test in the preparation of a Local Plan



The Exception Test should only be applied following the application of the Sequential Test and as set out in Table 3 of the NPPG Flood Risk and Coastal Change. The NPPG describes **how the Exception Test should be applied in the preparation of a Local Plan** (Figure 3-2).

Figure 3-2: Applying the Exception Test in the preparation of a Local Plan



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

3.4.1 Sequential Test

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, in other cases it may be identified by other Local Plan policies. A pragmatic approach should be taken when applying the Sequential Test.

Huntingdonshire District Council, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied, and will need to be satisfied that the proposed development would be safe and not lead to increased flood risk elsewhere.

The Sequential Test does not need to be applied for individual developments under the following circumstances:

- The site has been identified in development plans through the Sequential Test.
- Applications for minor development or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site).

It is normally reasonable to presume and state that individual sites that lie in Zone 1 satisfy the requirements of the Sequential Test; however, consideration should be given to risks from all sources, areas with critical drainage problems.

Section 4 of the **Cambridgeshire Flood and Water SPD** provides more detail on the sequential, test.

3.4.2 Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding the Exception Test must then be applied if deemed appropriate. The aim of the Exception Test is to ensure that more vulnerable uses, such as residential development can be implemented safely and are not located in areas where the hazards and consequences of flooding are inappropriate. For the Test to be satisfied, the following two elements have to be accepted for development to be allocated or permitted:

1. **It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared.**

   Local Planning Authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied, and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

2. **A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime, taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.**

   The site-specific Flood Risk Assessment should demonstrate that the site will be safe and the people will not be exposed to hazardous flooding from any source. The following should be considered:

   - The design of any flood defence infrastructure.
   - Access and egress.
   - Operation and maintenance.
   - Design of the development to manage and reduce flood risk wherever possible
   - Resident awareness.
   - Flood warning and evacuation procedures.
   - Any funding arrangements required for implementing measures.

The **NPPG** provides detailed information on how the Test can be applied and Section 4 of the **Cambridgeshire Flood and Water SPD** provides more detail on the Exception test.

3.5 Actual flood risk

If it has not been possible for all future development to be situated in Zone 1 then a more detailed assessment is needed to understand the implications of locating proposed development in Zones 2 or 3. This is accomplished by considering information on the "actual risk" of flooding. The assessment of actual risk takes account of the presence of flood defences and provides a picture of the safety of existing and proposed development. It should be understood that the standard of protection afforded by flood defences is not constant and it is presumed that the required minimum standards for new development are:

- residential development should be protected against flooding with an annual probability of river flooding of 1% (1 in 100-year chance of flooding) in any year; and
- residential development should be protected against flooding with an annual probability of tidal (sea) flooding of 0.5% (1 in 200-year chance of flooding) in any year.

The assessment of the actual risk should take the following issues into account:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for the Flood Risk Management Strategy to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development. Over time the effects of climate change may reduce the standard of protection afforded by defences, due to increased river flows and levels, and so commitment is needed to invest in the maintenance and upgrade of defences if the

present day levels of protection are to be maintained and where necessary land secured that is required for affordable future flood risk management measures.

- The assessment of actual risk can include consideration of the magnitude of the hazard posed by flooding. By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources. This assessment will be needed in circumstances where a) the consequences of flooding need to be mitigated or b) where it is proposed to place lower vulnerability development in areas of flood risk.

3.6 Impact of additional development on flood risk

When allocating land for development, consideration must be given to the potential cumulative impact of development on flood risk. The increase in impermeable surfaces and resulting increase in runoff increases the chances of surface water flooding if suitable mitigation measures, such as SuDS, are not put in place. Additionally, the increase in runoff may result in more flow entering watercourses, increasing the risk of fluvial flooding downstream.

Consideration must also be given to the potential cumulative impact of the loss of floodplain as a result of development. The effect of the loss of floodplain storage should be assessed, at both the development and elsewhere within the catchment and, if required, the scale and scope of appropriate mitigation should be identified. Further information on flood plain compensation is provided in Section 8.3.4.

Whilst the increase in runoff, or loss in floodplain storage, from individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe without appropriate mitigation measures.

The cumulative impact of development should be considered at the planning application and development design stages and the appropriate mitigation measures undertaken, within an appropriate FRA, to ensure flood risk is not exacerbated, and in many cases the development should be used to improve the flood risk.

Maintenance and upkeep of SuDS have been neglected in the past as a result of lack of clarity over where responsibility for it lies. Therefore, is it important that maintenance and upkeep for mitigation measures, such as SuDS, has been set out as part of a drainage strategy and that management funding for the lifetime of the development has been agreed.

3.7 Cross boundary considerations

The topography and location of the district means that all the major watercourses such as the River Nene and River Great Ouse flow through the study area. As such, future development, both within and outside the borough can have the potential to affect flood risk to existing development and surrounding areas, depending on the effectiveness of SuDS and drainage implementation. Huntingdonshire has boundaries with the following Local Authorities:

- Peterborough City Council
- Fenland District Council
- East Cambridgeshire District Council
- South Cambridgeshire District Council
- Central Bedfordshire Council
- Bedford Borough Council
- East Northamptonshire District Council

Neighbouring authorities were contacted and, where possible, Local Plans and SFRAs were reviewed to assess whether there are any proposed developments that may affect flood risk in the district. Details of any known cross-boundary flooding issues were also requested. Based on the responses received, there is nothing to suggest there will be any developments proposed in neighbouring authorities that would adversely affect flood risk within Huntingdonshire. None of the neighbouring authorities reported any known cross boundary flooding issues.

Development control should ensure that the impact on receiving watercourses from development in Huntingdonshire has been sufficiently considered during the planning stages and appropriate mitigation measures put in place to ensure there is no adverse impact on flood risk or water quality.

4 Climate change

4.1 Climate change and the NPPF

The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. NPPF and NPPG describe how FRAs should demonstrate how flood risk will be managed over the lifetime of the development, taking climate change into account.

4.2 Revised Climate Change Guidance

The Environment Agency published **updated climate change guidance** on 19 February 2016, which supports the NPPF and must now be considered in all new developments and planning applications. The document contains guidance on how climate change should be taken into account when considering development, specifically how allowances for climate change should be included with FRAs. The Environment Agency can give a free preliminary opinion to applicants on their proposals at pre-application stage. There is a charge for more detailed pre-application planning advice.

4.3 Climate change allowances

By making an allowance for climate change it will help reduce the vulnerability of the development and provide resilience to flooding in the future.

The 2016 climate change guidance includes climate change predictions of anticipated change for peak river flow and peak rainfall intensity. The guidance also covers sea level rise and water height. These allowances are based on climate change projections and difference scenarios of carbon dioxide emissions to the atmosphere.

Due to the complexity of projecting climate change, there are uncertainties attributed to climate change allowances. As a result, the guidance presents a range of possibilities to reflect the potential variation in climate change impacts over three periods.

4.4 Peak River Flows

Climate change is expected to increase the frequency, extent and impact of flooding, reflected in peak river flows. Wetter winters and more intense rainfall may increase fluvial flooding and surface water runoff and there may be increased storm intensity in summer. Rising river levels may also increase flood risk.

The peak river flow allowances provided in the guidance show the anticipated changes to peak flow for the river basin district within which the subject watercourse is located. Once the river basin district has been identified, guidance on uplift in peak flows are provided for three allowance categories, Central, Higher Central and Upper End which are based on the 50th, 70th and 90th percentiles respectively. The allowance category to be used is based on the vulnerability classification of the proposed development and the flood zones within which it is to be located.

These allowances are provided, in the form of figures for the total potential change anticipated, for three climate change periods:

- The ‘2020s’ (2015 to 2039)
- The ‘2050s’ (2040 to 2069)
- The ‘2080s’ (2070 to 2115)

The time period used in the assessment depends upon the expected lifetime of the proposed development. Residential development should be considered for a minimum of 100 years, whilst the lifetime of a non-residential development depends upon the characteristics of that development. Further information on what is considered to be the lifetime of development is provided in the **NPPG**.

The allowances for the Anglian River Basin District are provided in Table 4-1.

Table 4-1: Peak river flow allowances for the Anglian river basin district

Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Upper end	25%	35%	65%
Higher central	15%	20%	35%
Central	10%	15%	25%

4.4.1 High++ allowances

High++ allowances only apply in assessments for developments that are very sensitive to flood risk, for example large scale energy generating infrastructure, and that have lifetimes beyond the end of the century. H++ estimates represent the upper limit of plausible climate projections and would not normally be expected for schemes or plans to be designed to or incorporate resilience for the H++ estimate. Further information is provided in the Environment Agency publication, **Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities**.

4.4.2 Which peak river flow allowance to use?

The flood zone and flood risk vulnerability classification should be considered when deciding which allowances apply to the development or the plan. Vulnerability classifications are found in the **NPPG**. The guidance states the following

Flood Zone 2

Vulnerability classification	Central	Higher Central	Upper end
Essential infrastructure		✓	✓
Highly vulnerable		✓	✓
More vulnerable	✓	✓	
Less vulnerable	✓		
Water compatible	None		

Flood Zone 3a

Vulnerability classification	Central	Higher Central	Upper end
Essential infrastructure			✓
Highly vulnerable	Development not permitted		
More vulnerable		✓	✓
Less vulnerable	✓	✓	
Water compatible	✓		

Flood Zone 3b

Vulnerability classification	Central	Higher Central	Upper end
Essential infrastructure			✓
Highly vulnerable	Development not permitted		
More vulnerable			
Less vulnerable			
Water compatible	✓		

4.5 Peak rainfall intensity allowance

Climate change is predicted to result in wetter winters and increased summer storm intensity in the future. Such increased rainfall intensity would affect land and urban drainage systems, resulting in surface water flooding, due to the increased volume of water entering the systems. The table below shows anticipated changes in extreme rainfall intensity in small and urban catchments. These allowances should be used for small catchments and urban drainage sites. For catchments larger than 5km^2, the guidance suggests the peak river flow allowances should be used.

For Flood Risk Assessments, both the central and upper end allowances should be assessed to understand the range of impact.

Table 4-2: Peak rainfall intensity allowance in small and urban catchments

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Cambridgeshire County Council set out how they, as LLFA, expect climate change allowances to be used in FRAs and drainage strategies in their **Surface Water Guidance document**. For SuDS design purposes the central estimate of 20% should be used to assess the performance of the drainage system and ensure it can cope with the critical duration design rainfall event. The 'upper end' of 40% should be used in sensitivity analysis to assess the potential flood risk implications both on and off-site in the critical duration design rainfall event. When using the upper end figure it must be ensured that surface water is wholly contained on site and that flood hazard is within acceptable tolerances.

4.6 Using climate change allowances

To help developers decide which allowances to use to inform the flood levels that the flood risk management strategy will be based on for a development or development plan allocation, the following should be considered:

- likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s)
- vulnerability of the proposed development types or land use allocations to flooding
- 'built in' resilience measures used, for example, raised floor levels
- capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach

4.7 Groundwater

The effect of climate change on groundwater flooding problems, and those watercourses where groundwater has a large influence on winter flood flows, is more uncertain. Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months. The effect of climate change on groundwater levels for sites in areas where groundwater is known to be an issue should be considered at the planning application stage.

4.8 The impact of climate change in Huntingdonshire

Climate change modelling for the watercourses in Huntingdonshire was undertaken based on the new climate change guidance. Existing Environment Agency hydraulic models were run for the 2080s period for all three allowance categories. Mapping of the climate change modelling outputs are provided in Appendix D.

Of the watercourses in Huntingdonshire, modelling showed the Great Ouse, with its wide floodplain, to be the most significantly affected by increased flows due to climate change.

The most significantly affected areas are detailed below. The increase in flood extent as a result of climate change is particularly noticeable in those areas currently protected by flood defences.

- **St Neots:** the flood defences at Riverside Park in St Neots are shown to overtop when the Central climate change allowance for the 2080s (25%) is applied to the 1% AEP flows. The flooding from the overtopping is mainly confined to the St Neots Road and The Paddocks area. When the Higher Central allowance (35%) is applied there is an increase in the extent to Wordsworth Avenue and Orchard Road. The biggest increase in extent is seen when the Upper End allowance is applied, with the flood extent extending as far as Gainsborough Avenue, Alamein Court and Arnhelm Close.
- **Huntingdon:** The most significant increase in flood extent as a result of climate change is seen along Barracks Brook where modelling shows the culvert capacities are exceeded by the increase in flow. The area around the junction of Cromwell Walk, B1044 and B1514 is shown to be at risk from the 1% AEP event when the Higher Central and Upper End allowances are applied. The area around Nursery Road and Chequers Walk is shown to only be at risk from the 1% AEP event when the Upper End allowance is applied
- **Godmanchester:** the flood defences at Godmanchester are shown to overtop in all three 2080s climate change allowance scenarios, with the area north of Cambridge Street / B1044 being the most affected
- **Houghton:** the flood defences in Houghton continue to provide protection against flooding when the Central climate change allowance for the 2080s is applied to the 1% AEP flows. When the Higher Central allowance is applied there is a small area of overtopping of the defence in the Chapel Lane and Mill Street area. However, when the Upper End allowance is applied, the defences are completely overtopped and the majority of Houghton is at risk of flooding
- **Hemingford Grey:** the flood defences in Hemingford Abbots continue to provide protection against flooding when the Central and Higher Central climate change allowance for the 2080s is applied to the 1% AEP flows. However, when the Upper End allowance is applied to the 1% AEP flows, the defences are shown to overtop and flood properties and roads along High Street, Rideaway, New Road, Royal Oak Lane, Common Lane and River Meadow.
- **Hemingford Abbots**: Climate change modelling shows parts of the defences at Hemingford Grey overtop when the Central climate change allowance for the 2080s is applied to the 1% AEP flows. The extent of flooding as a result of overtopping increases when the Higher Central and Upper End flows are applied resulting in the majority of Hemingford Grey at risk of flooding.

The effect of climate change for the 1% AEP event flood extents tends to be less for the tributaries of the Great Ouse, such as the Alconbury Brook and River Kym. The tributaries tend to be in areas of steeper topography with a more confined floodplain and, as a result, increases in flow do not result in a significant increase in flood extent. However, despite climate change not having a significant increase in the flood extent of these watercourses, the modelling does show that those areas that do currently flood are likely to see an increase in flood depths and velocities, and therefore hazard, in the future.

The flat, low-lying nature of the fens, with many areas below sea level, means the area is vulnerable to the effects of climate change. More extreme periods of heavy rainfall in the future may lead to increased flooding as water may not be pumped fast enough. The **Great Fen Project** aims to create a 3,700 hectare landscape of mixed wetland habitats around Woodwalton Fen and Holme Fen National Nature Reserves. One of the aims of this project is to integrate adaptation to climate change by providing increased flood water storage to reduce the impact of climate change on local communities.

No, up-to-date, detailed hydraulic models exist of the majority of the IDB watercourses. Given the highly complex nature of the watercourses, 2D modelling techniques and standard Flood Estimation Handbook methodologies are not considered suitable for providing representative flood extents, therefore no climate change outlines have been included for these watercourses. Developers should develop detailed hydraulic models as part of a site-specific flood risk assessment and include climate change in the assessment.

4.8.1 Adapting to climate change

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

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses
- identifying no or low cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity, for example by leaving areas shown to be at risk of flooding as public open space

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5 Sources of information used in preparing the SFRA

5.1 Fluvial flood mapping

5.1.1 Flood Zones 2 and 3a

Flood Zones 2 and 3a, as shown in Appendix C, show the same extent as the Environment Agency's Flood Map for Planning.

5.1.2 Flood Zone 3b

Flood Zone 3b, as shown in Appendix C, has been compiled for Huntingdonshire District Council as part of this SFRA assessment and is based on the 5% AEP (1 in 20-year) extents produced from Environment Agency detailed hydraulic models. These models include the following watercourses and the extent of the modelled watercourse shown in Figure 5-1.

- Upper Ouse
- Lower Ouse
- River Kym
- Bury Brook
- Alconbury Brook and tributary 1D-2D model
- River Nene
- Barrack Brook
- Non-main river including upper reaches of the Alconbury Brook and tributary, Parsons Drove, Brampton Brook, Heath Drain, Diddington Brook, Hen Brook, Addersley Brook and an unnamed watercourse through Brampton.

For areas not covered by detailed models, a precautionary approach should be adopted for Flood Zone 3b with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site specific flood risk assessment to define the extent of Flood Zone 3b.

For the IDB watercourses, IDB general standard of protection has been reviewed and, in most cases, this is considered to be higher than the 20-year event. Therefore, Flood Zone 3b is restricted to the watercourse channel. Where the standard of protection is lower this has been highlighted in the SFRA report (see Section 6.4.4). Development in IDB districts should, where appropriate, undertake a more detailed assessment to determine the extent of Flood Zone 3b, through detailed modelling and consultation with the relevant IDB.

5.1.3 Additional modelling undertaken for the Level 2 SFRA

Additional modelling was also undertaken for the Level 2 SFRA for the following scenarios

- Where development sites are located in Flood Zone 1 in the Environment Agency's Flood Map for Planning, but Ordnance Survey mapping shows a watercourse flows through, or adjacent to the site. This was applicable to the following sites
  - St Neots East
  - Alconbury Weald
  - East of Silver Street, Buckden
  - Lodge Farm, Huntingdon
  - North East of Alconbury Airfield 2

- Where development sites are located in Flood Zone 2 or 3 in the Environment Agency's Flood Map for Planning, but no detailed hydraulic model exists. This was applicable to the following sites
  - Cromwell Road North, St Neots
  - North of Clyde Farm, Godmanchester

In the above scenarios, 2D modelling was undertaken to model a truncated section of the watercourse where it flowed through or adjacent to the site. This modelling provided the required information for the Level 2 assessment (flood extents, climate change extents, and depth, velocity

and hazard mapping information) to help inform the council's decision making when determining which sites to allocate in the local plan. The results from this modelling are not shown in Appendix C and D as it has not been used to undertake a full evidence based review. More detailed modelling with be required as part of a site-specific FRA to confirm Flood Zone extents and, if the results differ from the Flood Map for Planning, then a full, evidence based review will be required; where this is acceptable to the Environment Agency then amendments to the Flood Map for Planning may take place.

The locations of the watercourses modelled for the SFRA are shown in Figure 5-2.

5.1.4 Hazard mapping

Hazard ratings are calculated directly within the modelling packages using depth and velocity results and utilises the classifications of hazard presented in **DEFRA R&D Technical Report FD2320:** Flood Risk assessment Guidance for New Development.

5.1.5 Watercourses in IDB districts

No, up-to-date, detailed hydraulic models exist for the IDB watercourses. Given the highly complex nature of the watercourses, 2D modelling techniques and standard Flood Estimation Handbook methodologies are not considered suitable for providing representative flood extents. More detailed modelling was outside the scope of this study and therefore no Flood Zone 3b or climate change outlines have been produced for these watercourses.

Level 2 assessments for sites in IDB districts

Where sites were shown to be in the Flood Map for Planning Flood Zone 2 and 3, a shortened version of the site summary table has been produced. These tables exclude information on depth, hazard and velocity and climate change which are only available through detailed modelling. This is applicable to the following sites

- Ramsey Gateway, Ramsey
- Ramsey Gateway (High Lode), Ramsey
- South of The Foundry, Factory Bank, Ramsey
- East of Brookside, Sawtry
- Bill Hall Way, Sawtry
- Newtown Road, Ramsey

A detailed hydraulic model of the relevant board system should be produced as part of the evidence base for any associated detailed flood risk assessment in the IDB area. Developers will also have to provide the IDB with adequate evidence to prove that a viable scheme for appropriate water level/flood risk management exists. Breach and overtopping modelling, where relevant, as well as climate change should be included in the assessment. It is recommended the IDBs are contacted at an early stage to ensure the complexity of the system is taken into account.

Further information for planning, consents and contact information can be found on the IDB websites

- **Middle Level Commissioners (and associated IDBs)**
- **Bedford Group of IDBs (for Alconbury and Ellington IDB**
- **Whittlesey Consortium of IDBs**
- **Ramsey IDB**

Figure 5-1: Environment Agency modelled watercourses

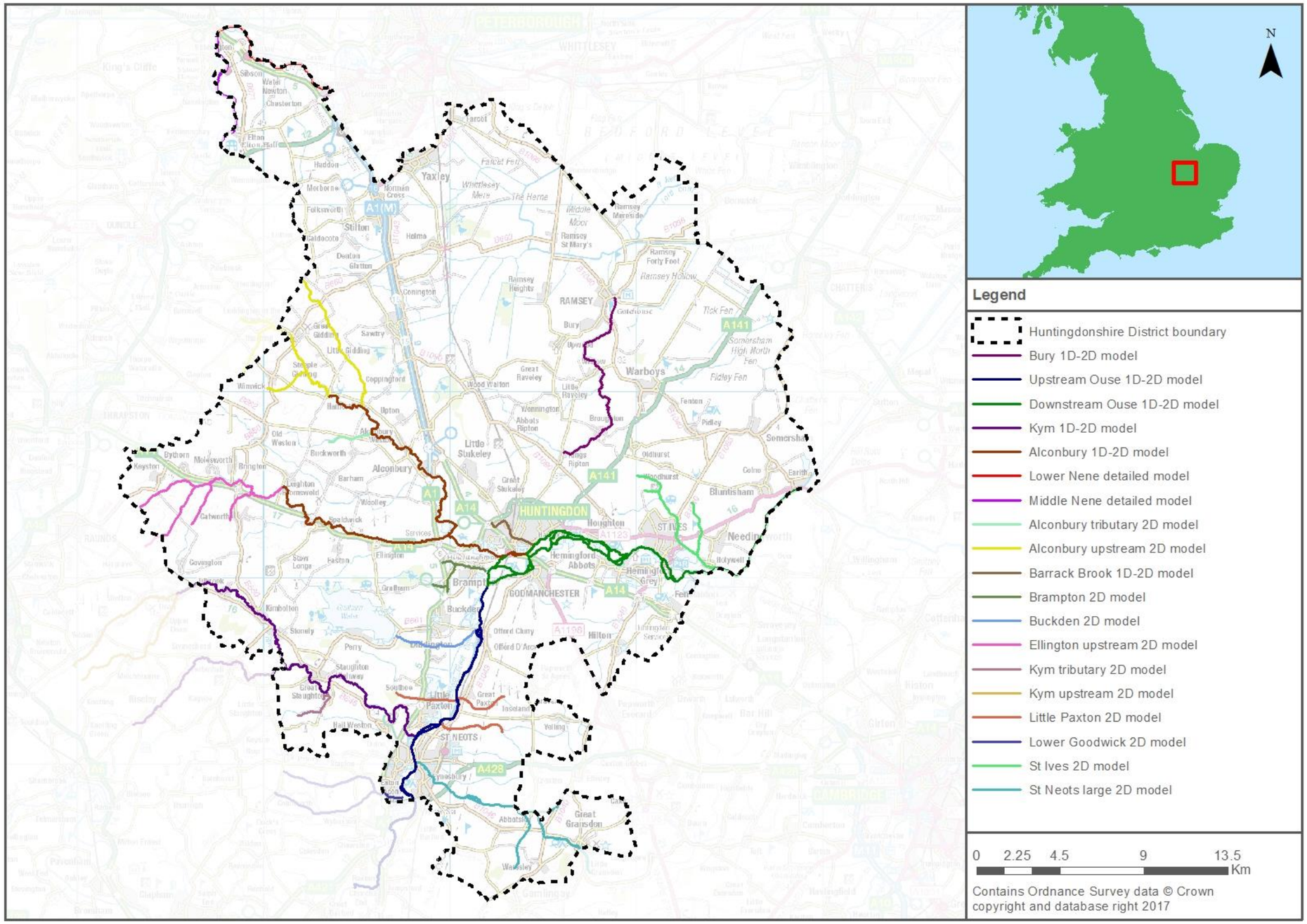
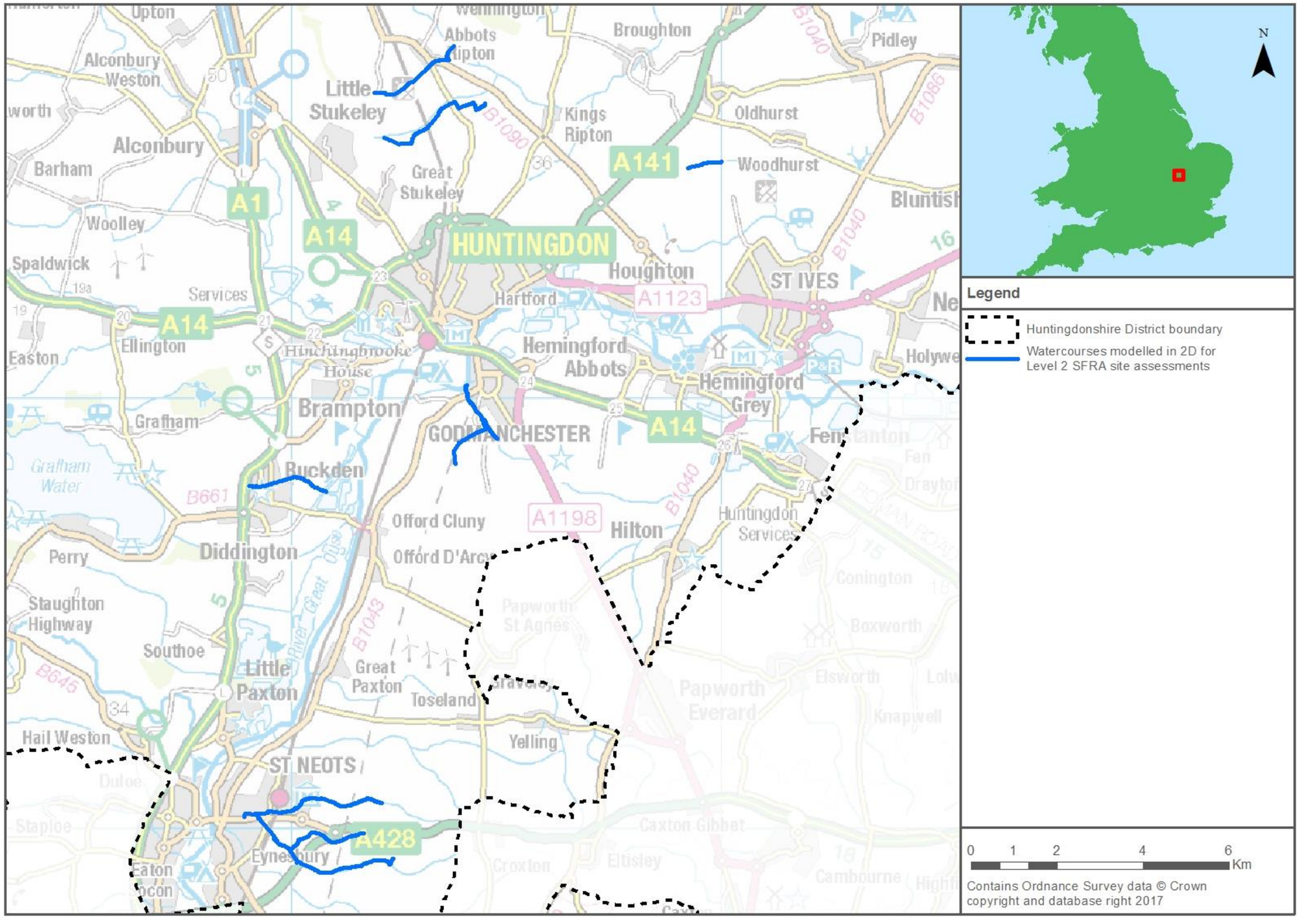


Figure 5-2: SFRA modelled watercourses



5.2 Climate change

Climate change modelling for the watercourses in Huntingdonshire was undertaken based on the new climate change guidance. Existing Environment Agency hydraulic models, as well as the SFRA 2D hydraulic models, were run for the 2080s period for all three allowance categories. Further detail is provided in Section 4.8.

Where no hydraulic models exist, no climate change modelling was undertaken. Developers should develop detailed hydraulic models as part of a site-specific flood risk assessment and include climate change in the assessment.

5.3 Surface Water

Mapping of surface water flood risk in Huntingdonshire has been taken from the updated Flood Map for Surface Water (uFMfSW) published online by the Environment Agency. These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the Environment Agency and any potential developers to focus their management of surface water flood risk.

The uFMfSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water (Table 5-1).

Table 5-1: uFMfSW risk categories

Category	Definition
High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year.
Low	Flooding occurring as a result of rainfall of between 1 in 1,000 (0.1%) and 1 in 100 (1%) chance in any given year.
Very Low	Flooding occurring as a result of rainfall with less than 1 in 1,000 (0.1%) chance in any given year.

Although the uFMfSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site specific scale. Such an assessment will use the uFMfSW in partnership with other sources of local flooding information to confirm the presence of a surface water risk at that particular location.

5.4 Groundwater

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater (AStGW) dataset.

The AStGW dataset is a strategic-scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and does not take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The AStGW data should be used only in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

5.5 Sewers

Historical incidents of flooding are detailed by Anglian Water through their DG5 register. The DG5 database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding. This data was requested from Anglian Water but was not provided at the time of completing this report.

5.6 Reservoirs

The risk of inundation as a result of reservoir breach or failure of a number of reservoirs within the area has been mapped using the outlines produced as part of the National Inundation Reservoir Mapping (NIRIM) study.

5.7 Suite of Maps

All of the mapping can be found in the appendices to this SFRA and is presented in the following structure:

- Appendix B: Watercourses in Huntingdonshire
  - B.1. Main Rivers
  - B.2. Awarded watercourses
  - B.3. Ordinary watercourses
  - B.4. IDB districts and watercourses
- Appendix C: Environment Agency Flood Map for Planning, including Flood Zone 3b derived for the SFRA
- Appendix D: Climate Change Mapping
- Appendix E: Surface Water Mapping
- Appendix F: Groundwater Mapping
- Appendix G: Flood Warning Coverage

5.8 Other relevant flood risk information

Users of this SFRA should also refer to other relevant information on flood risk where available and appropriate. This information includes:

- **Great Ouse Catchment Flood Management Plan (2011)**

  Provides information on the catchment-wide strategy for flood risk management. It should be ensured that any flood risk management measures are consistent with the strategy.

- **Cambridgeshire County Council Local Flood Risk Management Strategy 2015-2020** (2015)

  Provides information on local flooding issues and the plan for managing risk. It should be ensured that development and any flood risk management measures are consistent with the Plan

- **Cambridgeshire County Council Surface Water Management Plan** (Countywide Update 2014)

  Provides information on surface water flooding issues for St Neots and the plan for managing risk. It should be ensured that any surface water management measures are consistent with the Plan

- **St Neots Surface Water Management Plan** (2012)

  Provides information on surface water flooding issues for St Neots and the plan for managing risk. It should be ensured that any surface water management measures are consistent with the Plan.

- **Huntingdonshire District Council Water Cycle Study** (2014)

  Developers and planners should use the WCS as a starting point when considering any water supply, sewerage or water quality constraints on a development.

- **Anglian Flood Risk Management Plan**

  Provides information on the catchment-wide strategy for flood risk management. It should be ensured that any flood risk management measures are consistent with the strategy.

- **Environment Agency's Asset Information Management System (AIMS)** – users should note that recently completed schemes may not yet be included in this dataset. Provides information on assets in the area. Can be used to identify where residual risk should be assessed.

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6 Understanding flood risk in Huntingdonshire District

6.1 Historical flooding

Huntingdonshire has a history of documented flood events with the main source being from 'fluvial' (river/watercourse networks) sources.

Details of this flooding identified in the 2004 Huntingdonshire SFRA, and additional events since 2004, are summarised as follows:

- Houghton Field Drain and Kings Brook flooding in 1993, 1996 and 2001. The factories, located at the confluence were recorded to have flooded in these events by the Environment Agency.
- Godmanchester was recorded to have flooded in 1998 and 2001 from an upstream tributary of the Great Ouse River. The Environment Agency has identified that the access to No.2 Cows Lane was affected by the floodwaters in 1998, and the properties of Cambridge Villas were flooded in 2001.
- St Neots has previously flooded in 1993, 1998 and 2001 from Hen Brook, Fox Brook and the Great Ouse and has been identified to have flooded previously from surface water.
- Wintringham Brook has also been recorded to have flooded various properties in Manor Grove, St Neots in 2001.
- Colne Brook flooded Lorne Cottage, Colne in 1989, 1993 and 2003. Since this time, the pipe culvert under the road has been straightened and further improvements to the culvert have been undertaken on Earith Road.
- Huntingdon Town Park has flooded previously from Barracks Brook.
- St Ives, built on the banks of the wide Great Ouse River between Huntingdon and Ely, has flooded frequently in the past. The most significant floods were in 1947, Easter 1998 and January 2003[1]. Since these events occurred, extensive flood protection works were carried out in St Ives in 2006/2007. These defences were recorded to have been breached in December 2012[2].
- Alconbury and Alconbury Weston suffered large amounts of flooding from the Alconbury Brook in 1998, November 2000, October 2004, January 2007, November 2012[3] and March 2016.
- Surface water flooding from a water main burst inundated Needingworth Road on the A1123 (St Ives) in April 2015[4].
- Surface water and fluvial flooding affecting the A14 at Junction 21[5]

6.2 Demographics

The Huntingdonshire study area covers an area of approximately 910km^2 and has a population of approximately 169,500 (Census 2011).

6.3 Topography, geology, and soils

6.3.1 Topography

The topography of the study area can be seen in Figure 6-1 and is primarily comprised of higher elevations in the eastern part of the district. These areas reach approximate elevations of 71 metres Above Ordnance Datum (mAOD), decreasing in an easterly direction. Some areas of Huntingdonshire in the Fens area are below sea level.

1 http://www.st-ives.info/history/floods2003/

2 http://www.huntspost.co.uk/news/environment_agency_investigating_possible_breach_in_st_ives_flood_defences_1_1788646

3 http://www.huntspost.co.uk/news/gallery_flood_warning_lifted_for_parts_of_huntingdonshire_but_floods_continue_to_cause_havoc_to_motorists_as_roads_are_heavily_congested_1_1711239

4 http://www.huntspost.co.uk/news/burst_water_main_forces_road_closure_in_st_ives_1_4025067

5 http://www.cambridge-news.co.uk/A14-closed-flooding-Huntingdon/story-28897194-detail/story.html

6.3.2 Geology and soils

The geology of the catchment can be an important influencing factor on the way that water runs off the ground surface. This is primarily due to variations in the permeability of the surface material and bedrock stratigraphy.

Figure 6-2 shows the bedrock (solid permeable) formations in the District and Figure 6-3 shows the superficial (permeable, unconsolidated (loose) deposits). These are classified as the following:

- Principal: layers of rock or drift deposits with high permeability which, therefore, provide a high level of water storage
- Secondary A: rock layers or drift deposits capable of supporting water supplies at a local level and, in some cases, forming an important source of base flow to rivers
- Secondary B: lower permeability layers of rock or drift deposits which may store and yield limited amounts of groundwater
- Secondary undifferentiated: rock types where it is not possible to attribute either category a or b.
- Unproductive Strata: rock layers and drift deposits with low permeability and therefore have negligible significance for water supply or river base flow.

The majority of the bedrock in the district is classed as unproductive strata, associated with mudstone, siltstone and sandstone. There is a small area of Principal aquifer to the south and a mix of Secondary aquifer in the very north, associated with limestone. The superficial deposits in the District comprise mainly of Secondary aquifer to the south and along river corridors, with an area of unproductive strata to the north associated with the fenland peat deposits.

Figure 6-1: Huntingdonshire Topography

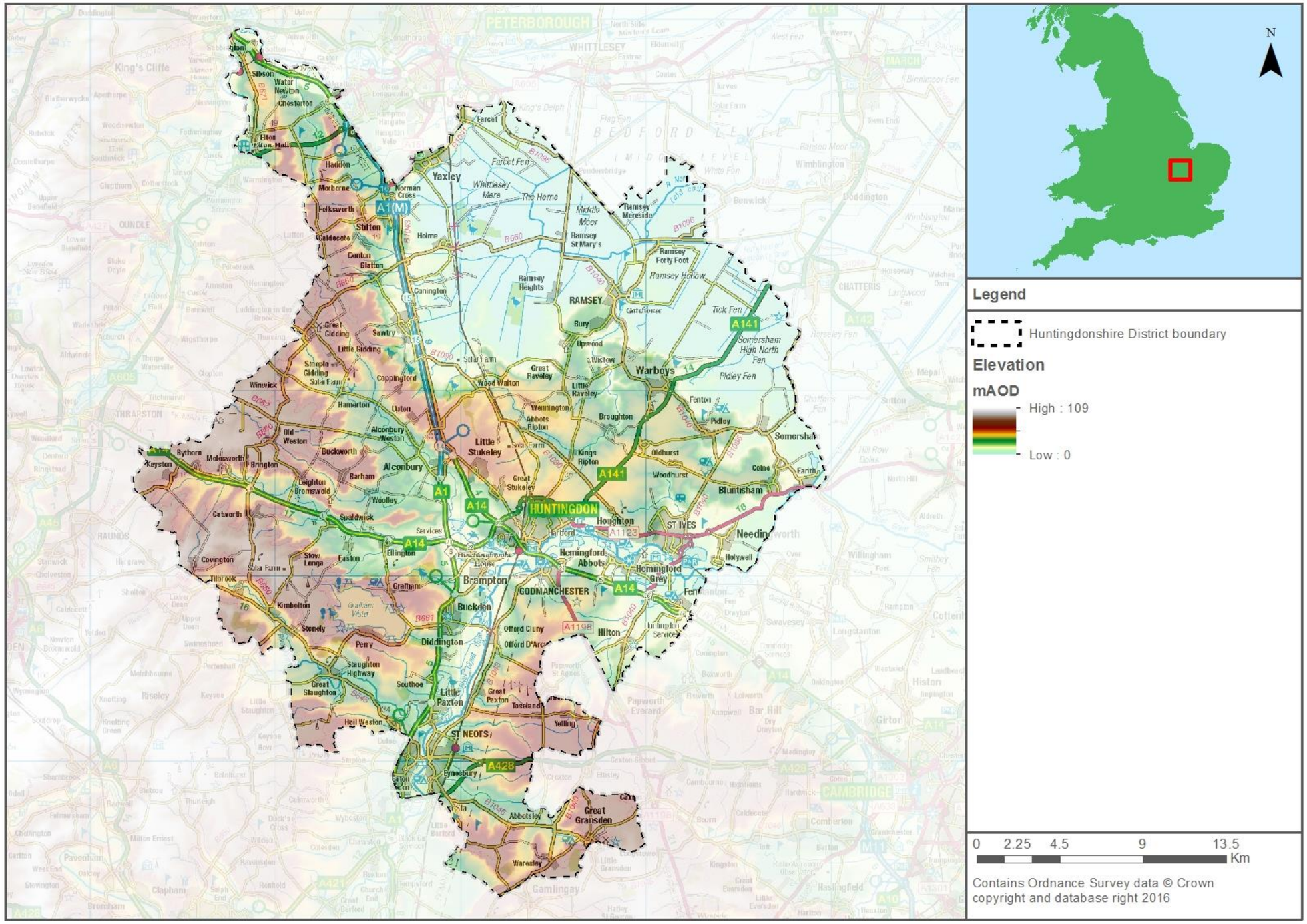


Figure 6-2: Bedrock aquifer classification in the Huntingdonshire District

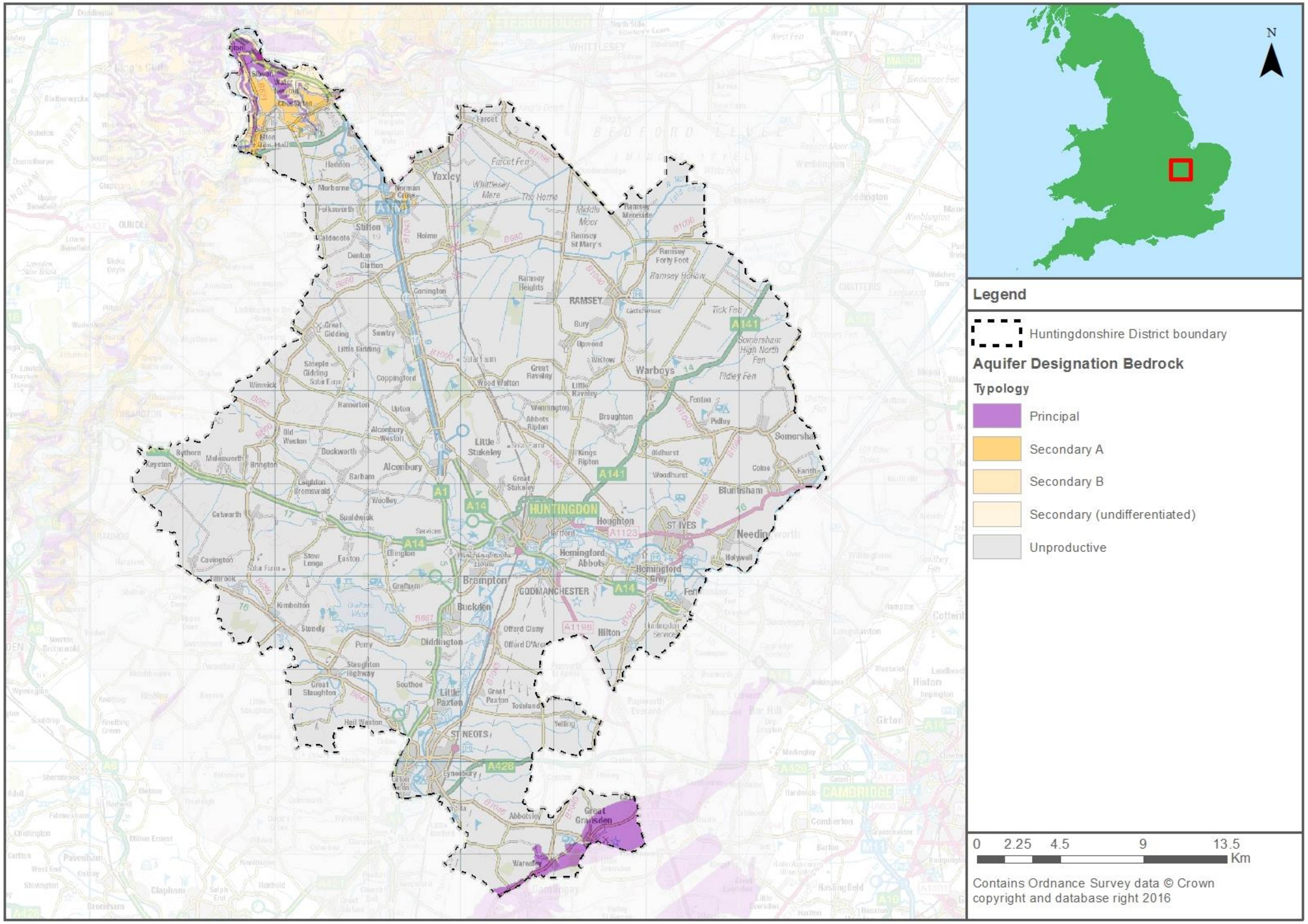
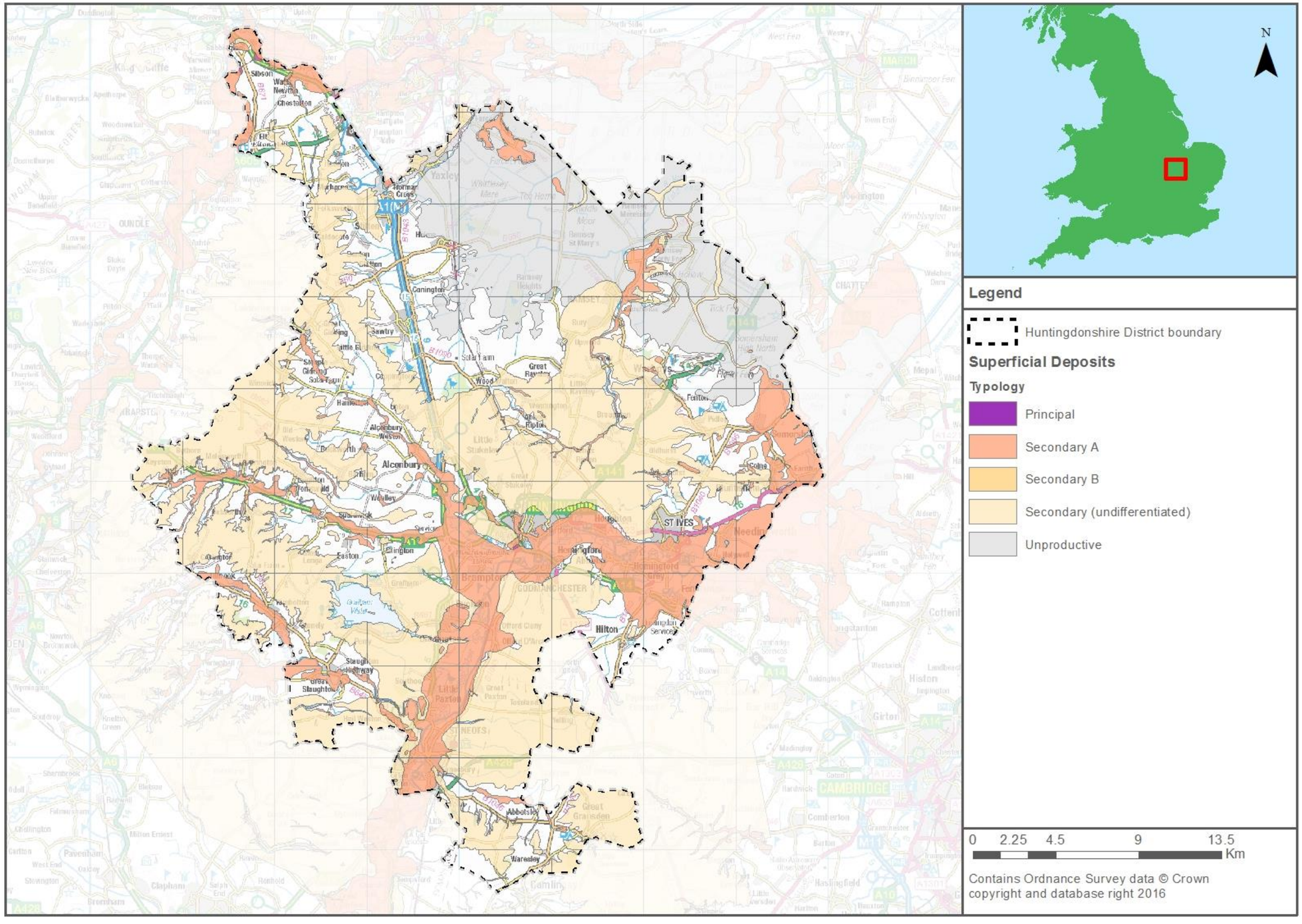


Figure 6-3: Superficial aquifer classification in the Huntingdonshire District



6.4 Watercourses in Huntingdonshire

There are a number of watercourses flowing through the district. These include Main River, awarded watercourses, ordinary watercourses and IDB watercourses.

6.4.1 Main Rivers

Main Rivers tend to be larger streams and rivers, though some of them are smaller watercourses of local significance. The Environment Agency has permissive powers to carry out maintenance, improvement or construction work on Main Rivers to manage flood risk. Main Rivers in Huntingdonshire are shown in Appendix B.1. Consultation with the Environment Agency will be required for any development projects within 20m of a Main River or flood defence, and any other water management matters.

6.4.2 Awarded Watercourses

Awarded watercourses are those whose maintenance responsibility lies with the relevant local authority. Awarded watercourses in Huntingdonshire are shown in Appendix B.2. Huntingdonshire District Council should be consulted where an awarded watercourse runs within, or adjacent to, a proposed development site.

6.4.3 Ordinary Watercourses

Ordinary watercourses are all watercourses not designated as Main River or IDB watercourses. The operating authority (local authority or IDB) has permissive powers to maintain them, but the responsibility lies with the riparian owner. Ordinary watercourses in Huntingdonshire are shown in Appendix B.1

6.4.4 Internal Drainage Board watercourses and drains

In addition to the Main Rivers and ordinary watercourses managed by the Environment Agency and LLFA respectively, numerous smaller watercourses and drains form the Internal Drainage Districts.

IDB boundaries and the location of the IDB watercourses and pumping stations are provided in Appendix B.4.

As part of the 2014 Water Cycle Study, MLCs advised that flood risk as a result of additional discharge from Ramsey wastewater treatment works was a concern in the St Germans Pond section of the Middle Level system. As a result, any increase in flow above the current consented volume would require assessment of flood risk before permission would be granted to discharge.

No detailed models exist of the IDB watercourses. As a result, it has not been possible to map Functional Floodplain (Flood Zone 3b) for these areas. Instead, the IDB policy statements of flood protection and water level management has been used to determine the general standard of flood protection provided to each IDB District. Where this is less than a 5% AEP this has been noted. Otherwise, Flood Zone 3b is presumed to be contained within channel.

Table 6-1: IDB general standard of protection

IDB	General standard of flood protection (% AEP)	Notes
MLC	1	-
Benwick	2-3	-
Bluntisham		-
Conington and Holme	2-3	-
Ramsey 1st	2-3	Areas adjacent to the north west boundary are potentially more vulnerable due to the condition of the Bury Brook Main River bank.
Ramsey 4th	2-3	-
Ramsey Upwood and Great Raveley	2-3	-
Sawtry	2-3	Woodwalton Fen (Ramsar, Special Area of Conservation (SAC) and National Nature

IDB	General standard of flood protection (% AEP)	Notes
		Reserve (NNR)) is potentially more vulnerable to flooding due to local circumstances.
Sutton and Mepal	3-5	-
Warboys Somersham and Pidley	2-3	-
Whittlesey Consortium an BGoIDBs	No information available	
Alconbury and Ellington IDB	No information available	

6.5 Fluvial flood risk

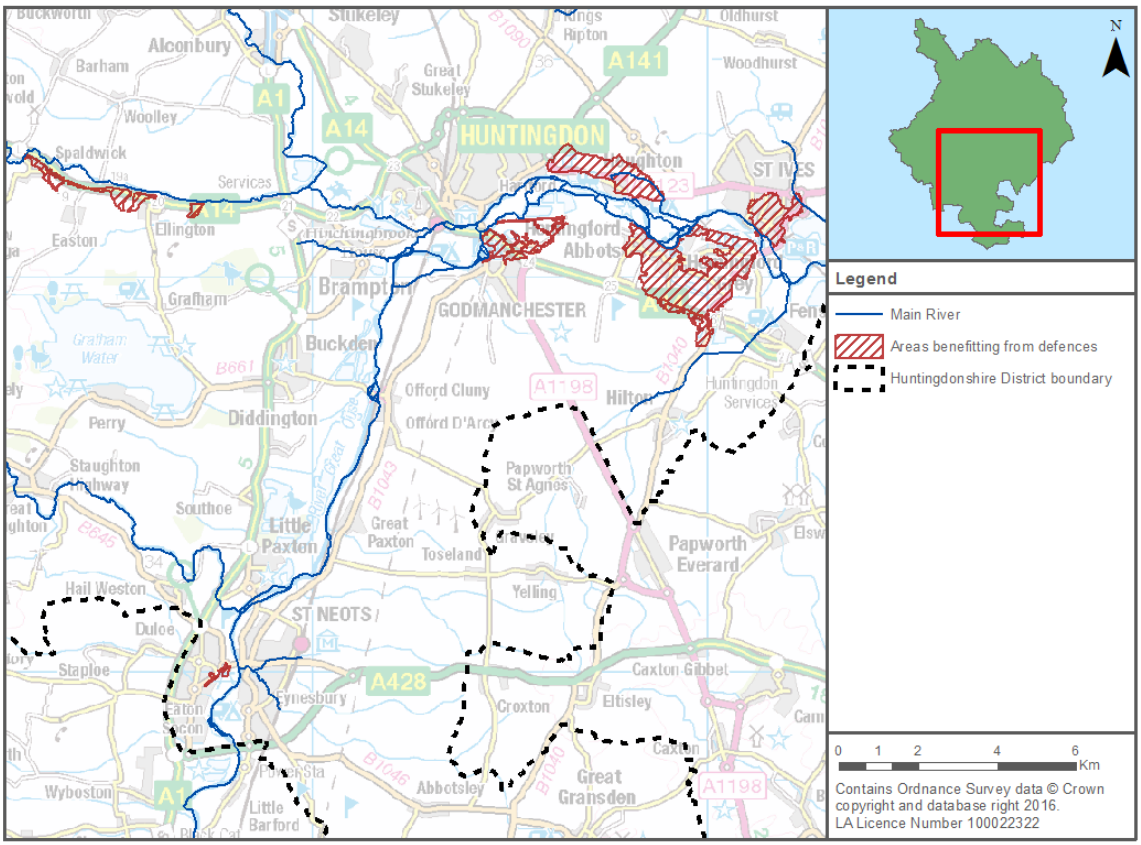
The primary fluvial flood risk in Huntingdonshire is associated with the River Great Ouse and its tributaries. Tributaries of the Great Ouse include, but are not limited to the River Kym, Alconbury Brook, Fox Brook, Hen Brook, Barracks Brook, Brampton Brook, and Parsons Drove Drain. The River Nene flows along the northern boundary of the district; however, this area is predominantly rural and the fluvial flood risk from the River Nene to property in this area is minimal.

Locations with associated fluvial flood risk from the Great Ouse catchments (as well as other sources of flooding) are detailed in Table 6-3.

6.5.1 Flood defences

There are a number of flood defence schemes within Huntingdonshire, particularly in the urban areas located along the River Great Ouse. Figure 6-4 shows the areas benefitting from defences in Huntingdonshire as designated by the Environment Agency. The Environment Agency's Areas benefitting from defences dataset shows areas that benefit from flood defences in the event of a river flood with a 1% chance of happening in any one year. If the defences did not exist, these areas would be flooded. The dataset may not yet include areas benefitting from recently completed schemes. Defences are covered in greater detail in Section 7.

Figure 6-4: Areas benefitting from defences in Huntingdonshire



6.6 Surface water flooding

Flooding from surface water runoff (or 'pluvial' flooding) is usually caused by intense rainfall that may only last a few hours, occurring often where the natural (or artificial) drainage system is unable to cope with the volume of water. Surface water flooding problems are inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding.

The updated Flood Map for Surface Water (uFMfSW) predominantly follows topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas.

As part of the 2014 Water Cycle Study the Middle Level Commissioners advised that for watercourses under their jurisdiction, there was no additional capacity in the system and run-off post development must be at existing runoff rates (where a site is currently undeveloped) unless the IDB explicitly requires surface water to be released early to avoid peak floods.

A summary of surface water flood risk to key locations in Huntingdonshire (as well as other sources of flooding) are detailed in Table 6-3.

The uFMfSW mapping for the Huntingdonshire District can be found in Appendix E.

6.7 Groundwater flooding

In comparison to fluvial flooding, current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. Under the Flood and Water Management Act (2010), LLFAs have powers to undertake risk management functions in relation to groundwater flood risk. Groundwater level monitoring records are available for areas on Major Aquifers. However, for lower lying valley areas, which can be susceptible to groundwater flooding caused by a high groundwater levels in mudstones, clays and superficial alluvial deposits, very few records are available. Additionally, there is increased risk of groundwater flooding where long reaches of watercourse are culverted as a result of elevated groundwater levels not being able to naturally pass into watercourses and be conveyed to less susceptible areas.

Mapping of the whole District has been provided showing the AStGW dataset and can be found in Appendix F.

6.8 Flooding from artificial sources

6.8.1 Flooding from sewers

Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system. Infiltration or entry of soil or groundwater into the sewer system via faults within the fabric of the sewerage system, is another cause of sewer flooding. Infiltration is often related to shallow groundwater, and may cause high flows for prolonged periods of time.

Since 1980, the Sewers for Adoption guidelines have meant that most new surface water sewers have been designed to have capacity for a 1 in 30-year rainfall event (3.3% AEP), although until recently this did not apply to smaller private systems. This means that, even where sewers are built to current specification, they are likely to be overwhelmed by larger events of the magnitude often considered when looking at river or surface water flooding. Existing sewers can also become overloaded as new development adds to the discharge to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

6.8.2 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975 and are listed on a register held by the Environment Agency. The level and standard of inspection and maintenance required under the Act means that the risk of flooding from reservoirs is relatively low. Recent changes to legislation under the Flood and Water Management Act require the Environment agency to designate the risk of flooding from these reservoirs. The Environment agency is currently progressing a 'Risk Designation' process so that the risk is formally determined.

Reservoir flooding is very different from other forms of flooding. It may happen with little or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate, but it is less likely than flooding from rivers or surface water. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

The risk of inundation to the Huntingdonshire District as a result of reservoir breach or failure of a number of reservoirs within the area was assessed as part of the National Inundation Reservoir Mapping (NIRIM) study. Five reservoirs are located within the Huntingdonshire District, including Grafham Water; however, there are also reservoirs outside of the area whose inundation mapping is shown to affect the district. Details of the reservoirs are provided in Table 6-2. Maps of the flood extent can be found on the Environment Agency's **'What's in Your Backyard' website**.

The Environment Agency maps represent a credible worst case scenario. In these circumstances it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential.

Table 6-2: Reservoirs with potential risk to Huntingdonshire District

Reservoir	Location	Reservoir Owner	Environment Agency area	Local Authority	In the District?
Grafham Water	517186, 266878	Anglian Water Services Ltd	Cambridgeshire and Bedfordshire	Cambridgeshire	Yes
Grafham Stage 2	515707, 266589	Anglian Water Services Ltd	Cambridgeshire and Bedfordshire	Cambridgeshire	Yes
Ouse Washes FSA	545831, 284570	Environment Agency	Cambridgeshire and Bedfordshire	Cambridgeshire	No
Fen Drayton Lakes	533526, 270338	Royal Society for the Protection of Bird	Cambridgeshire and Bedfordshire	Cambridgeshire	Yes
Ladyseat Reservoir	523053, 288636	BCN Wildlife Trust	Cambridgeshire and Bedfordshire	Cambridgeshire	Yes

White Water	503944, 303470	Burghley House Preservation Trust Ltd	Lincolnshire and Northamptonshire	City of Peterborough	No
Deene Lake	495484, 292838	Brudenell	Lincolnshire and Northamptonshire	Northamptonshire	No
Pitsford	475516, 268880	Anglian Water Services Ltd	Lincolnshire and Northamptonshire	Northamptonshire	No
Barnwell	504886, 283889	Environment Agency	Lincolnshire and Northamptonshire	Northamptonshire	No
Tithe Farm	514458, 257592	John Sheard (Farms) Ltd	Cambridgeshire and Bedfordshire	Bedford	No
Holland Wood	523572, 278362	Abbots Ripton Farming Company	Cambridgeshire and Bedfordshire	Cambridgeshire	Yes
Lower East End Farm	511232, 255488	R A Gibson (Colesden) Ltd	Cambridgeshire and Bedfordshire	Bedford	No
Blatherwycke Lake	498075, 296716	F & A George Ltd	Lincolnshire and Northamptonshire	Northamptonshire	No
Deene Lake	495484, 292838	Brudenell	Lincolnshire and Northamptonshire	Northamptonshire	No
Whittlesey (Nene) Washes FSA reservoir	529012, 298734	Environment Agency	Lincolnshire and Northamptonshire	Cambridge	No
Sacrewell	507160, 301269	William Scott Abbot Trust	Lincolnshire and Northamptonshire	Peterborough	No

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage.

- Developers should seek to contact the reservoir owner to obtain information which may include
    - reservoir characteristics: type, dam height at outlet, area/volume, overflow location;
    - operation: discharge rates / maximum discharge;
    - discharge during emergency drawdown; and
    - inspection / maintenance regime.
- Developers should apply the sequential approach to locating development within the site. The following questions should be considered
    - can risk be avoided through substituting less vulnerable uses or by amending the site lay-out?
    - can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
    - can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?
- Consult with relevant authorities regarding emergency plans in case of reservoir breach
- In addition to the risk of inundation those considering development in areas affected by breach events should also assess the potential hydraulic forces imposed by the rapid flood event and check that the proposed infrastructure fabric can withstand the loads imposed on the structures by a breach event.

Table 6-3: Summary of flood risk to key towns and villages in Huntingdonshire

Settlement	Fluvial flood risk	Formal Flood Defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risk
				<25%	>=25% <50%	>=50% <75%	>=75%	
St Neots	Fluvial flood risk to St Neots is from the River Great Ouse and its tributaries, Fox Brook, Hen Brook, Colmworth Brook and Duloe Brook. There are also a number of smaller drains that join the River Great Ouse in this area. Flood Zones show the undefended scenario. The defences along the Great Ouse in this location provide a 1% AEP standard of protection. However, there remains a residual risk should the defences breach or fail. Interaction between the watercourses has the potential to cause flooding - high levels in the Great Ouse may prevent the tributaries from discharging, causing them to back up and overtop.	See section 7.5	Mapping shows surface water flood risk in St Neots generally follows similar flow paths to the River Great Ouse and its tributaries. Away from the watercourses, it is mainly confined to residential roads and ponding in rural areas and gardens. Areas of noticeable risk include properties in the Eynesbury and Eaton Ford areas of St Neots.	✓	✓	✓	✓	Inundation from Graffham Water reservoir may affect parts of the Howard Road and Little End Road Industrial Estates as well as properties off of Huntingdon Road and the B1041.
Brampton	Mapping shows fluvial flood risk is from the Brampton Brook that flows west to east through the village. Areas at risk include properties to the south of West End, Hansell Road, Park Road, Layton Crescent, Lenton Close, Hawkes End, Allen Orchard, Buckden Road and Brampton Park. The River Great Ouse may also pose a flood risk to the east of the village either through direct flooding from the river or as a result of high levels in the Great Ouse preventing the Brampton Brook from discharging causing it to back up though the village.	None	Mapping shows surface water flood risk in Brampton consists predominantly of pockets of water ponding on roads and in gardens throughout the village.				✓	Inundation from Graffham Water reservoir may potentially affect the majority of Brampton.
Huntingdon	Mapping shows Huntingdon is largely unaffected by fluvial flood risk from the River Great Ouse, with risk confined to properties adjacent to the left bank of the watercourse, when facing downstream. The main fluvial flood risk in Huntingdon is from the Barracks Brook that flows south easterly through Huntingdon, rising by the A141 at Stukeley Meadows before joining the River Great Ouse at Westside Common. Flood risk from the Barracks Brook mainly affects the Stukeley Meadows area of Huntingdon, with smaller areas at risk along the northern (eastbound) section of the Huntingdon Ring Road (B1514).	None	Mapping shows surface water flooding mainly follows a similar flow path to the Barracks Brook. The Newtown area of Huntingdon is also shown to be at risk from surface water flooding. Surface water flood risk in other areas of the town is largely confined to roads including Sapley Road.	✓	✓	✓	✓	Inundation from Graffham Water reservoir may potentially affect areas along the left bank, looking downstream, of the River Great Ouse as well as parts of the centre of Huntingdon.
Godmanchester	Flood Zones show the main fluvial flood risk is from the River Great Ouse, which flows to the west and north of Godmanchester. Flood Zones show the undefended scenario. The defences along the Great Ouse in this location provide a 1% AEP standard of protection. However, there remains a residual risk should the defences breach or fail. The majority of fluvial flood risk is located in the area to the east of Post Street and north of Cambridge Street. There is also an area of risk to the south of Cambridge Street/Road (B1044), including, but not limited to, Cambridge Villas, Meadow Way and Tudor Road.	See section 7.4	Risk is predominantly confined to roads and ponding in rural areas and gardens. Areas notably at risk include Cambridge Villas, Meadow Way, Anderson Crescent, Earning Street, Silver Street, Lancaster Way, Roman Way, Croftfield Road and Tudor Road. : The majority of risk is from a 1% or higher AEP event		✓	✓	✓	Inundation from Graffham Water reservoir may potentially affect the majority of Godmanchester. The only area that is unlikely to be affected in the very south of the town.

Settlement	Fluvial flood risk	Formal Flood Defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risk
				<25%	>=25% <50%	>=50% <75%	>=75%	
Hemingford Abbots and Hemingford Grey	Flood Zones show the main fluvial flood risk is from the River Great Ouse, which flows to the north of the villages. Flood Zones show the undefended scenario. The defences along the Great Ouse in this location provide a 1% AEP standard of protection. However, there remains a residual risk should the defences breach or fail. Hemingford Abbotts: flood risk is mainly in the east of the village along High Street, Church Lane, and Royal Oak Lane. Hemingford Grey: flood zones show the majority of the village to be in Flood Zone 3. Additionally, the Longmarsh Brook and other, unnamed, drains flowing to the south of the village may pose a risk; these watercourses are currently not shown in the Flood Zones.	See section 7.2	Hemingford Abbotts: mapping shows the village to be largely unaffected by surface water flood risk. The main areas at risk include Meadow Lane, High Street and Royal Oak Lane. Hemingford Grey: Mapping shows surface water flood risk is confined mainly to roads including Braggs Lane, High Street, Manor Road and other, smaller, residential roads. Mapping also shows surface water ponding in open spaces and gardens.			✓	✓	Inundation from Graffham Water reservoir may potentially affect the entirety of Hemingford Grey and properties north of Common Lane, and along High Street, the Ridgeway and Royal Oak Lane in Hemingford Abbots.
St Ives	Flood Zones show the main fluvial flood risk is from the River Great Ouse, which flows to the south of the town, and Parsons Drove Drain, which flows along the eastern edge of the town. Flood risk is mostly confined to the areas of St Ives south of the A1123. Flood Zones show the undefended scenario. The defences at St Ives provide a 1% AEP standard of protection. However, there remains a residual risk should the defences breach or fail.	See section 7.2	Mapping shows surface water flood risk tends to follow the path of Parsons Drove Drain and another, unnamed, drain that flows west to east north of the A1123. as well as ponding and flowing along roads. The area to the south of the A1123 is also shown to be considerably at risk from surface water flooding.	✓	✓	✓	✓	Inundation from Graffham Water reservoir may potentially affect areas of St Ives to the south of the A1123.
Alconbury and Alconbury Weston	Flood Zones show the main fluvial flood risk is from the Alconbury Brook which flows south easterly through the villages. Alconbury: the main areas at risk include High Street, Brookside, The Leys, Palmers Lane, Sharps Lane, Great North Road and The Maltings. Alconbury Weston: the main areas at risk include High Street, North Road and Hamerton Road.	None. Property Level Resilience scheme introduced in 2011.	Mapping shows surface water flood risk tends to follow the path of the Alconbury Brook as well as ponding and flowing along roads. Alconbury: The majority of risk to roads is from a 1% or higher AEP event, with the exception of High Street and Rusts Lane which are shown to be considerably at risk from a 3.3% AEP event. Alconbury Weston: the majority of risk to roads is from a 3.3% AEP event or higher.		✓	✓		None
Sawtry	Flood risk from the majority of the watercourses flowing through Sawtry are not shown in the Environment Agency's Flood Zones. However, there is potentially some fluvial flood risk from the Sawtry Brook and two unnamed drains to the south of the village. These unnamed drains join just before flowing under the A1(M), after which they join the Middle Level Commissioner's Drain.	None	Mapping shows the village to be considerably at risk from surface water flooding with large areas in the north and south of the village. The location of the surface water risk tends to correspond with the location of the watercourses flowing through the village. The mapping shows a large proportion of those areas at risk are at risk from the 3.3% AEP event.					None
Ramsey	Flood Zones show the main fluvial flood risk is from High Lode which flows northwards through the town. To the south the flood risk is mainly to rural land. Towards the centre of the town flood risk is concentrated to properties along Hollow Lane and High Street. To the north of the town, risk to property on Millfields, Mill Lane, Turvers Lane, Newtown Road, Stocking Fen Road and St Mary's Road. Large expanses of rural land to the north of the town are also at risk. Due to the embanked nature of the watercourse, there is also a residual risk from potential breach of the embankment.	None	Risk is predominantly confined to roads and rural land to the north and south of the town, with the exception of the centre of the village where mapping shows risk to properties from a 30-year event. Roads in the centre of the town where properties are at risk include, but are not limited to, Station Road, Orchard Way, Vinery Close, Slade Close, Field Lane, Whytefield Road, Mews Close, Millfields, Turvers Lane, Silver Street, Tower Close, Little Whyte, Abbots Close and Abbey Fields.	✓	✓	✓	✓	None

7 Flood defences

7.1 Flood defences

There are a number of flood alleviation schemes (FAS) within Huntingdonshire.

Flood alleviation schemes identified within the SFRA area may include formal defences, initiatives to improve drainage, and/or land management to reduce the risk of high velocity overland surface runoff.

7.1.1 Defence standard of protection and residual risk

One of the principal aims of this SFRA is to include a Level 2 SFRA assessment to outline the present risk of fluvial flooding from watercourses across Huntingdonshire that includes consideration of the effect of flood risk management measures (including flood banks and defences). The fluvial modelling that has been developed for the SFRA is of a strategic nature for the purpose of preparing evidence on possible site options for development. In the cases where a specific site risk assessment is required, detailed studies should seek to refine the current, broad understanding of flood risk from all sources.

Consideration of the residual risk behind flood defences should be considered as part of detailed site specific flood risk assessments. The residual risk of flooding in an extreme flood event or from failure of defences should also be carefully considered.

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

Standard of Protection

Flood defences are designed to give a specific standard of protection, reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP standard of protection means that the flood risk in the defended area is reduced to a 1% chance of flooding in any given year.

Although flood defences are designed to a standard of protection it should be noted that, over time, the actual standard of protection provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change

7.1.2 Defence condition

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the Environment Agency for condition is provided in Table 7-1.

Table 7-1: Defence asset condition rating

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

Source: Condition Assessment Manual – Environment Agency 2006

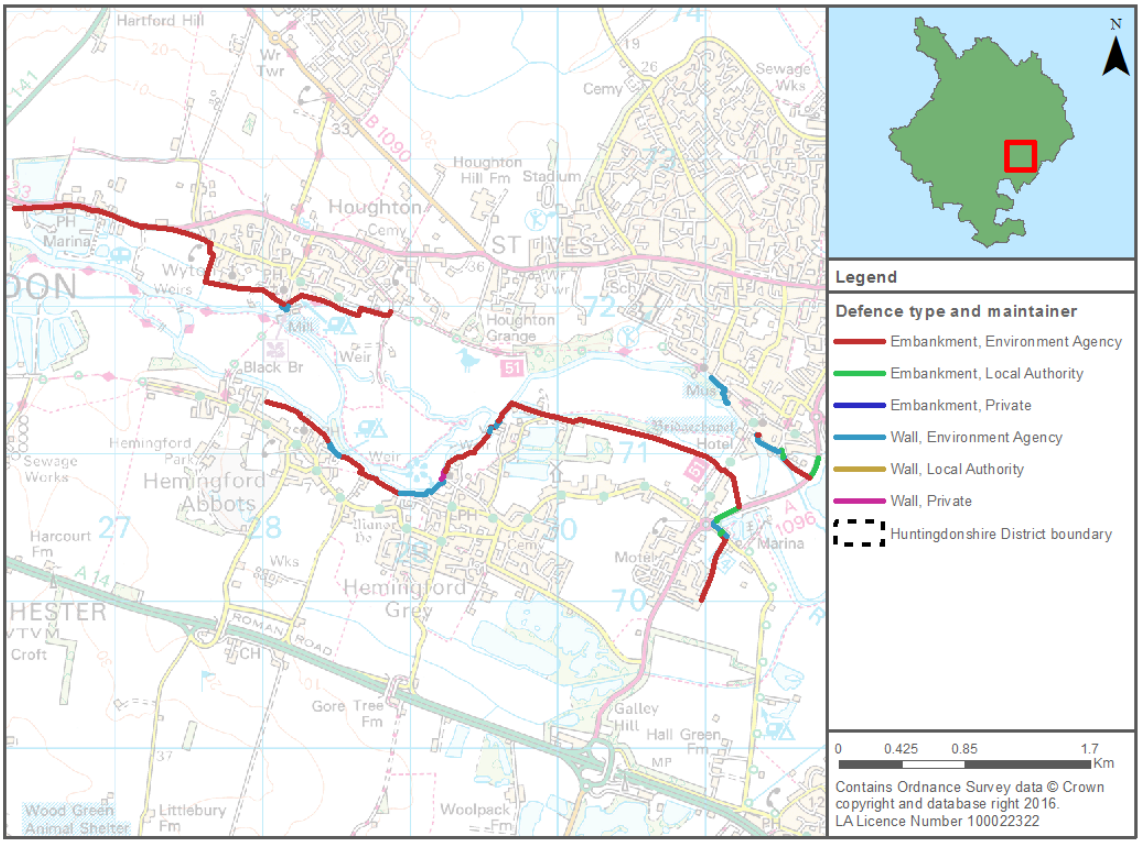
A review of key defences across Huntingdonshire District, their condition and standard of protection is included in the following sections.

7.2 Defences: St Ives and the Hemingfords

The St Ives and the Hemingfords FAS was completed in 2007 and protects 1,611 residential properties and 160 commercial properties from flooding from the River Great Ouse[6]. The scheme consists of a series of walls and embankments designed to protect properties to a 1% AEP standard of protection. The scheme cost £9.268 million.

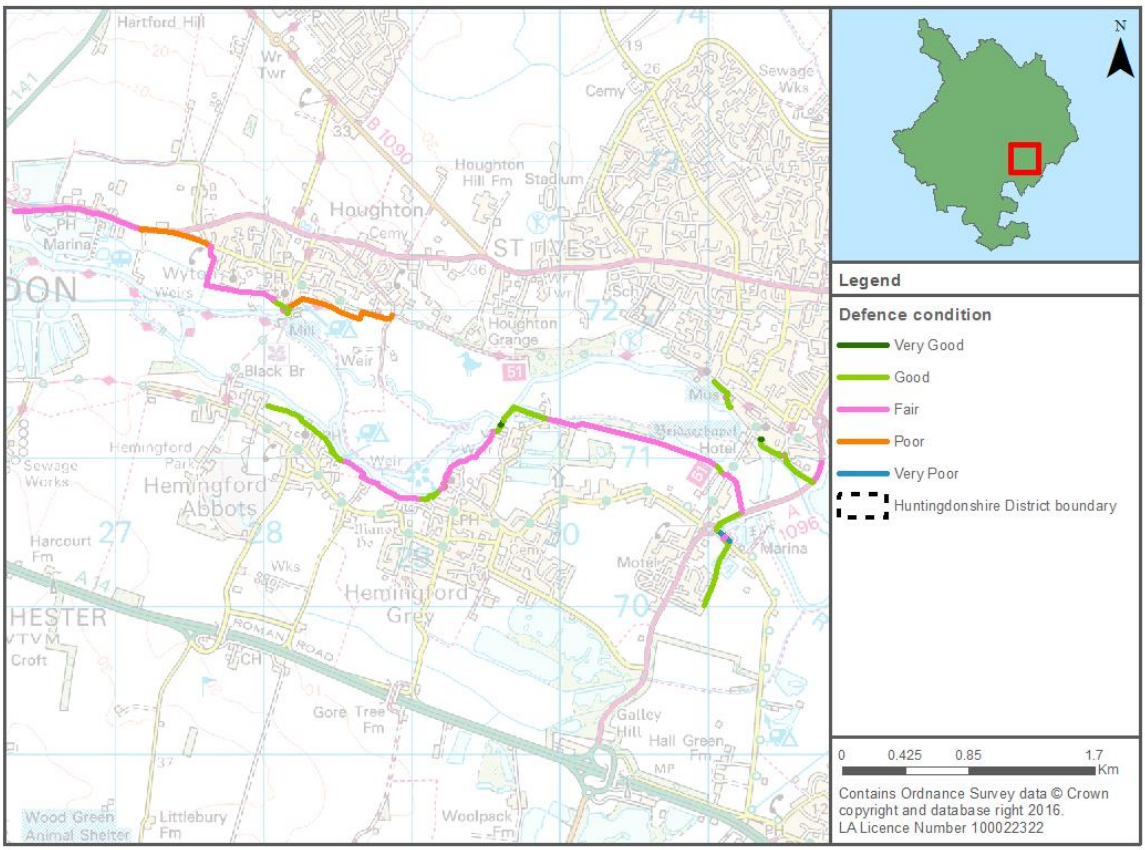
The condition of the defences is variable, ranging from poor to very good and are shown in Figure 7-2.

Figure 7-1: Houghton and the Hemingfords: defence type



[6] **Environment Agency: Anglian Central Flood Risk Fact Sheet (November 2012)**

Figure 7-2: Houghton and the Hemingfords: condition grade



7.3 Defences: Holywell to Earith

There are raised defences located along both banks of the River Great Ouse between Holywell and Earith. The majority of these defences are embankments maintained by the Environment Agency, with another section of embankment on the left bank of the River Great Ouse (looking downstream) at Bluntisham is privately maintained. The standard of protection provided by these defences varies between 20% for the privately maintained defence to 0.67% AEP for the embankments located along the right bank of the River Great Ouse.

The majority of the defences have a condition grade of fair; however, a section of embankment downstream of Holywell, as well as the privately maintained defence, have a lower condition grade of poor.

Figure 7-3: Holywell to Earith: defence type

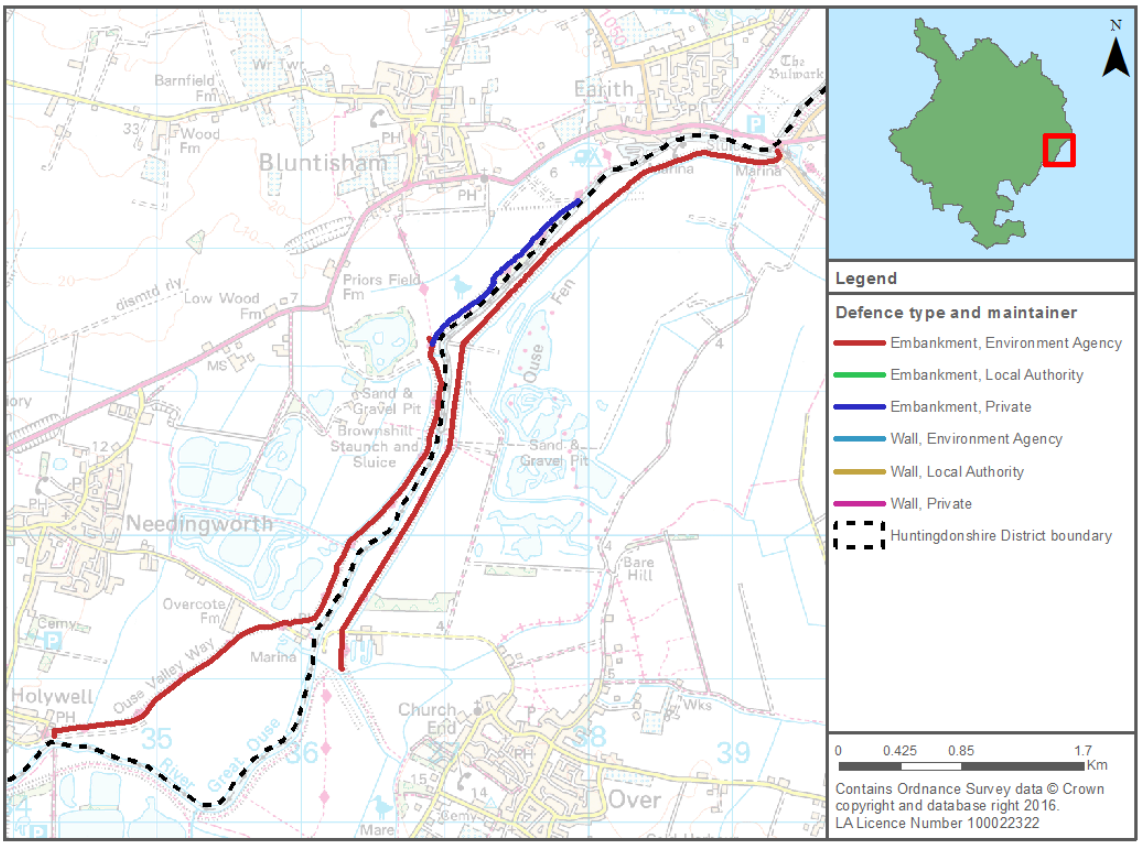
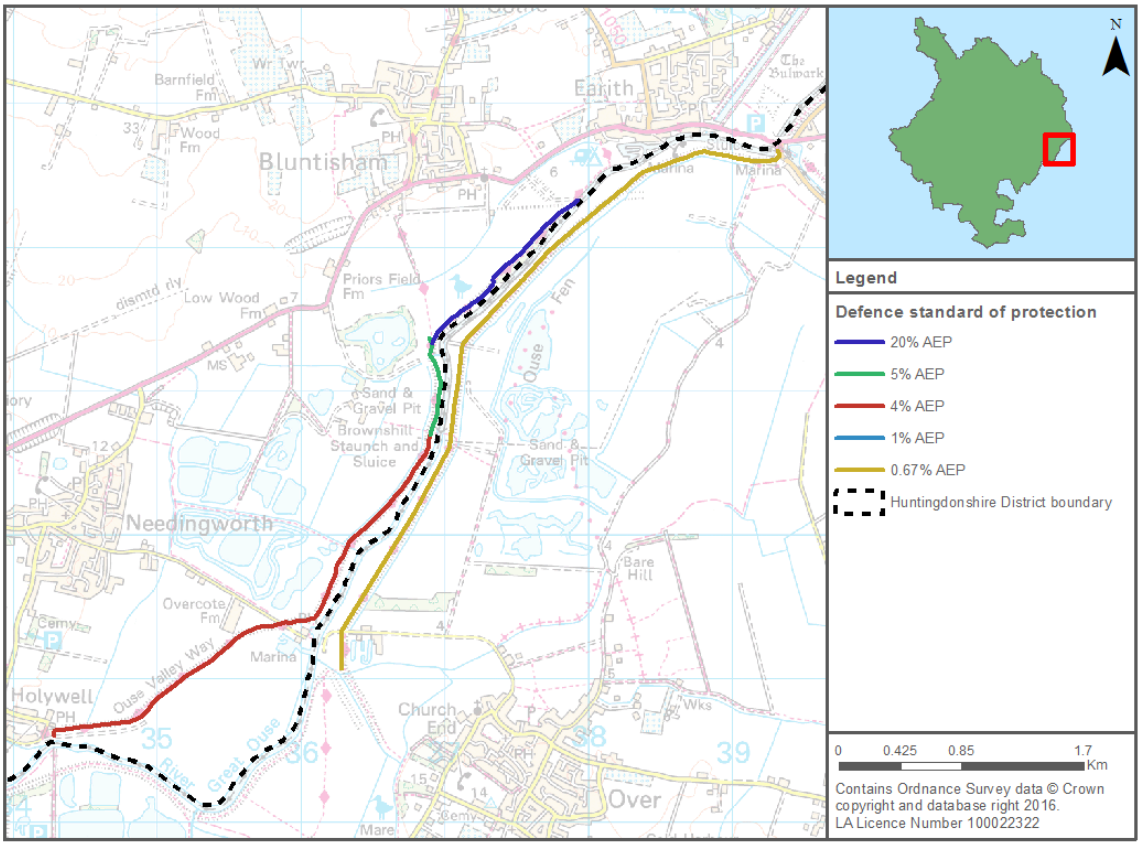


Figure 7-4: Holywell to Earith: defence standard of protection

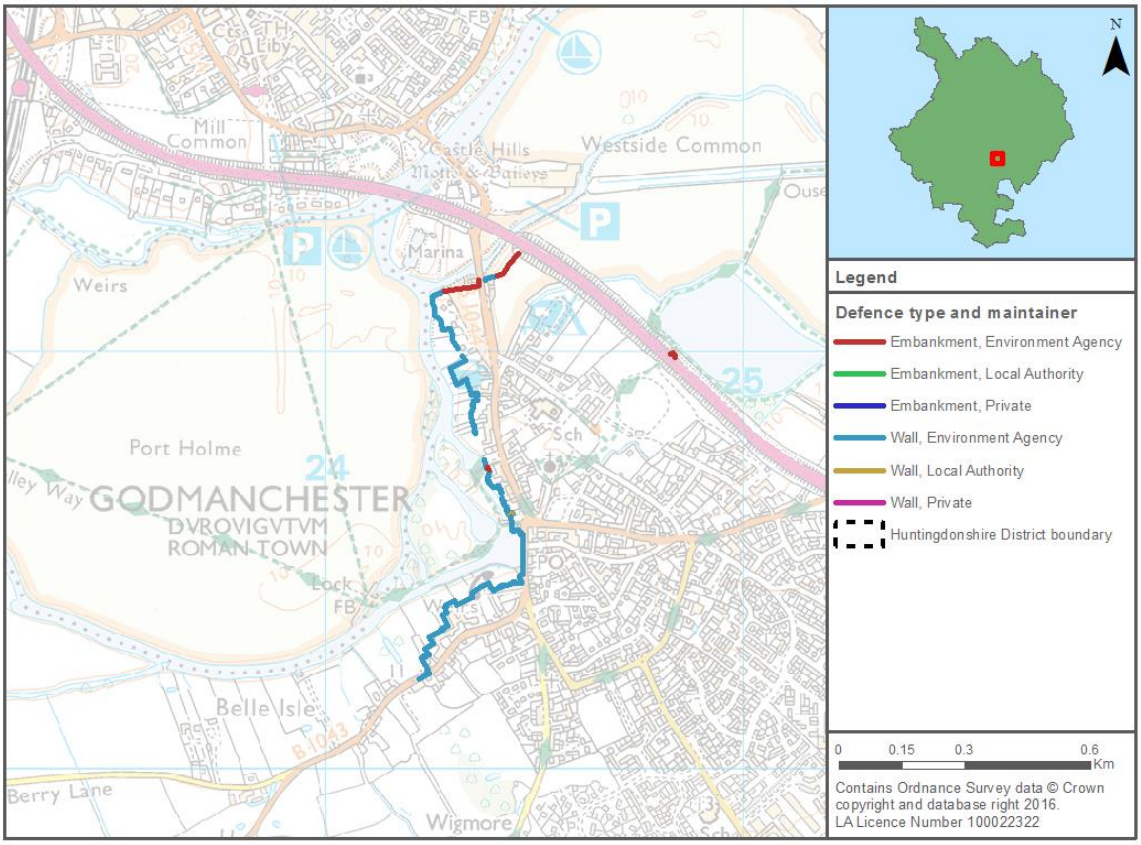


7.4 Godmanchester

The Godmanchester FAS was completed in 2014 at a cost of £9.2 million[6] and consists predominantly of an embankment located along the River Great Ouse between West Street and The Avenue. A section of flood wall is located adjacent to The Avenue. The scheme protects around 514 residential and 42 commercial properties[6] to a 1% AEP standard of protection. The scheme was developed by the Environment Agency in partnership with Cambridgeshire County Council and Huntingdonshire District Council.

The condition grade of the defences reflects the recent completion date; the condition of the embankments is graded as very good, with the flood wall graded as good.

Figure 7-5: Godmanchester: defence type

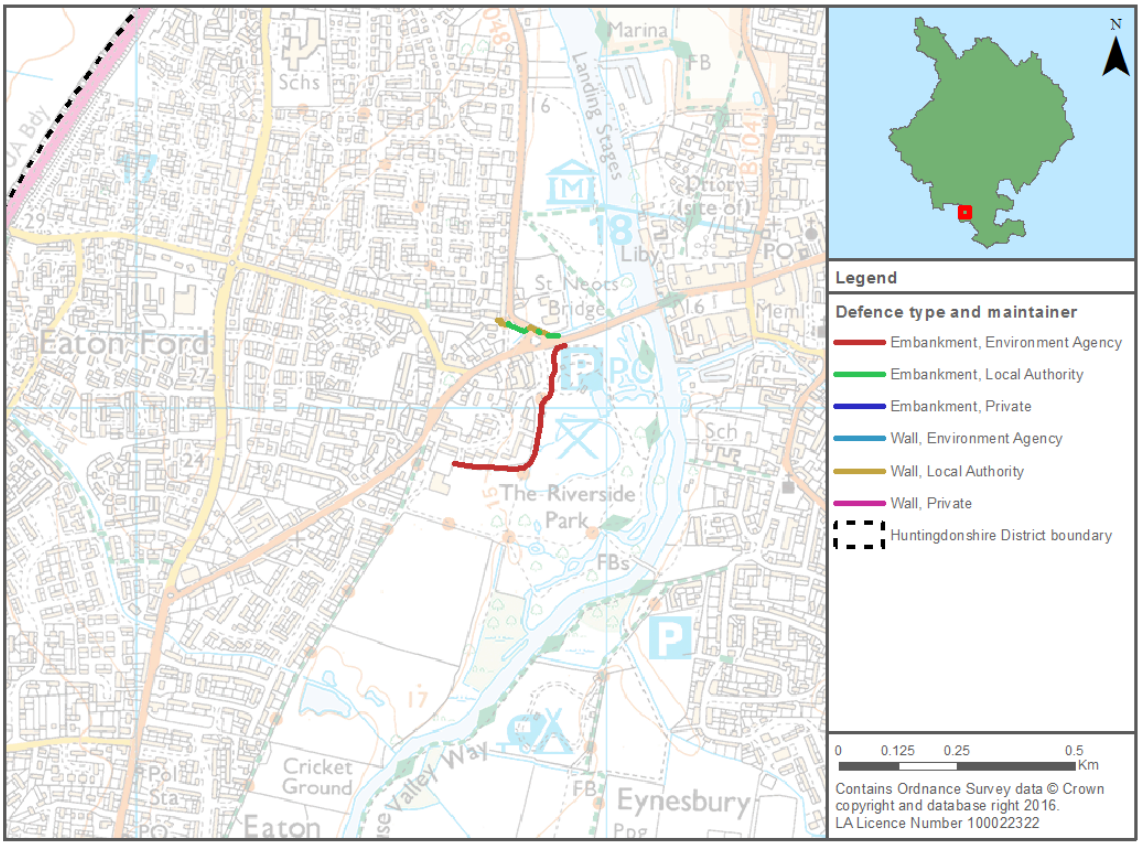


7.5 Defences: St Neots

The St Neots FAS was completed in 2009, at a cost of £1.874 million[6]. It consists of a series of embankment, walls and gates that protect 115 residential properties[6] to a standard of 1% AEP event. The scheme was developed by the Environment Agency in partnership with Anglian Water who installed a small surface water pumping station.

The Local Authority walls and embankments are classed as very good condition and good condition respectively. The Environment Agency embankment is classed as being in good condition.

Figure 7-6: St Neots: defence type



7.6 Alconbury and Alconbury Weston Property Level Resilience (PLR)

The Alconbury and Alconbury Weston PLR scheme was completed in 2011 and cost around £400,000. The PLR scheme was led by Huntingdonshire District Council with support from the Environment Agency. The scheme protects around 77 properties.

Property Level Resilience

Property Level Resilience is the use of flood protection measures in cases where flooding occurs frequently and other flood management solutions are not viable. Examples of PLR measures include barriers for doorways and airbricks, non-return valves for domestic and foul drainage systems, de-watering pumps, and waterproofing and sealants.

7.7 Residual flood risk

Residual risk refers to the risks that remain in circumstances after measures have been taken to alleviate flooding (such as flood defences). It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

- The effects of a flood with a magnitude greater than that for which the defences or management measures have been designed to alleviate (the 'design flood'). This can result in overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming discharges.
- Failure of the defences or flood risk management measures to perform their intended duty. This could be breach failure of flood embankments, failure of flood gates to operate in the intended manner or failure of pumping stations.

Defences in Huntingdonshire are generally shown to be in good condition and have a high standard of protection. However, in the event of a breach, depending on the extent and magnitude of the breach, water could rapidly inundate areas behind defences with little warning. Although the majority of areas protected by defences are within the Environment Agency's Flood Warning Service, the service does not provide a warning in the event of a breach.

There is also the potential that the risk of defences overtopping in the future may increase due to increased flows due to climate change.

7.7.1 Implications for development

The assessment of residual risk demands that attention be given to the vulnerability of the receptors and the response to managing the resultant flood emergency. In this instance attention should be paid to the characteristics of flood emergencies and the roles and responsibilities during such events. Additionally, in the cases of breach or overtopping events, consideration should be given to the structural safety of the dwellings or structures that could be adversely affected by significant high flows or flood depths.

Developers should include an assessment of the residual risk where developments are located in areas benefitting from defences, including identifying rapid inundation zones. They should consider both the impact of breach, including the effect on safe access and egress, as well as potential for flood risk to increase in the future due to overtopping. Any improvements to defences should ensure they are in keeping with wider catchment policy.

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8 FRA requirements and flood risk management guidance

8.1 Over-arching principles

This SFRA focuses on delivering a strategic assessment of flood risk within Huntingdonshire. Due to the strategic scope of the study, prior to any construction or development, site-specific assessments will need to be undertaken for individual development proposals (where required) so all forms of flood risk at a site are fully addressed. It is the responsibility of the developer to provide an FRA with an application.

It should be acknowledged that a detailed FRA may show that a site is not appropriate for development of a particular vulnerability or even at all. Where the FRA shows that a site is not appropriate for a particular usage, a lower vulnerability classification may be appropriate.

8.2 Requirements for site specific flood risk assessments

8.2.1 What are site specific FRAs?

Site specific FRAs are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted to LPAs with planning applications and should demonstrate how flood risk will be managed over the development's lifetime, taking into account climate change and vulnerability of users.

Appendix H sets out a checklist for developers to assist with site-specific flood risk assessments, based upon the list set out in **Paragraph 068** of the NPPG Flood Risk and Coastal Change Planning Practice Guidance. Where possible, links to sources of information and guidance have been provided.

8.2.2 When are site specific FRAs required?

Site specific FRAs are required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1.
- Proposals for new development (including minor development and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency).
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

A FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1)
- Where the site is intended to discharge to the catchment or assets of a water management authority which requires a site specific FRA
- Where the site's drainage system may have an impact on an IDB's system
- Where evidence of historical or recent flood events have been passed to the LPA
- In an area of significant surface water flood risk.

In some cases, a development meeting the criteria below may need to submit a FRA to the IDB to inform any consent applications

- Development being either within or adjacent to a drain/ watercourse, and/ or other flood defence
- structure within the area of an IDB
- Development being within the channel of any ordinary watercourse within an IDB area
- Where a direct discharge of surface water or treated effluent is proposed into an IDBs catchment

- For any development proposal affecting more than one watercourse in an IDBs area and having possible strategic implications
- In an area of an IDB that is in an area of known flood risk
- Development being within the maintenance access strips provided under the IDBs by-laws
- Any other application that may have material drainage implications.

8.2.3 Objectives of site specific FRAs

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

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

FRAs for sites located in Huntingdonshire should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the Environment Agency and Huntingdonshire District Council. Guidance and advice for developers on the preparation of site specific FRAs include:

- **Cambridgeshire Flood and Water Supplementary Planning Document** (2016)
- **Cambridgeshire County Council Surface Water Guidance document**
- **Standing Advice on Flood Risk** (Environment Agency)
- **Flood Risk Assessment for Planning Applications** (Environment Agency)
- **Site-specific Flood Risk Assessment: CHECKLIST** (NPPG, Defra)

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

8.3 Flood risk management guidance – mitigation measures

Mitigation measures should be seen as a last resort to address flood risk issues. Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered.

8.3.1 Site layout and design

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

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from Flood Zones 2 and 3, to higher ground, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. However, vehicular parking in floodplains should be based on the nature of parking, flood depths and hazard including evacuation procedures and flood warning.

Waterside areas, or areas along known flow routes, can act as Green Infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas, and avoid the creation of isolated islands as water levels rise.

Making space for water

The NPPF sets out a clear policy aim in Flood Zone 3 to create space for flooding by restoring functional floodplain.

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

The provision of a buffer strip can 'make space for water', allow additional capacity to accommodate climate change and ensure access to the watercourse, structures and defences is maintained for future maintenance purposes.

It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection. Building adjacent to riverbanks can also cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult.

8.3.2 Raised floor levels

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

If it has been agreed with the Environment Agency that, in a particular instance, the raising of floor levels is acceptable finished flood levels should be set a minimum of 600mm above the 1% AEP event plus an allowance for climate change and an appropriate allowance for freeboard. The additional height that the floor level is raised above the maximum water level is referred to as the "freeboard". Additional freeboard may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

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. However, access and egress would still be an issue, particularly when flood duration covers many days.

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

8.3.3 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain. It would be preferable for schemes to involve an integrated flood risk management solution.

Temporary or demountable defences are not acceptable forms of flood protection for a new development but might be appropriate to address circumstances where the consequences of residual risk are severe but the time required to install the defences, for example in an overtopping scenario, would be realistic. In addition to the technical measures the proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate. The storage and accessibility of such structures must be considered.

8.3.4 Modification of ground levels

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken at locations where raising ground levels could adversely affect existing communities and property; in most areas of fluvial flood risk, raising land above the floodplain would reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land.

All new development within the 1% AEP flood extent including an allowance for climate change (for the lifetime of the development) must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water, and seek opportunities to provide floodplain betterment. Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain should be provided to ensure that the total volume of the floodplain storage is not reduced.

For compensatory flood storage to be effective and not require hydraulic modelling, it must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary. Where land is not within the site boundary, it must be in the immediate vicinity, in the applicant's ownership/control and linked to the site. Floodplain compensation should be considered in the context of the 1% annual probability (1 in 100 year) flood level including an allowance for climate change. When designing a scheme flood water must be able to flow in and out unaided. An FRA should demonstrate that there is no loss of flood storage capacity and include details of an appropriate maintenance regime to ensure mitigation continues to function for the life of the development. Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C62430.

Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

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

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

8.3.5 Developer contributions

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

DEFRA's Flood and Coastal Risk Management Grant in Aid (FCRMGiA)[7] can be obtained by operating authorities to contribute towards the cost of a range of activities including flood risk management schemes that help reduce the risk of flooding and coastal erosion. Some schemes are only partly funded by FCRMGiA and therefore any shortfall in funds will need to be found from elsewhere when using Resilience Partnership Funding, for example local levy funding, local businesses or other parties benefitting from the scheme.

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

However, the provision of funding by a developer for the cost of the necessary standard of protection from flooding or coastal erosion does not mean the development is appropriate as other policy aims must also be met. Funding from developers should be explored prior to the granting of planning permission and in partnership with the Council and the Environment Agency.

The appropriate route for the consideration of strategic measures to address flood risk issues is the LFRMS. The LFRMS should describe the priorities with respect to local flood risk management, the measures to be taken, the timing and how they will be funded. It will be preferable to be able to demonstrate that strategic provisions are in accordance with the LFRMS, can be afforded and have an appropriate priority.

The Environment Agency is also committed to working in partnership with developers to reduce flood risk. Where assets are in need of improvement or a scheme can be implemented to reduce

7 Principles for implementing flood and coastal resilience funding partnerships (Environment Agency, 2012)

flood risk, the Environment Agency request that developers contact them to discuss potential solutions.

8.4 Flood risk management guidance – resistance measures

Measures designed to keep flood water out of properties and businesses.

There may be instances where flood risk to a development remains despite implementation of such planning measures as those outlined above. For example, where the use is water compatible, where an existing building is being changed, where residual risk remains behind defences, or where floor levels have been raised but there is still a risk at the 0.1% AEP scenario. In these cases, (and for existing development in the floodplain), additional measures can be put in place to reduce damage in a flood and increase the speed of recovery. These measures should not normally be relied on for new development as an appropriate mitigation method. Most of the measures should be regarded as reducing the rate at which flood water can enter a property during an event and considered an improvement on what could be achieved with sand bags. They are often deployed with small scale pumping equipment to control the flood water that does seep through these systems. The effectiveness of these forms of measures are often dependant on the availability of a reliable forecasting and warning system to user the measures are deployed in advance of an event. The following measures are often deployed:

Permanent barriers

Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers.

Temporary barriers

Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discreet and keep architectural impact to a minimum. On a smaller scale temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.

Community resistance measures

These include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.

8.5 Flood risk management guidance – resilience measures

Measures designed to reduce the impact of water that enters property and businesses.

Flood-resilient buildings are designed and constructed to reduce the impact of flood water entering the building. These measures aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding include:

- Electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level
- Water-resistant materials for floors, walls and fixtures
- Non-return valves to prevent waste water from being forced up bathroom and kitchen plugs, or lavatories
- Front doors that reduce ingress of water all the time with no further installation required. Such methods must consider hydrostatic pressure and that water may still come in through the floor. Such methods offer time and reduce damage but may not remove flood water from entering the house completely

8.6 Reducing flood risk from other sources

8.6.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and for this reason many conventional flood defence and mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1% AEP plus climate change event, or where high ground water levels are known. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

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

When redeveloping existing buildings, it may be acceptable to install pumps in basements as a resilience measure. However, for new development this is not considered an acceptable solution.

8.6.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. It is important that a surface water drainage strategy shows that development will not make the risk worse, increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk.

When redeveloping existing buildings, the installation of some permanent or temporary flood-proofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers, providing they are maintained appropriately. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly, and appropriately, maintained. Consideration must also be given to attenuation and flow ensuring that flows during the 100-year plus climate change storm event are retained within the site if any flap valves shut. This must be demonstrated with suitable modelling techniques.

8.6.3 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) re-create the benefits of natural drainage systems by integrating water management with urban form to create and enhance the public realm, streets and open spaces. The flexibility of SuDS components means that SuDS can apply in both the urban and rural context and in both natural and man-made environments.

SuDS allow the delivery of high quality surface water drainage whilst at the same time supporting urbanised areas in coping with severe rainfall. SuDS generally replace traditional underground, piped systems that gather runoff using grates or storm water drains. They control flows to prevent deluges during times of high rainfall and reduce the risk of flooding whilst also providing benefits for amenity and biodiversity. The SuDS approach keeps water on the surface as much as possible to avoid concentration and acceleration of flows in piped systems while also taking the opportunity to provide valuable amenity assets for local residents and increase the provision of green infrastructure in urban areas. Keeping water on the surface also means that any problems with the system are quicker and easier to identify than with a conventional system and are generally cheaper and more straightforward to rectify.

SuDS provide an opportunity to improve and connect habitat in urbanised environments, as well as playing an important role in delivering and reinforcing wider green infrastructure ambitions. SuDS can also deliver recreation and education opportunities.

SuDS must be considered at the outset, during preparation of the initial site conceptual layout to ensure that enough land is given to design spaces that will be an asset to the development rather than an after-thought. Advice on best practice is available from Cambridgeshire County Council (as LLFA), the Environment Agency and the Construction Industry Research and Information Association (CIRIA).

More detailed guidance on the use of SuDS is providing in Section 9.

9 Surface water management and SuDS

9.1 What is meant by Surface Water Flooding?

Surface water flooding describes flooding from sewers, drains, and ditches that occurs during heavy rainfall.

Surface water flooding includes

- **pluvial flooding:** flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (overland surface runoff) before it either enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity;
- **sewer flooding:** flooding that occurs when the capacity of underground water conveyance systems is exceeded, resulting in flooding inside and outside of buildings. Normal discharge of sewers and drains through outfalls may be impeded by high water levels in receiving waters which may cause water to back up and flood around buildings or in built up areas. Sewer flooding can also arise from operational issues such as blockages or collapses of parts of the sewer network; and
- **overland flows entering the built up area from the rural/urban fringe:** includes overland flows originating from groundwater springs.

9.2 Role of the LLFA and Local Planning Authority in surface water management

From April 2015 local planning policies and decisions on planning applications relating to major development should ensure that SuDS for management of run-off are put in place. The approval of SuDS lies with the Local Planning Authority.

In April 2015 Cambridgeshire County Council was made a statutory consultee on the management of surface water and, as a result, will be required to provide technical advice on surface water drainage strategies and designs put forward for major development proposals.

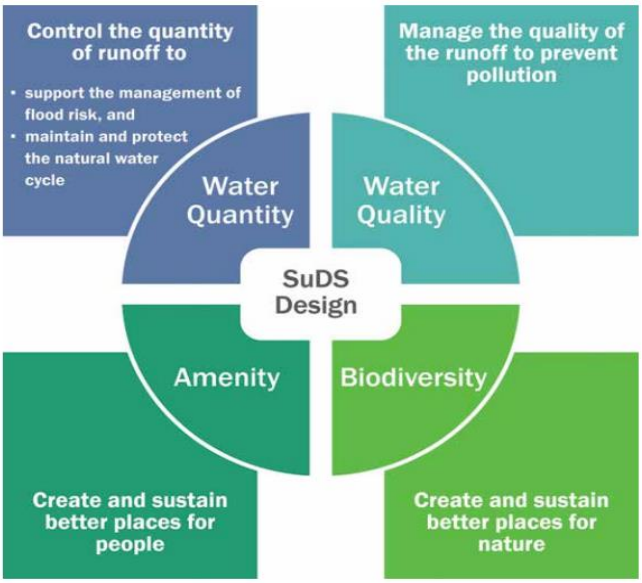
Major developments are defined as

- residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known; and
- non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of one hectare or more.

When considering planning applications, Huntingdonshire District Council will seek advice from the relevant flood risk management bodies, principally Cambridgeshire County Council on the management of surface water, to satisfy themselves that the development's proposed minimum standards of operation are appropriate, and to ensure, through the use of planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the development's lifetime. Judgement on what SuDS system would be reasonably practicable will be through reference to **Defra's Non-Statutory Technical Standards for SuDS** and the **Cambridgeshire Flood and Water SPD** and will take into account design and construction costs.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. This will assist with the delivery of well designed, appropriate and effective SuDS. Proposals should also comply with the key SuDS principles regarding solutions that deliver multiple long-term benefits. These four principles are shown in Figure 9-1.

Figure 9-1: Four principles of SuDS design



Source: **The SuDS Manual (C753) Ciria (2015)**

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9.3 Sustainable Drainage Systems (SuDS)

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

SuDS provide a means of dealing with the quantity and quality of surface water whilst offering additional benefits over traditional systems of improving amenity and biodiversity. The correct use of SuDS can also allow developments to counteract the negative impact that urbanisation has on the water cycle by promoting infiltration and replenishing ground water supplies. SuDS if properly designed can improve the quality of life within a development offering additional benefits such as:

- Improving air quality
- Regulating building temperatures
- Reducing noise
- Providing education opportunities
- Cost benefits over underground piped systems

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 the majority of spaces. For example, permeable paving could be used in parking spaces or rainwater gardens into traffic calming measures.

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

9.3.1 Types of SuDS Systems

There are many different SuDS components that can be implemented in attempts to mimic pre-development drainage (Table 9-1). The suitability of the techniques will be dictated in part by the development proposal and site conditions. Advice on best practice is available from the Environment Agency and the Construction Industry Research and Information Association (CIRIA) e.g. the **CIRIA SuDS Manual C753 (2015).**

Cambridgeshire County Council has produced **SuDS guidance** which includes information on different types of SuDS systems detailing practical issues, solutions and design considerations.

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

SuDS Technique	Flood Reduction	Water Quality Treatment & Enhancement	Landscape and Wildlife Benefit
Living roofs	✓	✓	✓
Basins and ponds	✓	✓	✓
Constructed wetlands	✓	✓	✓
Balancing ponds	✓	✓	✓
Detention basins	✓	✓	✓
Retention ponds	✓	✓	✓
Filter strips and swales	✓	✓	✓
Infiltration devices	✓	✓	✓
Soakaways	✓	✓	✓
Infiltration trenches and basins	✓	✓	✓
Permeable surfaces and filter drains	✓	✓	
Gravelled areas	✓	✓	
Solid paving blocks	✓	✓	
Porous pavements	✓	✓	
Tanked systems	✓		
Over-sized pipes/tanks	✓		
Storm cells	✓		

9.3.2 Treatment

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

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

The number of treatment stages required depends primarily on the source of the runoff. A drainage strategy will need to demonstrate that an appropriate number of treatment stages are delivered. Further information on treatment stages is provided in Section 6.3 the **Cambridgeshire Flood and Water SPD**.

9.3.3 SuDS Management

SuDS components should not be used individually but as a series of features in an interconnected system designed to capture water at the source and convey it to a discharge location. SuDS

components should be selected based on design criteria and how surface water management is to be integrated within the development and landscaping setting. By using a number of SuDS components in series it is possible to reduce the flow and volume of runoff as it passes through the system as well as minimising pollutants which may be generated by a development. Further information on SuDS management is provided in Section 6.3 the **Cambridgeshire Flood and Water SPD**.

9.3.4 Overcoming SuDS constraints

The design of a SuDS system will be influenced by a number of physical and policy constraints. These should be taken into account and reflected upon during the conceptual, outline and detailed stages of SuDS design. Table 9-2 details some possible constraints and how they may be overcome and includes information from both the SuDS Manual (C753) and the Cambridgeshire Flood and Water SPD. Guidance should also be sought from the Environment Agency.

Table 9-2: Example SuDS constraints and possible solutions

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

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

9.4 Other surface water considerations

9.4.1 Groundwater Source Protection Zones (GSPZ)

In addition to the AStGW data the Environment Agency also defines Groundwater Source Protection Zones in the vicinity of groundwater abstraction points. These areas are defined to protect areas of groundwater that are used for potable supply, including public/private potable

supply, or for use in the production of commercial food and drinks. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. The definition of each zone is shown below:

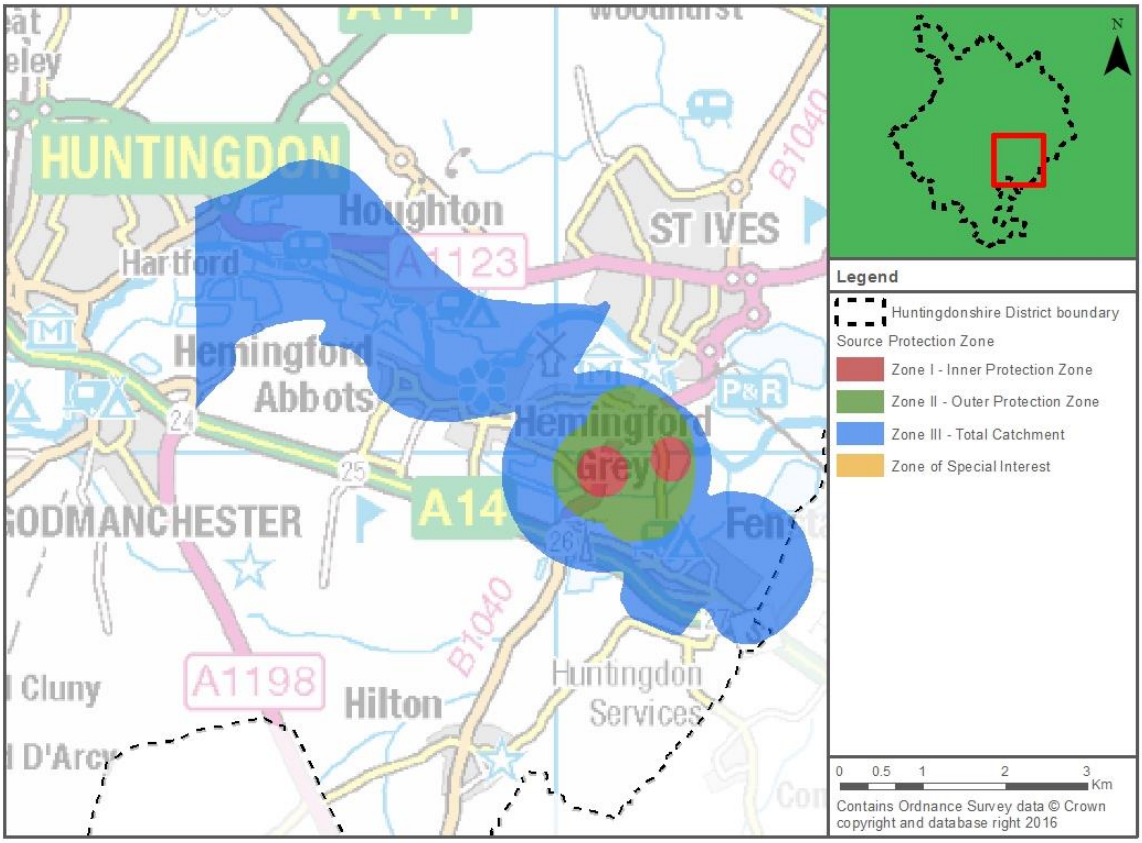
- Zone 1 (Inner Protection Zone) – Most sensitive zone: defined as the 50-day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres
- Zone 2 (Outer Protection Zone) – Also sensitive to contamination: defined by a 400-day travel time from a point below the water table. This zone has a minimum radius around the source, depending on the size of the abstraction
- Zone 3 (Total Catchment) - Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source.
- Zone 4 (Zone of special interest) – A fourth zone SPZ4 or 'Zone of Special Interest' usually represents a surface water catchment which drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream).

Four GSPZ have been identified in Huntingdonshire. They are located in the following areas:

- South-east of Huntingdon
- Hemingford
- South of St Ives

The locations of the GPSZs are shown in Figure 9-2.

Figure 9-2: Groundwater Source Protection Zones



9.5 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies.

The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process.

The whole of the Huntingdonshire District is classed as a surface water NVZ. In addition, the area in the south of the district (Huntingdon and St Ives) is classed as a groundwater NVZ.

10 Flood warning and emergency planning

10.1 Flood emergencies

Emergency planning is a core component of civil protection and public safety practices and seeks primarily to prevent, or secondly mitigate the risk to life, property, businesses, infrastructure and the environment. In the UK, emergency planning is performed under the direction of the 2004 Civil Contingencies Act (CCA).

From a flood risk perspective, emergency planning can be broadly split into three phases: before, during and after a flood. The measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to respond to, and recover from, flooding. In development planning, a number of these activities are already **integrated** with national building control and planning policies e.g. the NPPF.

Safety is a key consideration for any new development and includes the likely impacts of climate change and, where there is a residual risk of flooding, the availability of adequate flood warning systems for the development, safe access and egress routes and evacuation procedures. It is a requirement under the NPPF that a flood warning and evacuation plan is prepared for sites at risk of flooding used for holiday or short-let caravans and camping and are important at any site that has transient occupants (e.g. hostels and hotels) and for essential ancillary sleeping or residential accommodation for staff. Flood warning and evacuation plans may also be referred to as an emergency flood plan or flood response plan.

Emergency planning and flood risk management links

- **2004 Civil Contingencies Act**
- **DEFRA (2014) National Flood Emergency Framework for England**
- **Government guidance for public safety and emergencies**

10.2 Existing Flood Warning Systems

The Environment Agency is the lead organisation for providing warnings of fluvial flooding (for watercourses classed as *Main Rivers*) and coastal flooding in England. The Environment Agency supplies Flood Warnings via the Floodline Warnings Direct (FWD) service, to homes and businesses within Flood Zones 2 and 3. The different levels of warning are shown in Table 10-1.

It is the responsibility of individuals to sign-up to this service in order to receive the flood warnings via FWD. Registration and the service is free and publically available. It is recommended that any household considered at risk of flooding signs-up. Developers should also encourage those owning or occupying developments, where flood warnings can be provided, to sign up to receive them. This applies even if the development is defended to a high standard.

There are currently 10 fluvial Flood Alert Areas and 19 fluvial Flood Warning Areas (FWAs) covering parts of Huntingdonshire. Appendix G shows the fluvial FWA coverage for the district.

Table 10-1: Environment Agency Flood Warnings Explained

Flood Warning Symbol	What it means	What to do
	**Flood Alerts** are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. It is issued earlier than a flood warning, to give customers advance notice of the possibility of flooding, but before there is full confidence that flooding in Flood Warning Areas is expected.	✓ Be prepared to act on your flood plan ✓ Prepare a flood kit of essential items ✓ Monitor local water levels and the flood forecast on the Environment Agency website ✓ Stay tuned to local radio or TV ✓ Alert your neighbours ✓ Check pets and livestock ✓ Reconsider travel plans
	**Flood Warnings** warn people of expected flooding and encourage them to take action to protect themselves and their property.	✓ Move family, pets and valuables to a safe place ✓ Turn off gas, electricity and water supplies if safe to do so ✓ Seal up ventilation system if safe to do so ✓ Put flood protection equipment in place ✓ Be ready should you need to evacuate from your home ✓ 'Go In, Stay In, Tune In'
	**Severe Flood Warnings** warn people of expected severe flooding where there is a significant threat to life.	✓ Stay in a safe place with a means of escape ✓ Co-operate with the emergency services and local authorities ✓ Call 999 if you are in immediate danger
Warnings no longer in force	Informs people that river or sea conditions begin to return to normal and no further flooding is expected in the area. People should remain careful as flood water may still be around for several days.	✓ Be careful. Flood water may still be around for several days ✓ If you've been flooded, ring your insurance company as soon as possible

10.3 Emergency planning and development

NPPF seeks to avoid inappropriate development in areas at risk from all sources of flooding. It is essential that any development which will be required to remain operational during a flood event is located in the lowest flood risk zones to ensure that, in an emergency, operations are not impacted on by flood water. All flood sources should be considered. In particular sites should be considered in relation to the areas of drainage critical problems highlighted in the Cambridgeshire and St Neots SWMPs.

The outputs of this SFRA should be compared and reviewed against any emergency plans and continuity arrangements within Huntingdonshire. This includes the nominated rest and reception centres (and prospective ones), to ensure evacuees are outside of the high risk flood zones and will be safe during a flood event.

10.3.1 Safe access and egress

The NPPG outlines how developers can ensure safe access and egress to and from development in order to demonstrate that development satisfies the second part of the Exception Test. Access considerations should include the voluntary and free movement of people during a 'design flood' as well as for the potential of evacuation before a more extreme flood. The access and egress

must be functional for changing circumstances over the lifetime of the development. The NPPG sets out that:

- Access routes should allow occupants to safely access and exit their dwellings in design flood conditions. In addition, vehicular access for emergency services to safely reach development in design flood conditions is normally required; and
- Where possible, safe access routes should be located above design flood levels and avoid flow paths including those caused by exceedance and blockage. Where this is unavoidable, limited depths of flooding may be acceptable providing the proposed access is designed with appropriate signage etc. to make it safe. The acceptable flood depth for safe access will vary as this will be dependent on flood velocities and risk of debris in the flood water. Even low levels of flooding can pose a risk to people in situ (because of, for example, the presence of unseen hazards and contaminants in floodwater, or the risk that people remaining may require medical attention).

As part of an FRA, the developer should review the acceptability of the proposed access in consultation with the Council and the Environment Agency. Site and plot specific velocity and depth of flows should be assessed against standard hazard criteria to ensure safe access and egress can be achieved.

10.3.2 Potential evacuations

During flood incidents, evacuation may be considered necessary. The Environment Agency and DEFRA's standing advice for undertaking flood risk assessments for planning applications states that details of emergency escape plans are required for any parts of the building that are below the estimated flood level. The plans should show

- single storey buildings or ground floors that do not have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- basement rooms have clear internal access to an upper level, e.g. a staircase; and
- occupants can leave the building if there is a flood and there is enough time for them to leave after flood warnings.

Situations may arise where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. developments located immediately behind a defence and at risk of a breach). These allocations should be assessed against the outputs of the SFRA and where applicable, a site-specific Flood Risk Assessment to help develop emergency plans.

10.3.3 Flood warning and evacuation plans

Flood warning and evacuation plans are a potential mitigation measure to manage the residual risk.

The Environment Agency provides practical advice and templates on how to prepare a flood plan for individuals, communities and businesses (see text box for useful links).

Guidance documents for preparation of flood response plans

- **Environment Agency (2012) Flooding – minimising the risk, flood plan guidance for communities and groups**
- **Environment Agency (2014) Community Flood Plan template**
- **Environment Agency Personal flood plans**
- **Flood Plan UK 'Dry Run' - A Community Flood Planning Guide**

It is recommended that emergency planners at Huntingdonshire District Council are consulted prior to the production of any emergency flood plan.

10.4 Risk to critical infrastructure / vulnerable land uses

Flood Zones have been queried against the locations of critical infrastructure / vulnerable land uses including schools, hospitals, care homes, major road networks etc. Overall the level of flood risk is relatively low throughout the district with no hospitals in Flood Zone 2 or 3. There are potentially some care homes and electricity sub-stations shown to be within Flood Zones 2 and 3. Approximately 11 schools are also shown to be at risk in the district.

In addition, the following key transport infrastructure is also shown to be at risk

- A14
  - At Spaldwick
- A1
  - at Little Paxton
- A141
  - through Warboys High Fen between Chapel Head and Chatteris
- A1123
  - between the A141 junction and Huntingdon and Houghton cemetery
  - between Bluntisham Road, Needingworth and Station Road, Bluntisham
  - Saint Audrey Lane, St Ives (near Pig Lane and Woodside Way)
  - At roundabout with B1040
- A1198
  - near Papworth St Agnes
- A1096
  - Whole length of road between St Ives and Galley Hill
- B1041
  - Between High Street, St Neots and Skipper Way, Little Paxton
- B1048
  - Between St Neots Road and Milton Avenue
- B1428
  - Between junction with Great North Road and Huntingdon Street
  - Pockets of risk along Cambridge Street through St Neots until it passes under the railway line
- Cambridgeshire Guided Busway
  - The Cambridgeshire Guided Busway is shown to be at risk between the council boundary and St Ives as well as between Houghton and Huntingdon.
- East Coast Mainline
  - The East Coast Mainline is shown to be at risk as it passes through the Middle Level, between Church End and Yaxley

11 Strategic flood risk solutions

11.1 Introduction

Strategic flood risk solutions may offer a potential opportunity to reduce flood risk in the district. As described in Section 2.6, Huntingdonshire is covered by the Sub Area 7 Policy Unit as part of the Great Ouse CFMP. In this Policy Unit there are specific 'actions' to manage flood risk in the area. Those relevant to Huntingdonshire, in relation to strategic flood risk mitigation, are:

- Continue with the current flood risk management.
- Investigate options to provide local property-level flood mitigation for Huntingdon and Brampton to reduce flood risk in low magnitude flood events.
- Continue with improvements to the flood warning service by extending the current Flood Warnings Direct Service.
- Ensure any policies within the Local Plan, or any revisions, are in line with the CFMP policy.
- Work with partners to develop emergency response plans for critical infrastructure, community facilities and transport links at risk from flooding.
- Continue with, and implement, the recommendations from the Cambridgeshire County Council Surface Water Management Scoping Study (this has been superseded since the CFMP was published by the Cambridgeshire County Council SWMP).

The following sections outline different options which could be considered for strategic flood risk solutions.

It should be noted that the policy option for Sub Area 7 is Policy 3 – continue with the existing or alternative actions to manage flood risk at the current level; therefore, any strategic solutions should ensure that they are consistent with the wider catchment policy.

Water Framework Directive considerations are also covered in Section 7 of the **Cambridgeshire Flood and Water SPD**.

11.2 Flood storage schemes

Flood storage schemes aim to reduce the flows passed downriver to mitigate downstream flooding. Development increases the impermeable area within a catchment, creating additional and faster runoff into watercourses. Flood storage schemes aim to detain this additional runoff, releasing it downstream at a slower rate, to avoid any increase in flood depths and/or frequency downstream. Methods to provide these schemes include[8]:

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

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

The construction of new upstream storage schemes as part of upstream catchment-based approaches within Huntingdonshire would provide one potential strategic solution to flood risk. Watercourses which are rural in their upper reaches but have high levels of flood risk to urban areas in the downstream reaches are potential candidates, as the open land in the upper reaches can potentially provide the space for an attenuation area, providing benefit to the urban area downstream.

11.2.1 Promotion of SuDS

By considering SuDS at an early stage in the development of a site, the risk from surface water can be mitigated to a certain extent within the site as well as reduce the risk that the site poses to third party land. SuDS should be promoted on all new developments to ensure the quantity and quality of surface water is dealt with sustainably to reduce flood risk. The policies and guidance produced by Cambridgeshire County Council as LLFA (summarised in Chapter 9), should actively

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

encourage developers to use the information to produce technically proficient and sustainable solutions for drainage.

11.3 Catchment and Floodplain restoration

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

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

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible. Buffer areas around watercourses provide an opportunity to restore parts of the floodplain
- Removal of redundant structures to reconnect the watercourse and the floodplain. There are a number of culverted sections of watercourse located throughout the district which if returned to a more natural state would potentially reduce flood risk to the local area
- Apply the Sequential Approach to avoid new development within currently undefended floodplain.

For those sites considered within the Local Plan and / or put forward by developers, that also have watercourses flowing through or past them, the sequential approach should be used to locate development away from these watercourses. This will ensure the watercourses retain their connectivity to the floodplain. Loss of floodplain connectivity in rural upper reaches of tributaries which flow through urban areas in the district, could potentially increase flooding within the urban areas. This will also negate any need to build flood defences within the sites. It is acknowledged that sites located on the fringes of urban areas within the district are likely to have limited opportunity to restore floodplain in previously developed areas.

11.3.1 Upstream natural catchment management

Essentially, opportunities to work with natural processes to reduce flood and erosion risk, benefit the natural environment and reduce costs of schemes should be sought, requiring integrated catchment management and involving those who use and shape the land. It also requires partnership working with neighbouring authorities, organisations and water management bodies.

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

11.3.2 Structure Removal and / or modification (e.g. Weirs), de-culverting

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

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

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

With careful early planning, watercourses can be made a feature of the site and ownership and maintenance should be considered early. De-culverting of a watercourse, to open it up and make it a feature of the site to allow for flood storage and betterment downstream, should be considered for all sites with culverted watercourses within their boundary.

Further information is provided in the 'Trash and Security Screen Guide 2009'[9], published by the Environment Agency/ Defra, which should be used as evidence for any culvert assessment, improvement or structure retention.

11.3.3 Bank Stabilisation

It is generally recommended that bank erosion is avoided where possible and all landowners are encouraged to avoid using machinery and vehicles close to or within the watercourse.

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

11.3.4 Bank removal, set back and / or increased easement

The removal or realignment of flood embankments and walls can allow the natural interrelationship between the river channel and the floodplain to be reinstated. This can be achieved at a small scale within urban areas providing pockets of attractive green spaces along rivers, whilst also improving floodplain storage within confined urban environments at times of flooding.

A detailed assessment would need to be undertaken to gain a greater understanding of the response to the channel modification, including flood risk analysis to investigate flood risk impacts.

An assessment of formal flood defences has been undertaken as part of this SFRA. All formal defences have a role in reducing flood risk, and therefore opportunities for bank removal, set back and / or increased easement will be limited. However, there may be informal artificial structures (embankments, walls) or defences within the district which are now redundant.

11.3.5 Re-naturalisation

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

11.4 Flood defences

There are a number of formal flood defences present within Huntingdonshire (see Section 7) for further information). Few of the proposed development sites would benefit from these defences.

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

9 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291172/scho1109brhf-e-e.pdf

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12 Level 1 assessment of potential development sites

12.1 Introduction

A number of potential development sites were provided by Huntingdonshire District Council. These sites were screened against a suite of available flood risk information and spatial data to provide a summary of risk to each site (Table 12-1). Indication is provided on the proportion of a given site affected by levels and types of flood risk, along with whether historic incidences of flooding have occurred, and any watercourses with a catchment less than 3km^2 flow through the site.

The information provided is intended to enable a more informed consideration of the sites using the sequential approach. Sites shown to be at fluvial flood risk or where further modelling is required to understand the level of risk have been taken forward to the Level 2 assessment.

12.2 Sequential testing

Table 12-1 summarises the flood risk to the supplied development sites. The majority of the sites are predominantly located within Flood Zone 1 or have a relatively small proportion of the site area within Flood Zones 2 and 3. Surface water flooding is shown to be a risk to the majority of sites.

Inclusion of these sites in the SFRA does not mean that development can be permitted without further consideration of the Sequential Test. The required evidence should be prepared as part of a Local Plan Sustainability Appraisal or alternatively, it can be demonstrated through a free-standing document, or as part of strategic housing land or employment land availability assessments. NPPG Flood Risk and Coastal Change describes how the **Sequential Test** should be applied in the preparation of a Local Plan. The assessments undertaken for this SFRA will assist the council when they undertake the Sequential Test.

Table 12-1: Summary of flood risk to Huntingdonshire potential development sites

Site name	Area (ha)	Proportion of site shown to be at risk (%)									Ordinary Watercourse with catchment less than 3km^2 flowing adjacent or through site	Taken forward to Level 2 Assessment	Additional modelling undertaken for Level 2 SFRA (see section 13.2.1)
		Flood Zones				Updated Flood Map for Surface Water			Historic Flood Map	Reservoir inundation mapping			
		FZ3b	FZ3a	FZ2	FZ1	30yr	100yr	1,000yr					
Tyrell's Marina, Godmanchester	0.3	77%	9%	2%	12%	0%	0%	2%	100%	92%	No	No	No
Cromwell Road North, St Neots	2.61	32%	2%	2%	64%	6%	15%	22%	1%	0%	Yes	Yes	Yes
Loves Farm Reserved Site, St Neots	1.02	26%	37%	36%	0%	10%	2%	74%	0%	0%	Yes	Yes	Yes
RGE Engineering, Godmanchester	2.57	24%	3%	7%	66%	0%	0%	4%	100%	99%	No	Yes	No
Gas Depot, Mill Common, Huntingdon	0.64	8%	0%	36%	56%	0%	0%	0%	47%	100%	No	Yes	No
North of Clyde Farm, Godmanchester	2.15	8%	2%	4%	86%	9%	4%	10%	0%	1%	Yes	Yes	Yes
Vindis Car Show Room, St Ives	2.77	7%	93%	0%	0%	0%	1%	14%	100%	100%	No	Yes	No
St Mary's Urban Village, St Neots	0.9	7%	6%	88%	>1%	0%	0%	1%	100%	1%	No	Yes	No
Thrapston Road, north and west of Church Road	5.74	7%	10%	24%	59%	0%	1%	5%	32%	100%	No	Yes	No
Brampton Park	34.4	7%	6%	37%	50%	0%	1%	15%	0%	193%	No	No	No
Former Youth Centre, Priory Road, St Neots	0.47	6%	93%	1%	0%	0%	0%	4%	100%	100%	No	Yes	No
Riversfield, Little Paxton	9.86	5%	2%	3%	90%	0%	1%	6%	5%	10%	No	Yes	No
North East of Alconbury Airfield	88.07	5%	1%	2%	92%	4%	1%	5%	0%	0%	Yes	Yes	Yes
St Ives West	53.79	2%	0%	0%	98%	0%	0%	3%	4%	4%	No	Yes	No
Lodge Farm, Huntingdon	204.00	2%	0%	1%	97%	2%	1%	7%	0%	2%	Yes	Yes	Yes
St Neots East	226.00	1%	7%	4%	88%	4%	3%	9%	0%	0%	Yes	Yes	Yes
Alconbury Weald	575.00	1%	1%	0%	98%	2%	2%	7%	0%	0%	Yes	Yes	Yes
Ramsey Gateway (High Lode)	2.57	1%	81%	5%	13%	1%	1%	8%	0%	0%	Yes	Yes	No
South of The Foundry, Factory Bank, Ramsey	1.52	0%	100%	0%	0%	0%	0%	1%	0%	0%	No	Yes	No
West of London Road, St Ives	1.51	0%	100%	0%	0%	0%	0%	<1%	0%	100%	No	Yes	No
West of Cullum Farm, Hemingford Grey	1.31	0%	99%	1%	0%	<1%	2%	6%	0%	100%	No	Yes	No
Newtown Road, Ramsey	0.39	0%	84%	10%	6%	0%	<1%	1%	0%	0%	Yes	Yes	No
Former car showroom, London Road, St Ives	1.22	0%	52%	48%	0%	0%	0%	0%	100%	86%	No	Yes	No
East of Brookside, Sawtry	4.00	0%	15%	7%	78%	48%	15%	26%	0%	0%	Yes	Yes	No
Bill Hall Way, Sawtry	1.70	0%	12%	9%	79%	6%	2%	38%	0%	0%	Yes	Yes	No
Fire Station, Huntingdon	0.40	0%	9%	51%	41%	2%	8%	53%	100%	100%	No	Yes	No
North of Edison Bell Way, Huntingdon	0.62	0%	5%	95%	0%	0%	2%	27%	41%	35%	No	Yes	No
Ramsey Gateway	1.80	0%	4%	6%	90%	2%	5%	15%	0%	0%	No	Yes	No
Giffords Farm, St Ives	5.57	0%	2%	13%	85%	30%	18%	28%	0%	0%	No	Yes	No
Main Street, Huntingdon	1.49	0%	0%	100%	0%	1%	21%	39%	100%	100%	No	Yes	No
Huntingdon Street, St Neots	1.00	0%	0%	100%	0%	0%	2%	9%	93%	90%	No	Yes	No
South of Edison Bell Way, Huntingdon	1.09	0%	0%	82%	18%	2%	8%	50%	41%	81%	No	Yes	No
St Neots Fire Station and vacant land, St Neots	0.41	0%	0%	68%	32%	11%	10%	21%	100%	91%	No	Yes	No
Brampton Golf Course	2.96	0%	0%	59%	41%	0%	0%	6%	0%	100%	No	Yes	No
Ermine Street / Edison Bell Way, Huntingdon	0.3	0%	0%	37%	63%	0%	0%	13%	3%	27%	No	Yes	No
Chequers Court, Huntingdon	2.62	0%	0%	27%	73%	3%	8%	43%	9%	88%	No	Yes	No
East of Silver Street, Buckden	0.68	0%	0%	4%	96%	0%	0%	18%	0%	0%	Yes	Yes	Yes
Giffords Park	126.97	0%	0%	3%	97%	9%	6%	13%	0%	0%	No	Yes	No
Somersham Town Football Ground	1.80	0%	0%	0%	100%	22%	26%	30%	0%	0%	No	No	No
Cambridge Road, Fenstanton	7.86	0%	0%	0%	100%	18%	5%	4%	0%	0%	No	No	No
West of St Andrews Way, Sawtry	2.40	0%	0%	0%	100%	12%	7%	10%	0%	0%	No	No	No
94 Great Whyte, Ramsey	0.71	0%	0%	0%	100%	10%	39%	13%	0%	0%	Yes	No	No

Site name	Area (ha)	Proportion of site shown to be at risk (%)									Ordinary Watercourse with catchment less than 3km² flowing adjacent or through site	Taken forward to Level 2 Assessment	Additional modelling undertaken for Level 2 SFRA (see section 13.2.1)
		Flood Zones				Updated Flood Map for Surface Water			Historic Flood Map	Reservoir inundation mapping			
		FZ3b	FZ3a	FZ2	FZ1	30yr	100yr	1,000yr					
Ermine Street, Huntingdon	85.00	0%	0%	0%	100%	8%	4%	19%	0%	0%	No	No	No
Land adjacent Bicton Industrial Estate, Kimbolton	1.30	0%	0%	0%	100%	7%	12%	14%	0%	0%	No	No	No
East of Glebe Farm, Sawtry	3.87	0%	0%	0%	100%	6%	15%	32%	0%	0%	Yes	No	No
Newlands, St Ives Rd, Somersham	2.48	0%	0%	0%	100%	5%	6%	22%	0%	0%	No	No	No
North of Blackhorse Ind. Estate, Sawtry	1.60	0%	0%	0%	100%	3%	3%	11%	0%	0%	Yes	No	No
Wigmore Farm Buildings, Godmanchester	0.70	0%	0%	0%	100%	3%	4%	13%	100%	100%	No	No	No
Biggin Lane	9.04	0%	0%	0%	100%	3%	2%	29%	0%	0%	Yes	No	No
Bearscroft Farm, Godmanchester	45.5	0%	0%	0%	100%	2%	1%	8%	0%	6%	No	No	No
West of Station Road, Kimbolton	1.30	0%	0%	0%	100%	2%	4%	15%	0%	0%	No	No	No
South of Farrier's Way, Warboys	3.63	0%	0%	0%	100%	2%	3%	6%	0%	0%	No	No	No
West Station Yard and Northern Mill	1.00	0%	0%	0%	100%	2%	2%	6%	0%	0%	No	No	No
RAF Alconbury	84.1	0%	0%	0%	100%	1%	2%	7%	0%	0%	Yes	No	No
Hinchingbrooke Health Campus, Huntingdon	22.6	0%	0%	0%	100%	1%	1%	5%	0%	0%	No	No	No
Wyton on the Hill	254.06	0%	0%	0%	100%	1%	1%	5%	0%	0%	No	No	No
Former Dairy Crest Factory, Fenstanton	3.2	0%	0%	0%	100%	1%	1%	6%	0%	0%	No	No	No
The Pasture, Somersham	0.90	0%	0%	0%	100%	1%	0%	2%	0%	0%	No	No	No
Field Road, Ramsey	5.2	0%	0%	0%	100%	1%	1%	8%	0%	0%	No	No	No
West of Ramsey Road, Warboys	1.70	0%	0%	0%	100%	1%	1%	2%	0%	0%	No	No	No
North of the Bank, Somersham	2.14	0%	0%	0%	100%	1%	0%	1%	0%	0%	No	No	No
South of Fern Court, Stukeley Road, Huntingdon	0.90	0%	0%	0%	100%	0%	3%	7%	0%	0%	No	No	No
Former Forensic Science Laboratory, Huntingdon	2.71	0%	0%	0%	100%	0%	1%	2%	0%	0%	No	No	No
George Street, Huntingdon	2.7	0%	0%	0%	100%	0%	1%	2%	0%	0%	No	No	No
Former Snowcap Mushrooms, Yaxley	2.30	0%	0%	0%	100%	0%	1%	9%	0%	0%	No	No	No
Nelson Road, St Neots	1.90	0%	0%	0%	100%	0%	1%	3%	0%	0%	No	No	No
Askew's Lane, Yaxley	0.50	0%	0%	0%	100%	0%	1%	3%	0%	0%	No	No	No
George Street / Edison Bell Way, Huntingdon	0.30	0%	0%	0%	100%	0%	0%	29%	0%	0%	No	No	No
St Mary's St, Huntingdon	0.10	0%	0%	0%	100%	0%	0%	15%	0%	0%	No	No	No
South of St Andrews Way, Sawtry	1.41	0%	0%	0%	100%	0%	0%	10%	0%	0%	No	No	No
Whytefield Road, Ramsey	0.90	0%	0%	0%	100%	0%	0%	7%	0%	0%	No	No	No
St Ives football Club	1.40	0%	0%	0%	100%	0%	0%	6%	0%	0%	No	No	No
Manor Farm Buildings, Warboys	0.61	0%	0%	0%	100%	0%	0%	6%	0%	0%	No	No	No
Corpus Christi Lane, Godmanchester	0.40	0%	0%	0%	100%	0%	0%	4%	0%	100%	No	No	No
RAF Upwood and Upwood Hill House, Ramsey	25.00	0%	0%	0%	100%	0%	0%	2%	0%	0%	No	No	No
West of Station Road, Warboys	4.70	0%	0%	0%	100%	0%	0%	2%	0%	0%	No	No	No
Eaton Court, St Neots	1.20	0%	0%	0%	100%	0%	0%	2%	0%	0%	No	No	No
West of Edison Bell Way, Huntingdon	0.50	0%	0%	0%	100%	0%	0%	2%	0%	0%	No	No	No
West of Brampton	12.25	0%	0%	0%	100%	0%	0%	2%	0%	100%	Yes	No	No
Yax Pak, Yaxley	3.20	0%	0%	0%	100%	0%	0%	1%	0%	0%	No	No	No
Fenton Field Farm, Warboys	1.10	0%	0%	0%	100%	0%	0%	1%	0%	0%	No	No	No
Sapley Park Farm	71.00	0%	0%	0%	100%	<1%	<1%	<1%	0%	0%	Yes	No	No
West of Railway, Brampton Rd, Huntingdon	2	0%	0%	0%	100%	0%	0%	0%	0%	0%	No	No	No
Park View Garage, Brampton	0.41	0%	0%	0%	100%	0%	0%	0%	0%	100%	No	No	No
California Road, Huntingdon	1.2	0%	0%	0%	100%	0%	0%	0%	0%	0%	No	No	No
Cromwell Road Car Park, St Neots	0.58	0%	0%	0%	100%	0%	0%	0%	0%	0%	No	No	No

Site name	Area (ha)	Proportion of site shown to be at risk (%)									Ordinary Watercourse with catchment less than 3km² flowing adjacent or through site	Taken forward to Level 2 Assessment	Additional modelling undertaken for Level 2 SFRA (see section 13.2.1)
		Flood Zones				Updated Flood Map for Surface Water			Historic Flood Map	Reservoir inundation mapping			
		FZ3b	FZ3a	FZ2	FZ1	30yr	100yr	1,000yr					
Ivy Nursey, Fenstanton	1.48	0%	0%	0%	100%	0%	0%	0%	0%	0%	No	No	No
Rear of 64 High Street, Warboys	0.40	0%	0%	0%	100%	0%	0%	0%	0%	0%	No	No	No

13 Level 2 assessment of potential development sites

13.1 Introduction

The SFRA forms an integral part of Huntingdonshire District Council's evidence base, in terms of identifying locations for development and preparation of flood risk policies in the Local Plan, with one of the objectives of an SFRA being to help inform site allocations so they are in accordance with the NPPF. Proposed sites have been provided by the Council for assessment. Following the Level 1 screening assessment, a site was brought forward for a Level 2 assessment if it met the following criteria:

- The site is within Flood Zone 2 and/or 3; and/or
- An ordinary watercourse runs through or adjacent to the site.

This Level 2 SFRA assessment of sites helps to determine variations in flood risk across the Specified Sites, identifying site-specific FRA requirements and helping guide local policies to provide sustainable developments as well as reducing flood risk to existing communities.

13.2 Detailed site summary tables

As part of the Level 2 SFRA, detailed site summary tables have been produced for the Specified Sites below:

- Huntingdon
    - Fire Station, Huntingdon
    - Thrapston Road, north and west of Church Road
    - Lodge Farm, Huntingdon
    - Main Street, Huntingdon
    - North of Edison Bell Way, Huntingdon
    - South of Edison Bell Way, Huntingdon
    - Ermine Street / Edison Bell Way, Huntingdon
    - Alconbury Weald
    - Gas Depot by Port Holm, Huntingdon
    - North East of adjacent Alconbury Airfield
    - Chequers Court, Huntingdon
    - Brampton Park
    - Brampton Golf Course
- St Neots
    - Former Youth Centre, Priory Road, St Neots
    - St Neots Fire Station and vacant Land, St Neots
    - Love's Farm Reserved Site, St Neots
    - Cromwell Road North, St Neots
    - Huntingdon Street, St Neots
    - Riversfield, Little Paxon
    - St Mary's Urban Village, St Neots
    - St Neots East
- Godmanchester
    - RGE Engineering, Godmanchester
    - North of Clyde Farm, Godmanchester

    - Tyrells Marina, Godmanchester
- St Ives
    - Former car showroom, St Ives
    - Vindis Car Show Room, St Ives
    - Giffords Park
    - Giffords Farm, St Ives
    - St Ives West
    - West of Cullum Farm, Hemingford Grey
    - West of London Road, St Ives
- Buckden
    - Land East of Silver Street, Buckden
- Ramsey
    - South of the foundry, Ramsey
    - Newtown Road, Ramsey
    - Ramsey Gateway (High Lode), Ramsey
    - Ramsey Gateway, Ramsey
- Sawtry
    - Bill Hall Way, Sawtry
    - East of Brookside, Sawtry

Where available, the results from detailed hydraulic models were used in the assessment.

Where there are no detailed hydraulic models, 2D modelling was undertaken to determine Flood Zone 3a, Flood Zone 3b and Flood Zone 2, as well as provide depth, hazard and velocity information and map the effects of climate change, for a number of watercourses flowing through or adjacent to sites. Using this information combined with the uFMfSW, detailed site summary tables have been produced for the Specified Sites (see Appendix A). Each table sets out the following information:

- Site area
- Proportion of the site in each Flood Zone
- Mapping including Flood Zones, climate change and surface water
- Depth, hazard and velocity mapping
- A broad scale assessment of suitable SuDS components and considerations
- The presence of any flood defences
- Whether the site is covered by a flood warning service
- Whether there are any access and egress issues for the site
- The potential impacts of climate change in the future
- The flood risk implications for development
- Advice on the preparation of site-specific FRAs and considerations for developers

13.2.1 Important note on Flood Zones within the summary tables

Where available, Environment Agency hydraulic modelling results have been used to produce the mapping in the site summary tables.

However, additional modelling was undertaken for the Level 2 SFRA for the following scenarios

- Where development sites are located in Flood Zone 1 in the Environment Agency's Flood Map for Planning, but Ordnance Survey mapping shows a watercourse flows through, or adjacent to the site. This was applicable to the following sites

- St Neots Eastern Expansion
- Alconbury Weald
- Land east of Silver Street, Buckden
- Lodge Farm, Sapley
- Land adjacent Alconbury Airfield 2

- Where development sites are located in Flood Zone 2 or 3 in the Environment Agency's Flood Map for Planning, but no detailed hydraulic model exists. This was applicable to the following sites
  - Cromwell Road North, St Neots
  - North of Clyde Farm, Godmanchester

Mapping shown in the detailed site summary tables in Appendix A may differ to the Environment Agency Flood Zones and 'Flood Map for Planning' (Appendix C of this report) as results from the additional Level 2 modelling for the sites listed above are not included in Appendix C.

13.2.2 Note on SuDS suitability

As part of the assessment, an investigation has been undertaken to identify potentially suitable SuDS for each of the potential development locations taken forward to the Level 2 SFRA assessment.

This is based on catchment characteristics and additional datasets such as the Areas Susceptible to Ground Water flooding (AStGW) map and Soil maps of England and Wales which allow for a basic assessment of the soil characteristics on a site by site basis. Lidar (Light Detection and Ranging) Digital Terrain Model (DTM) was used as a basis for determining the topography and average slope across each potential development location. This data was then collated to provide an indication of particular groups of SuDS systems which might be suitable at a site.

Other datasets were used to determine other influencing factors on potential SuDS. These datasets include the following:

- Historic landfill sites
- Groundwater Source Protection Zones
- Groundwater Vulnerability Zones

This data was then collated to provide an indication of particular groups of SuDS systems which might be suitable at a site. SuDS components were categorised into five main groups, as shown in Table 12-2, and are included in each site summary table as part of the Level 2 assessment. This assessment should not be used as a definitive guide as to which SuDS would be suitable but used as an indicative guide of general suitability. More detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. It may be possible that those SuDS components highlighted as possibly not being suitable can be designed to overcome identified constraints.

Table 13-1: Summary of SuDS Categories

SuDS Type	Technique
Source Controls	Green Roof, Rainwater Harvesting, Pervious Pavements, Rain Gardens
Infiltration	Infiltration Trench, Infiltration Basin, Soakaway
Detention	Pond, Wetland, Subsurface Storage, Shallow Wetland, Extended Detention Wetland, Pocket Wetland, Submerged Gravel Wetland, Wetland Channel, Detention Basin
Filtration	Surface Sand filter, Sub-Surface Sand Filter, Perimeter Sand Filter, Bioretention, Filter Strip, Filter Trench
Conveyance	Dry Swale, Underdrained Swale, Wet Swale

The suitability of each SuDS type for the Specified Sites has been displayed using a traffic light colour system in the summary tables. The assessment of suitability is broad scale and indicative only; more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. The LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

Suitability	Description
	The SuDS Group and its associated techniques may be unsuitable
	The SuDS Group and its associated techniques may be suitable at the development but is likely to require additional engineering works
	The SuDS Group and its associated techniques are likely to be suitable

13.3 Complex sites

2D hydraulic modelling was used to determine Flood Zones and to gather strategic information on flood depth, velocities and hazard to people for a number of the proposed sites.

However, in a number of cases no modelling has been undertaken as the 2D modelling techniques would be unsuitable and flood extents would not be representative. More detailed modelling is outside the scope of this strategic study.

13.3.1 Ground model and / or hydrology issues

Hydrology, for input into the 2D model, is derived from the FEH CD-ROM catchment descriptors. Due to a number of the ordinary watercourses located within or adjacent to sites being relatively small (e.g. field drains), they were neither represented within the FEH CD-ROM nor located within detailed Lidar data. In these instances, it was determined that strategic 2D modelling techniques would be unsuitable, producing unrepresentative flood extents. These sites are summarised below

- 94 Great Whyte (culverted watercourse)
- West of Brampton (watercourse not represented in Environment Agency's detailed river network dataset or the FEH CD-ROM.)
- Biggin Lane, Ramsey (watercourse not defined in Lidar or represented on the FEH CD-ROM)
- Sapley Park Farm (watercourses are poorly defined in Lidar and not represented on the FEH CD-ROM)

- RAF Alconbury (watercourse not represented on the FEH CD-ROM)

In many cases, these may be small field ditches or highway drains. It is recommended that, during the planning stages, the presence of a watercourse is confirmed. If the watercourse does exist then a detailed flood risk assessment, including detailed modelling, should be undertaken to assess the level of flood risk the watercourse may pose to the development.

13.3.2 Watercourses in IDB districts

Where sites were shown to be in the Flood Map for Planning Flood Zone 2 and 3, a shortened version of the site summary table has been produced. These tables exclude information on depth, hazard and velocity and climate change which are only available through detailed modelling. This is applicable to the following sites

- Ramsey Gateway, Ramsey
- Ramsey Gateway (High Lode), Ramsey
- South of The Foundry, Factory Bank, Ramsey
- East of Brookside, Sawtry
- Bill Hall Way, Sawtry
- Newtown Road, Ramsey

A detailed hydraulic model of the relevant board system should be produced as part of the evidence base for any associated detailed flood risk assessment in the IDB area.

14 Summary

14.1 Overview

This Level 1 and 2 SFRA delivers a strategic assessment of risk from all sources of flooding in Huntingdonshire. It also provides an overview of policy and provides guidance for planners and developers.

14.2 Level 1 SFRA

14.2.1 Sources of flood risk

- Flood history shows that Huntingdonshire has been subject to flooding from several sources of flood risk, with the principal risk from fluvial sources.
- The key watercourse flowing through the study area is the River Great Ouse and its tributaries. The River Nene flows through a small area in the north of the district; however, the level of risk in the district from the River Nene is relatively low as it flows through a predominantly rural area. The majority of recorded fluvial flood events are associated with the River Great Ouse and its tributaries but there are numerous ordinary watercourses and awarded watercourses also within Huntingdonshire, with which recorded fluvial flood events are associated.
- The primary fluvial flood risk is associated with the River Great Ouse and its tributaries. The main urban areas are located along the River Great Ouse corridor; however, they are afforded some protection by flood defences.
- Watercourses in Internal Drainage Board (IDB) districts are managed for water level and flood risk management. They aim to provide a general standard of protection against flooding of 1% (Middle Level Commissioner watercourses) and 2-3% AEP (other IDBs), although there may be areas where the standard of protection is lower due to local circumstances.
- Huntingdonshire has 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. The update Flood Map for Surface Water (uFMfSW) further shows a number of prominent overland flow routes; these predominantly follow topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas. In addition, a number of these follow local road infrastructure.
- The sewers are managed by Anglian Water. The DG5 register of recorded historical sewer flooding was requested but not provided at the time of publication.
- The risk of inundation to the Huntingdonshire District as a result of reservoir breach or failure of a number of reservoirs within the area was assessed as part of the National Inundation Reservoir Mapping (NIRIM) study. Five reservoirs are located within the Huntingdonshire District, including Grafham Water; however, there are also reservoirs outside of the area whose inundation mapping is shown to affect the district.
- There are no records of flooding from reservoirs impacting properties inside the study area. The level and standard of inspection and maintenance required under the Reservoir Act 1975 means that the risk of flooding from reservoirs is relatively low.

14.2.2 Key policies and flood risk strategic documents

There are a number of relevant regional and local flood risk strategic documents and policies which have been considered within the SFRA, such as the Cambridgeshire Flood and Water Supplementary Planning Document (SPD), Catchment Flood Management Plan (CFMP), River Basin Flood Risk Management Plan (FRMP), the Preliminary Flood Risk Assessment (PFRA) and Local Flood Risk Management Strategy (LFRMS). Other policy considerations have also been incorporated, such as sustainable development principles, climate change and flood risk management.

14.2.3 Development and flood risk

The Sequential and Exception Test procedures for both Local Plans and Flood Risk Assessments (FRAs) have been documented, along with guidance for planners and developers. Links have been provided for various guidance documents and policies published by other Risk Management Authorities such as the Lead Local Flood Authority (LLFA) and the Environment Agency.

14.2.4 Defences

A high-level review of existing flood defences was undertaken and found a number of formal defences in the study area. Defences mainly consist of flood walls and embankments with the majority providing protection against a 1% AEP event. Defences are mainly located along the River Great Ouse at Houghton and the Hemingfords, Godmanchester, Holywell to Earith and St Neots. A Property Level Resilience scheme has also been implemented at Alconbury and Alconbury Weston.

14.2.5 Level 1 site screening

Potential development sites within the study area were screened against flood risk information to identify sites which would potentially need to be taken forward to a Level 2 SFRA. The screening also identified sites where additional modelling would be required, for example, sites where there is a watercourse that is not included in the Environment Agency's Flood Zone 2 and 3 coverage, or where Flood Zones 2 and 3a exist but further modelling was required to identify Flood Zone 3b and climate change as well as depth, velocity and hazard information. Additional 2D modelling was then undertaken for these sites for the purposes of the SFRA. For all other sites, results from Environment Agency hydraulic models were used.

On completion of the modelling, the sites were screened again to provide a summary of risk to each site including: the proportion of the site in each Flood Zone, the proportion of the site at risk from surface water and reservoir inundation, and whether the site is within, or partially within, the Environment Agency's Historic Flood Map.

Of the 87 potential development sites provided by Huntingdonshire District Council for assessment, 18 were at risk in Flood Zones 3b, 3a and 2, 11 were at risk in Flood Zones 3a and 2, and nine were at risk in Flood Zone 2. Of the remaining sites, all but six were shown to be at risk of surface water flooding. It should be noted that the proportion of the site at risk varied.

Where sites are shown to be in Flood Zones 2 and 3, flood risk to the sites has been assessed and summarised in more detail in a series of detailed summary tables as part of the Level 2 SFRA

14.3 Level 2 SFRA

14.3.1 Assessment methods

As part of the Level 2 SFRA, detailed site summary tables have been produced for each of the potential development sites taken forward from the Level 1 assessment. These sites are ones which are shown to be at risk of fluvial flood risk from watercourses running either through or adjacent to the site.

The summary tables set out the flood risk to each site, including maps of extent, depth and velocity of flooding as well as hazard mapping. Each table also sets out the flood risk implications for the site as well as guidance for site-specific FRAs. A broad scale assessment of possible SuDS constraints has also been provided giving an indication where there may be constraints to certain sets of SuDS components.

Flood risk information for the sites is largely from Environment Agency detailed hydraulic models, with the exception of the following sites, for which additional 2D modelling was undertaken for the SFRA to provide the level of detail required.

- St Neots East
- Alconbury Weald
- East of Silver Street, Buckden
- Lodge Farm, Huntingdon
- North East of Alconbury Airfield 2
- Cromwell Road North, St Neots

- North of Clyde Farm, Godmanchester

14.3.2 Key site issues

There were a number of instances where it was determined that strategic 2D modelling techniques would be unsuitable, producing unrepresentative flood extents. These sites are summarised below

- 94 Great Whyte (culverted watercourse)
- West of Brampton (watercourse not represented in Environment Agency's detailed river network dataset or the FEH CD-ROM.)
- Biggin Lane, Ramsey (watercourse not defined in Lidar or represented on the FEH CD-ROM)
- Sapley Park Farm (watercourses are poorly defined in Lidar and not represented on the FEH CD-ROM)
- RAF Alconbury (watercourse not represented on the FEH CD-ROM)

Additionally, given the highly complex nature of the IDB watercourses, 2D modelling techniques and standard FEH methodologies were not considered suitable for providing representative flood extents for IDB watercourses. Where sites were shown to be in the Flood Map for Planning Flood Zone 2 and 3, a shortened version of the site summary table has been produced. These tables exclude information on depth, hazard and velocity and climate change which are only available through detailed modelling. This is applicable to the following sites

- Ramsey Gateway, Ramsey
- Ramsey Gateway (High Lode), Ramsey
- South of The Foundry, Factory Bank, Ramsey
- East of Brookside, Sawtry
- Bill Hall Way, Sawtry
- Newtown Road, Ramsey

A detailed hydraulic model of the relevant board system should be produced as part of the evidence base for any associated detailed flood risk assessment in the IDB area.

14.3.3 Strategic flood risk solutions

- It is preferential that developments take a sequential approach to site layout, with the development being placed furthest away from the source of flood risk where sites are shown to be in Flood Zones 2 and 3.
- The construction of upstream storage schemes on watercourses within the District may provide one potential strategic solution to flood risk. Watercourses which are rural in their upper reaches but have high levels of flood risk to urban areas in the downstream reaches are potential candidates, as the open land in the upper reaches can potentially provide the space for an attenuation area, providing benefit to the urban area downstream. However, site assessments have shown that the majority of sites are too small, or are on urbanised watercourses, to provide storage. Further studies would be required to assess the feasibility, whether there is any benefit and, if so, whether the benefits would outweigh the costs.
- Floodplain restoration is one option which could benefit the District on a strategic level. De-culverting may help reduce flood risk by removing constrictions that lead to a build-up of flood water

14.4 Data issues

- Although the DG5 register was requested from Anglian Water, no response has been received at the time of publication of this report.
- There have been several flood reduction schemes in Huntingdonshire, most notably at St Ives, St Neots and Godmanchester. Flooding information in the SFRA for these areas has been based on the most up-to-date information at the time of preparation – the Environment Agency's lower Great Ouse model. The Environment Agency may hold other models that were undertaken for the schemes.

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15 Recommendations

A review of national and local policies has been conducted against the information collated on flood risk in this SFRA, along with assessment of the proposed sites brought forward into the Level 2 assessment. Following this, several recommendations have been made for the Council to consider as part of Flood Risk Management in Huntingdonshire.

15.1 Development management

15.1.1 Sequential approach to development

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

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

- Reducing volume and rate of runoff through the use of SuDS, as informed by national and local guidance
- Relocating development to zones with lower flood risk
- Creating space for flooding
- Green Infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

15.1.2 Cumulative impact of development and cross-boundary issues

The cumulative impact of development should be considered at the planning application and development design stages and the appropriate mitigation measures undertaken to ensure flood risk is not exacerbated, and in many cases the development should be used to improve the flood risk

Development control should ensure that the impact on receiving watercourses from development in Huntingdonshire has been sufficiently considered during the planning stages and appropriate mitigation measures put in place to ensure there is no adverse impact on flood risk or water quality, both within Huntingdonshire and the wider area.

15.1.3 Sequential and Exception tests

The SFRA has identified that areas of Huntingdonshire are at high risk of flooding from both fluvial and surface water sources. Therefore, a large number of proposed development sites will be required to pass the Sequential and, where necessary, Exception Tests in accordance with the NPPF. Huntingdonshire District Council should use the information in this SFRA when deciding which development sites to take forward in their Local Plan.

Developers should consult with Huntingdonshire District Council, Cambridgeshire County Council, the Environment Agency, Anglian Water and, where necessary, relevant IDBs at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

15.1.4 Site-specific flood risk assessments

The Level 2 SFRA is not intended to replace site-specific FRAs. Site specific FRAs are required by developers to provide a greater level of detail on flood risk and any protection provided by defences and, where necessary, demonstrate the development passes part b of the Exception Test.

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), inform development zoning within the site and prove, if required, whether the Exception Test can be passed. Where a site specific FRA has produced modelling outlines which differ from the Flood Map for Planning then a full evidence based review would be required; where this is acceptable to the EA then amendments to the Flood Map for Planning may take place.

Where the watercourses are embanked, the effect of overtopping and breach must be considered an appropriately assessed.

All new development within the 1% AEP flood extent including an allowance for climate change (for the lifetime of the development) must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage. Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water, and seek opportunities to provide floodplain betterment. Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain should be provided to ensure that the total volume of the floodplain storage is not reduced.

Planning applicants should also consult with the Environment Agency, LLFA, relevant IDB (if in IDB district) and Anglian Water at an early stage to discuss FRA and/or consent requirements.

15.1.5 Residual risk

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

Developers should include an assessment of the residual risk where developments are located in areas benefitting from defences. They should consider both the impact of breach, including the effect on safe access and egress, as well as potential for flood risk to increase in the future due to overtopping. Any improvements to defences should ensure they are in keeping with wider catchment policy.

15.1.6 Drainage strategies and SuDS

- Planners should be aware of the conditions for surface water management and ensure development proposals and applications are compliant with policy. SuDS are approved as part of the planning application for a development. It is the Local Planning Authority's (LPA) responsibility to ensure that the design submitted as part of either an outline or full planning application is robust and contains adequate detail to ensure that the SuDS are appropriate for the development and will be adequately maintained throughout their lifetime. The LPA may also seek expert advice from the LLFA as part of this process.
- A surface water drainage strategy is required to be submitted with a planning application which should contain details of the SuDS. Its scope should be commensurate with the size of development and can range from a paragraph describing the proposed drainage measures with a discharge location for residential extension, to extensive hydrological modelling accompanied by a full report with drawings for a larger site. Section 6.7 of the Cambridgeshire Flood and Water **SPD** provides further information on developing a surface water drainage strategy.
- The residual risk and maintenance of sustainable drainage and surface water systems must be clearly set out as part of a drainage strategy. Initial agreements should be in place to cover management funding for the lifetime of the development. Section 6.9 of the Cambridgeshire Flood and Water **SPD** provides further information on adoption and maintenance of SuDS.
- SuDS should be designed by a competent design team that works together from the outset to deliver a successful scheme. In many cases, overall costs savings can be realised where multiple benefits such as improved open spaces, recreational areas and surface water drainage function in one area. Principles governing SuDS design in Huntingdonshire are discussed in Section 6.3 of the Cambridgeshire Flood and Water **SPD**.

15.1.7 Windfall sites

Windfall sites are sites that have not been specifically identified in the Local Plan or other Council assessment documents, that do not have planning permission and have unexpectedly become available.

The acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms[10].

15.1.8 Council review of planning applications

The Council should consult the Environment Agency's 'Flood Risk Standing Advice (FRSA) for Local Planning Authorities', last updated 15 April 2015, when reviewing planning applications for proposed developments at risk of flooding, as well as the Cambridgeshire Flood and Water SPD. The Council will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases, also contact non-statutory consultees (e.g. IDBs or Anglian Water) that have an interest in the planning application.

15.2 Infrastructure and Access

15.2.1 Safe access and egress

Safe access and egress will need to be demonstrated at all development sites; the development should be above the 1% AEP event plus an allowance for climate change, and emergency vehicular access should be possible during times of flood. Finished Floor Levels should be above the 1% AEP event plus an allowance for climate change.

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

15.3 Future flood management in Huntingdonshire

15.3.1 Flood defences

Developers should include an assessment of the residual risk where developments are located in areas benefitting from defences. They should consider both the impact of breach, including the effect on safe access and egress, as well as potential for flood risk to increase in the future due to overtopping. Any improvements to defences should ensure they are in keeping with wider catchment policy.

15.3.2 Strategic solutions

- The construction of new upstream storage schemes as part of upstream catchment-based approaches is one possible solution. Watercourses which are rural in their upper reaches but have high levels of flood risk to urban areas in the downstream reaches are potential candidates, as the open land in the upper reaches can potentially provide the space for an attenuation area, providing benefit to the urban area downstream.
- Floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, for example by bank stabilisation, re-naturalisation, structure removal/ modification and enhancing outfalls in the riparian environment.

15.4 Use of SFRA data

It is important to recognise that the SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

[10] **http://webarchive.nationalarchives.gov.uk/20140328084622/http:/www.environment-agency.gov.uk/static/documents/Sequential_test_process_4.pdf**

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

The SFRA should be **periodically updated** when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by Huntingdonshire District Council, Cambridgeshire County Council (in its role as LLFA), the Highways Authority, the MLCs and IDBs, Anglian Water or the Environment Agency. It is recommended that the SFRA is reviewed internally on an annual basis, allowing a cycle of review, followed by checking with the above bodies for any new information to allow a periodic update.

Appendices

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A Level 2 SFRA detailed site summary tables

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B Watercourses in Huntingdonshire

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C Flood Zone mapping

The flood zone maps show the extents of Flood Zones 1, 2 3a and 3b in Huntingdonshire. The flood zones are defined as follows:

Zone 1: Comprised of land having a less than 0.1% annual probability of river or sea flooding in any year.

Zone 2: Comprised of land having between a 1% and a 0.1% annual probability of river flooding or 0.5% and 0.1% annual probability of sea flooding in any year.

Zone 3a: Comprised of land assessed as having a greater than 1% annual probability of river flooding or a greater than 0.5% annual probability of flooding from the sea in any year.

Zone 3b: Comprised of land where water has to flow or be stored in times of flood (the functional floodplain). The SFRA identified this Flood Zone as land which would flood with an annual probability of 5%, where detailed hydraulic modelling exists.

Where detailed models are not available, it is not possible to identify what land would flood with an annual probability of 1%. Instead, a precautionary approach should be adopted for these areas with the assumption that the extent of Flood Zone 3b is the same as that for Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site specific flood risk assessment to define the extent of Flood Zone 3b.

The only exception to this is the IDB watercourses. Due to the heavily managed nature of the watercourses, this presumption would not give a realistic representation of the Functional Floodplain. Instead, the IDB general standard of protection has been reviewed and in most cases this is higher than the 20-year event. Therefore, Flood Zone 3b is restricted to the watercourse channel. Where the standard of protection is lower this has been highlighted in the main SFRA report.

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D Climate change mapping

Climate change modelling for the watercourses in Huntingdonshire was undertaken based on the new climate change guidance. Existing Environment Agency hydraulic models were run for the 2080s period for all three allowance categories.

No, up-to-date, detailed hydraulic models exist of the majority of the IDB watercourses. Given the highly complex nature of the watercourses, 2D modelling techniques and standard Flood Estimation Handbook methodologies are not considered suitable for providing representative flood extents, therefore no climate change outlines have been included for these watercourses. Developers should develop detailed hydraulic models as part of a site-specific flood risk assessment and include climate change in the assessment

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E Surface water mapping

The updated Flood Map for Surface Water (uFMfSW) maps show the flooding that takes place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which:

a) is on the surface of the ground (whether or not it is moving), and

b) has not yet entered a watercourse, drainage system or public sewer.

The uFMfSW will pick out natural drainage channels, rivers, low areas in the floodplain and flow paths between buildings but it will only indicate flooding caused by local rainfall.

The uFMfSW shows predictions of flooded area but does not show whether individual properties will be affected by surface water flooding or have been affected in the past. The uFMfSW should not be used to predict if individual properties will flood.

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F Groundwater mapping

The Areas Susceptible to Groundwater Flooding (AStGW) maps are a set of strategic maps which show groundwater flood areas on a 1km square grid. The data was produced to annotate indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the Lead Local Flood Authorities (LLFAs) to determine whether there may be a risk of flooding from groundwater.

This data shows the proportion of each 1km grid square where geological and hydrogeological condition show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of ground water flooding.

The AStGW data should only be used in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

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G Flood warning coverage

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. It is issued earlier than a flood warning, to give customers advance notice of the possibility of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

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H Site-specific FRAs: checklist for developers

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