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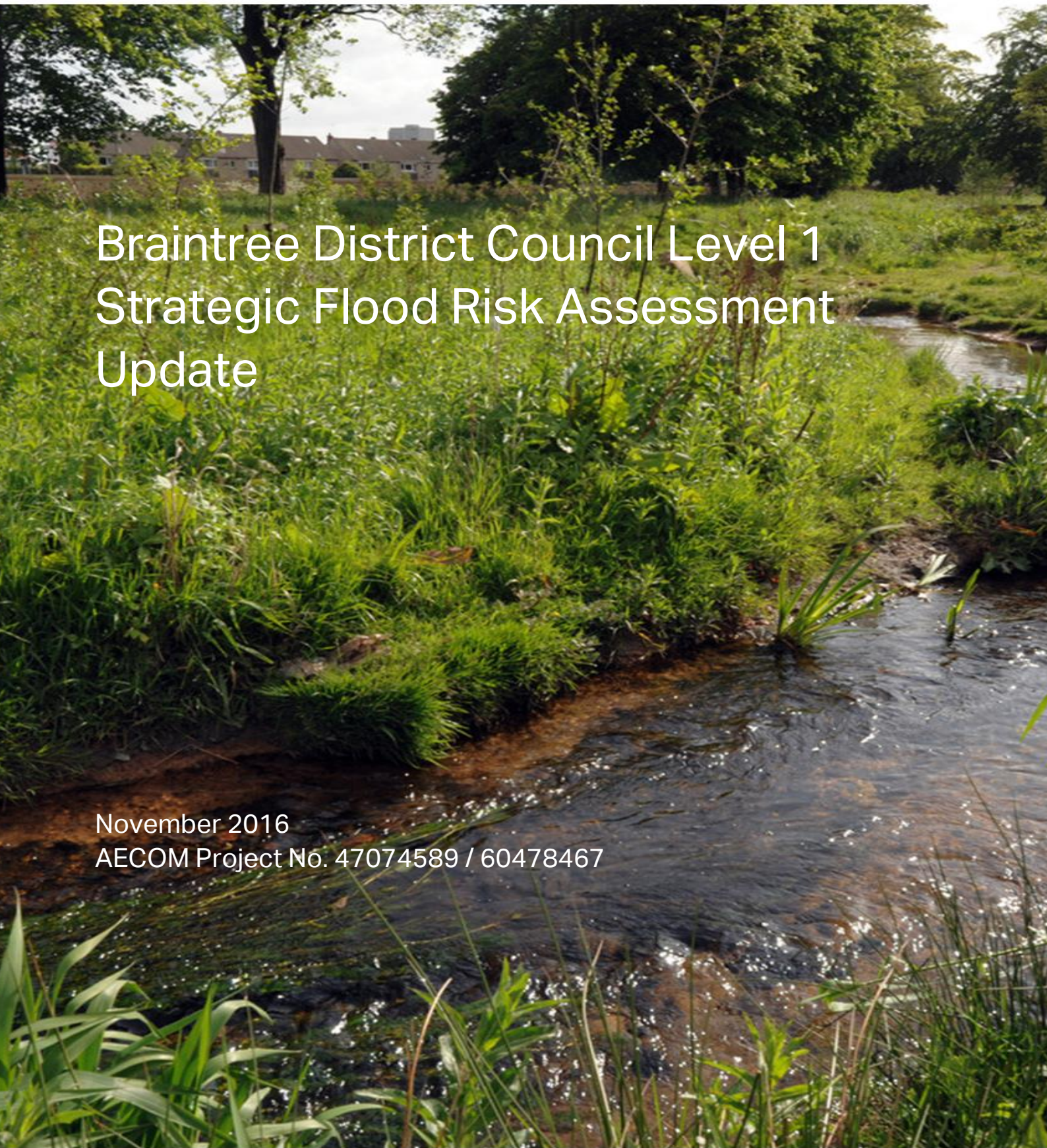
Submitted by
AECOM
Midpoint
Alençon Link
Basingstoke
Hampshire
RG21 7PP
United Kingdom



Braintree District Council Level 1 Strategic Flood Risk Assessment Update

November 2016
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Prepared by: Sarah Betts
Graduate Water Consultant

Sarah Littlewood
Senior Consultant

Joanna Bolding
Hydrology Consultant

Reviewed by: Gemma Hoad
Senior Consultant

Approved by: Jon Robinson
Director

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Midpoint, Alençon Link, Basingstoke, Hampshire, RG21 7PP, United Kingdom
Telephone: -01256-310-200 Website: http://www.aecom.com

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List of Acronyms

ABD	Areas Benefiting from Defences
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
AOD	Above Ordnance Datum
AWS	Anglian Water Services
BGS	British Geological Survey
CC	County Council
CFMP	Catchment Flood Management Plan
DC	District Council
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Flood and Rural Affairs
DRN	Detailed River Network
EA	Environment Agency
ECC	Essex County Council
ENS	East Anglia, Essex, Norfolk and Suffolk
EU	European Union
FCERM	Flood and Coastal Erosion Risk Management
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act 2010
GCSE	General Certificate of Secondary Education
GIS	Geographic Information System
GPs	General Practioners
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LoWS	Local Wildlife Sites
LPA	Local Planning Authority
NNR	National Nature Reserve
NPPF	National Planning Policy Framework
PDL	Previously Developed Land
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Policy Guidance
PPS25	Planning Policy Statement 25
RoFSW	Risk of Flooding from Surface Water
RBD	River Basin District
RMAs	Risk Management Authorities
SFRA	Strategic Flood Risk Assessment
SFRA	Strategic Flood Risk Assessment
SSSIs	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UKCP09	United Kingdom Climate Projections
WCS	Water Cycle Study
WFD	Water Framework Directive
WwTW	Wastewater Treatment Works

Glossary of Terms

Glossary	Definition
Annual exceedance probability (AEP)	Chance of occurrence in any one year, expressed as a percentage. For example, a 1% annual probability event has a 1 in 100 chance of occurring in any given year.
Areas Benefitting from Defences (ABD)	Hatched areas on the Environment Agency Flood Map for Planning (Rivers and Sea) behind flood defences, which, if the flood defences were not present, would flood, in the event of a river flood with a 1 % (1 in 100) chance of happening each year, or a flood from the sea with a 0.5 % (1 in 200) chance of happening each year.
Asset Information Management System (AIMS)	Environment Agency management system of assets associated with main rivers including defences, structures and channel types. Information regarding location, standard of service, dimensions and condition.
Aquifer	A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water.
Catchment Flood Management Plan (CFMP)	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.
Civil Contingencies Act	This Act delivers a single framework for civil protection in the UK. As part of the Act, Local Resilience Forums must put into place emergency plans for a range of circumstances, including flooding.
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions. For fluvial events a 20% increase in river flow is applied and for rainfall events, a 30% increase. These climate change values are based upon information within the NPPF and Planning Practice Guidance (PPG).
Culvert	A channel or pipe that carries water below the level of the ground.
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.
Exception Test	A method set out in the NPPF to 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. 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.
Flood and Water Management Act (FWMA)	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 local flood risk (flooding from surface water, groundwater and ordinary watercourses) in England.
Flood Defence	Infrastructure used to protect an area against flooding such as floodwalls and embankments.
Resilience measures	Measures designed to reduce the impact of water that enters property and businesses and to promote fast drying and easy cleaning; for example raising electrical appliances, installing tiled flooring.
Resistance measures	Measures to prevent flood water entering a building or damaging its fabric, for example the use of flood guards. This has the same meaning as flood proofing.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption).
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 Zone	Areas defined by the probability of river and sea flooding, ignoring the presence of defences. Flood Zones are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's web site.
Fluvial	Relating to the actions, processes and behaviour of a watercourse (river or stream).
Freeboard	The height of a flood defence crest level (or building level) above a particular design flood level.
Functional Floodplain	Land where water has to flow or be stored in times of flood. It is defined by LPAs within SFRAs. Functional floodplain (also referred to as Flood Zone 3b) is not separately distinguished from Zone 3a on the Environment Agency Flood Map for Planning.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.

Glossary	Definition
Lead Local Flood Authority (LLFA)	As defined by the Flood and Water Management Act, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area. In this case, Essex County Council.
Local Planning Authority (LPA)	Body that is responsible for controlling planning and development through the planning system.
Main river	Watercourse defined on a 'main river map' designated by Defra. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities for main rivers. However overall responsibility for maintenance lies with the riparian owner.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
National Planning Policy Framework (NPPF)	The National Planning Policy Framework was published on 27 March 2012. It is a framework which sets out the Government's planning policies for England and how these are expected to be applied.
Ordinary watercourse	A watercourse that does not form part of a main river. This includes "all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows" according to the Land Drainage Act 1991.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account.
Return Period	The average time period between rainfall or flood events with the same intensity and effect.
Risk	Risk is a factor of the probability or likelihood of an event occurring multiplied by consequence: Risk = Probability x Consequence. It is also referred to in this report in a more general sense.
Sequential Test	An approach to future site planning whereby new development is directed towards areas with the lowest probability of flooding before consideration of higher risk areas. The Sequential Test helps ensure that development can be safely and sustainably delivered and developers do not waste their time promoting proposals which are inappropriate on flood risk grounds.
Sewer Flooding	Flooding caused by a blockage or overflowing of a sewer or urban drainage system.
Surface Water	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer.
Surface Water Management Plan (SWMP)	A plan which outlines the preferred surface water management strategy in a given location. In this context surface water flooding describes flooding from sewers, drains, groundwater and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall.
Sustainable drainage systems (SuDS)	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Topographic survey	A survey of ground levels.

1 Introduction and Background

1.1 Terms of Reference

AECOM has been commissioned by Braintree District Council (DC) to review and update the Level 1 Strategic Flood Risk Assessment (SFRA) for its administrative area. This Report comprises the updated Level 1 SFRA Report.

1.2 Project Background

The National Planning Policy Framework[1] (NPPF) and associated Planning Practice Guidance for Flood Risk and Coastal Change (PPG)[2] emphasise the active role Local Planning Authorities (LPAs) should take to ensure that flood risk is understood and managed effectively and sustainably throughout all stages of the planning process. The NPPF outlines that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and LPAs should use the findings to inform strategic land use planning.

In July 2008, Scott Wilson Consultants prepared a SFRA for Braintree District Council based on Planning Policy Guidance 25 (PPG25) and Planning Policy Statement 25 (PPS25) published by Central Government in 2006.

Since the preparation of these reports there have been a number of further changes in legislation and guidance relating to planning and flood risk. The introduction of the Localism Act in 2011 was intended to create a planning system oriented around consideration of local planning issues. Planning Policy Statements (PPS), covering all aspects of national planning policy have since been replaced by the NPPF. The accompanying technical guidance document relating to flood risk, originally derived from the PPS documents has also been recently replaced by the Planning Practice Guidance (PPG). Furthermore, the wider planning system has been subject to considerable change since 2008 with the withdrawal of the previous regional planning framework and the revocation of Regional Spatial Strategies in 2010.

The Flood and Water Management Act (FWMA) attained royal assent in 2010, with the intention of enabling the provision of more effective flood management following the flooding of July 2007. As such, Essex County Council (ECC) is designated a Lead Local Flood Authority (LLFA) and has significant duties and powers in relation to flooding from local sources across Braintree, specifically surface water, groundwater and ordinary watercourses. The Environment Agency retains responsibility for leading and coordinating the management of flood risk associated with main rivers and the sea.

As well as legislative and planning policy changes, a number of new and revised datasets have been made available since the release of the previous Level 1 SFRA. Environment Agency flood risk mapping has been revised for the main river watercourses in Braintree and updated national surface water flood risk mapping has been released by the Environment Agency for use by LPAs in SFRAs.

The purpose of the Level 1 SFRA Update is to collate and analyse the most up to date readily available flood risk information for all sources of flooding, to provide an overview of flood risk issues across the District. This will be used by Braintree District Council to inform the preparation of Local Plans, including the application of the Sequential Test to future site allocations. It is also intended that the revised Level 1 SFRA deliverables will assist prudent decision-making on flood risk issues by Development Management Officers on a day-to-day basis.

[1] Department for Communities and Local Government. 2012. *National Planning Policy Framework*. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2

[2] Department for Communities and Local Government. 2014. *Planning Practice Guidance: Flood Risk and Coastal Change.* Available at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

1.3 Approach to Flood Risk Management

The NPPF sets stringent tests to protect people and property from flooding which all LPAs are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed. The main steps to be followed can be summarised as **Assess**, **Avoid** and **Manage and Mitigate** flood risk. These steps are set out below, and are designed to ensure that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.

Table 1-1 Approach to Flood Risk Management set out by the NPPF

Assess Flood Risk	LPAs should undertake a SFRA to fully understand the flood risk in the area to inform Local Plan preparation. For sites in areas at risk of flooding, or with an area of 1 hectare or greater, developers must undertake a site-specific Flood Risk Assessment (FRA) to accompany planning applications (or prior approval for certain types of permitted development).
Avoid Flood Risk	Braintree DC should apply the **sequential approach** to site selection so that development is, as far as reasonably possible, located where the risk of flooding from all sources is lowest, taking account of climate change and the vulnerability of future users to flood risk. In **plan-making this involves applying the Sequential Test**, and where necessary the **Exception Test** to Local Plans, as described in Section 4. In **decision-taking this involves applying the Sequential Test** and if necessary the **Exception Test** for specific development proposals.
Manage and Mitigate	Where alternative sites in areas at lower risk of flooding are not available, it may be necessary to locate appropriate development in Flood Zone 2 (medium risk of flooding) and Flood Zone 3 (high risk of flooding. In these cases, Braintree DC and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development, and will not increase flood risk overall. Braintree DC and developers should seek flood risk management opportunities (e.g. safeguarding land), and to reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems).

A flow chart to provide guidance on the use of the SFRA when taking flood risk into account during the planning process and preparation of the Local Plan is outlined in **Figure 1-1**.

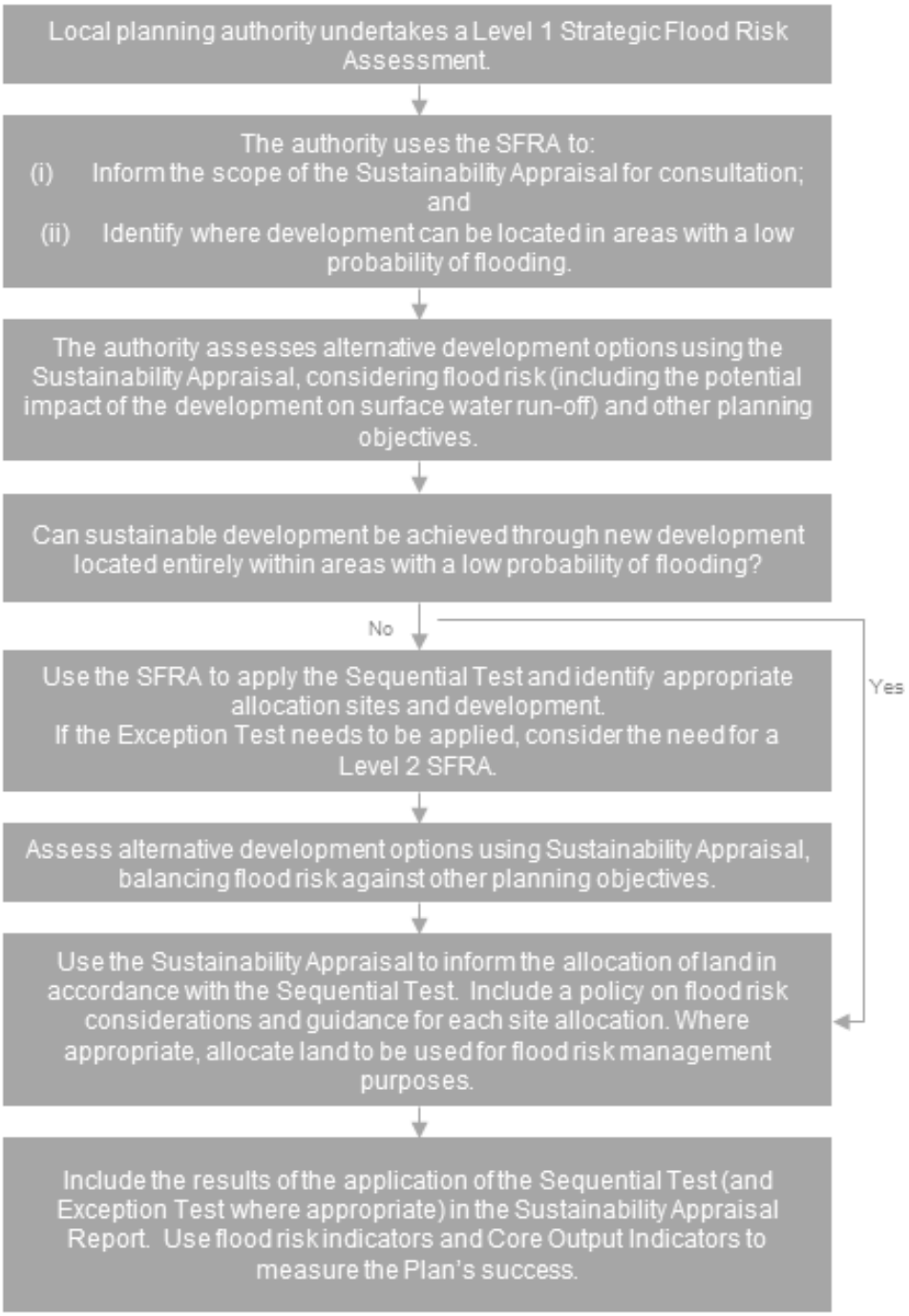


Figure 1-1 Taking flood risk into account in the preparation of a Local Plan (PPG, P6)

1.4 Partner Organisations

There are several organisations involved in development and flood risk management across the study area. These are identified below.

Braintree District Council is the Local Planning Authority (LPA) for the study area, responsible for long term strategic planning of future development through the preparation of Local Plans, as well as for determining planning applications within the District. In accordance with the FWMA and subsequent communication from Central Government, from 6th April 2015, Braintree District Council is required to ensure that SuDS are implemented for all major developments where appropriate, and that through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

Essex County Council is designated the Lead Local Flood Authority (LLFA) under the Flood and Water Management Act (FWMA), and has a duty to lead and coordinate the management of local flood risk, which includes flood risk from surface water, groundwater and ordinary watercourses.

Essex Fire and Rescue is a first responder to flood situations, and play a key role in helping to tackle preventable flood incidents.

Environment Agency has a strategic overview role for flood risk management associated with main rivers in the District and is a statutory consultee for any development, other than minor development, proposed within Flood Zone 2 or 3 associated with these watercourses, or works in the bed or within 20m of a Main River. The Environment Agency is continually improving and updating their flood map for main rivers and has permissive powers to carry out flood defence works, maintenance and operational activities for these main rivers. However, overall responsibility for maintenance lies with the riparian owner.

Anglian Water Services has a duty as a statutory body to provide clean and waste water services to the study area and is responsible for the management, maintenance and operation of flood control structures. Water Companies are defined as a Risk Management Authority within the FWMA and are responsible for flood risk management functions in accordance with the Water Resources Act 1991 and the Land Drainage Act 1991. AWS is responsible for surface water drainage from development via adopted sewers and for maintaining trunk sewers into which much of the highway drainage in the study area connects.

Highways Agency has responsibilities (under the Highways Act 1980) for the effectual drainage of surface water from adopted roads along red routes insofar as ensuring that drains, including kerbs, road gullies , ditches and the pipe network which connect to the sewers (often AWS), are maintained. In relation to the SFRA, the Highways Agency was consulted to provide details of any known historic and recent flood risks along the highways in the District, areas that are susceptible to flooding, flood mitigation measures that have already been put in place and maintenance regimes.

1.5 Level 1 SFRA Approach

The Level 1 SFRA is a desk-based study, using readily available existing information and datasets to enable the application of the Sequential Test and to identify where the Exception Test may be required. The main tasks in preparing the Level 1 SFRA are described below.

The remainder of Section 1 provides a description of the study area and identification of partner organisations involved in assessing and managing flood risk in Braintree. Section 2 provides a review of the legislative and planning policy context of managing flood risk in the District.

1.5.1 Gathering data and analysing it for suitability

Under Section 10 of NPPF, the risk of flooding from all sources must be considered as part of a Level 1 SFRA, including flooding from tidal sources, rivers (fluvial), land (overland flow and surface water), groundwater, sewers and artificial sources.

In order to provide this assessment of all sources of flooding in the study area, an extensive set of datasets was requested from a number of organisations, including Braintree District Council, Essex County Council (as the LLFA and Highways Authority), the Environment Agency, Anglian Water and the Highways Agency.

Datasets and information gathered as part of the preparation of the first iteration of the SFRA in 2008 have been retained where appropriate. The datasets are described further in Section 3, including detail regarding appropriate uses and limitations, and how they have been used within the Level 1 SFRA.

1.5.2 Producing strategic flood risk maps, GIS deliverables and a technical report

A series of GIS maps have been produced using the data gathered during the study. The mapping deliverables are summarised in Table 1-2 and should be referred to when reading Section 3'Assessing Flood Risk' which provides an overview of flood risk across the District.

Table 1-2 Strategic Flood Risk Maps

Figure No.	Figures Title and Content
Figure 1	Study Area *(Administrative boundaries, watercourses, water bodies, development areas)*
Figure 2	Flooding from Rivers *(NPPF Flood Zones, watercourses, flood defences, storage areas, areas benefitting from flood defences)*
Figure 3	Updated Flood Map for Surface Water (RoFSW *watercourses, Braintree DC and ECC flood incidents)*
Figure 4	Groundwater Flooding *(Areas susceptible to groundwater flooding (AStGWF) dataset)*
Figure 5	Sewer Flooding *(Historic records of sewer flooding)*

Figure 6	Flood Warning Areas
Figure 7	Historic Flood Maps (Environment Agency historic flood outlines)

1.5.3 Providing suitable guidance

Based on Section 3 'Assessing Flood Risk', and the supporting mapping deliverables, the Level 1 SFRA Report provides specific guidance for Braintree DC.

Section 4 provides guidance on 'Avoiding Flood Risk' through the appropriate application of the Sequential Test by Braintree DC when allocating future development sites as part of the plan-making process, as well as by developers promoting development on windfall sites.

Sections 5 provides guidance for measures to 'Manage and Mitigate Flood Risk' on future development sites and to assist the preparation of site-specific FRAs.

Section 8 outlines a number of flood risk management objectives and policy recommendations for consideration by Braintree DC throughout the development of their strategic planning documents.

2 Legislative and Planning Policy Context

2.1 Introduction

This Section provides an overview of the legislative, national and local planning policy context specific to the Level 1 SFRA Update for Braintree DC. The information presented in the SFRA should be used by Braintree DC to establish robust policies in relation to flood risk as part of their emerging local plan.

2.2 Flood and Water Management Act

In response to severe flooding across large parts of England and Wales in summer 2007, the government commissioned Sir Michael Pitt to undertake a review of flood risk management. The Pitt Review – Learning Lessons from the 2007 Floods[3] and subsequent progress reviews outlined the need for change in the way the UK is adapting to the increased risk of flooding and the role different organisations have to deliver this function.

The Flood and Water Management Act 2010 (FWMA)[4], enacted by Government in response to The Pitt Review, designated unitary authorities, such as Essex County Council (ECC), as Lead Local Flood Authority (LLFA). As LLFA ECC has responsibilities to lead and co-ordinate local flood risk management. Local flood risk is defined as the risk of flooding from surface water runoff, groundwater and small ditches and watercourses (collectively known as ordinary watercourses).

The FWMA also formalises the flood risk management roles and responsibilities for other organisations including the Environmental Agency, water companies and highways authorities. The responsibility to lead and co-ordinate the management of tidal and fluvial risk remains that of the Environment Agency.

2.2.1 National Strategy for Flood and Coastal Erosion Risk Management

In accordance with the FWMA, the Environmental Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England[5]. This strategy provides a framework for the work of all flood and coastal erosion risk management authorities. Braintree is not a coastal District; therefore for this area the National FCERM Strategy sets out the other long-term objectives for managing all other sources of flood risk and the measures proposed to achieve them.

It sets the context for, and informs the production of local flood risk management strategies by LLFAs, which will in turn provide the framework to deliver local improvements needed to help communities manage local flood risk. It also aims to encourage more effective risk management by enabling people, communities, business and the public sector to work together to:

- Ensure a clear understanding of the risks of flooding, 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 risks;
- Encourage innovative management of risks taking account of the needs of the communities and the environment;
- Ensure the emergency responses to flood incidents are effective and that communities are able to respond properly to flood warnings; and,
- Ensure informed decisions are made on land use planning.

[3]Cabinet Office (2008) Sir Michael Pitt Report 'Learning lessons learned from the 2007 floods' http://www.environment-agency.gov.uk/research/library/publications/33889.aspx
[4] Environment Agency (2010) Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities
[5] Defra, Environment Agency (2011) The National Flood and Coastal Erosion Risk Management Strategy for England.

The Environment Agency's 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities'[6] guidance is a supporting note for the National FCERM Strategy. It provides the UK Climate Projections (UKCP09) climate change factors for river flood flows and extreme rainfall for each river basin District, and provides advice on applying climate change projections in the FCERM. It is essential that land use planning decisions consider the impact of a changing climate where appropriate both now and into the future.

2.2.2 Local Flood Risk Management Strategy

As LLFA, ECC has a statutory duty to develop, maintain, apply and monitor a strategy for local flood risk management in the administrative area. ECC has prepared a Local Flood Risk Management Strategy (LFRMS) to enable flood risk across Essex to be managed more effectively and holistically.

The overall aim of the LFRMS is to "to work with organisations, businesses and communities to manage flood risks, and where it is practicable, affordable and sustainable to do so, to reduce risks to life, property and livelihoods that may arise from local surface runoff, ordinary watercourse and groundwater flooding". The LFRMS will seek to implement the following strategic objectives:

1. Determine and communicate Local Flood Risk – Undertake projects to determine and understand the risks of flooding from surface run-off, ordinary watercourses and groundwater. Increase public awareness through the publication of clear and consistent information about local flood risk.

2. Partnership working – work with all Risk Management Authorities (RMAs) and other stakeholders to coordinate flood risk management roles, responsibilities and activities. Share best practice; raise the profile of Risk Management Authorities working within Essex and assist organisations in ensuring their plans and projects take proper account of flood risk from all sources.

3. Partnership Programmes and Projects – Identify, secure and optimise resources to develop and deliver measures to manage flood risk. Assist organisations to establish and update long-term plans to manage flood risk.

4. Riparian Responsibilities - Work with RMAs to encourage and where necessary enforce the management and maintenance of privately owned flood management structures and ordinary watercourses and minimise unnecessary constrictions and obstructions within local drainage networks.

5. Flood Risk and Development – Ensure that planning authorities are properly informed about local flood risk, that there is a consistent approach to the consideration of flood risk management I the new development and that new developments seek to reduce existing flood risk and contribute to the achievement of sustainable development.

6. Water Framework Directive – Support the implementation of the 'Water Framework Directive' by ensuring that watercourse morphology, water quality and ecological status are not harmed by activities that are controlled by, or undertaken by, owners, occupiers and managers of Flood and Coastal Erosion Risk Management infrastructure. Facilitate measures to improve morphology, water quality and ecological status whenever it is practicable and necessary to do so.

7. Support Water and Sewerage Company infrastructure – Work closely with water and sewerage companies to minimise flood risks associated with their infrastructure and promote the development and management of sustainable water resources.

2.2.3 Surface Water Management Plan

A SWMP is a framework to understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk. The main outputs are a co-ordinated Action Plan to prioritise projects to reduce surface water flood risk and detailed mapping of areas prone to surface water flood risk.

ECC has coordinated a number of SWMPs in urban areas across the County, including Maldon, Colchester Town, Chelmsford, Brentwood, Harlow and South Essex (Rochford, Basildon, Castle Point). A Surface Water Management Plan (SWMP) is presently being prepared on behalf of the ECC for Braintree and Witham only. This is being prepared by AECOM and its conclusions are expected to feed into the new Local Plan.

[6] Environment Agency (2010) Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities

2.3 Flood Risk Regulations

As well as the duties under the Act to prepare a LFRMS, LLFAs have legal obligations under the EU Floods Directive[7], which was transposes into UK Law through the Flood Risk Regulations 2009[8] ('the Regulations') as outlined below.

2.3.1 Preliminary Flood Risk Assessment

Under the Regulations, all LLFAs were required to prepare a Preliminary Flood Risk Assessment (PFRA) report. This is a high level screen exercise to identify areas of significant risks as 'Indicative Flood Risk Areas' across England where 30,000 people or more are at risk from flooding for reporting to Europe.

A PFRA was prepared for ECC in 2011[9]. The PFRA seeks to provide a high level overview of flood risk from local flood sources and includes flooding from surface water (i.e. rainfall resulting overland runoff), groundwater, ordinary watercourses (smaller watercourses and ditches) and canals. It excludes flood risk from main rivers, the sea and reservoirs, as these are assessed nationally by the Environment Agency. The PFRA report looks at past flooding and where future flooding might occur across the area and the consequences it might have to people, properties and the environment. The report provides a useful baseline for the County to inform their LFRMS as well as the preparation of this revised Level 1 SFRA.

2.4 Anglian River Basin District draft Flood Risk Management Plan

Under the EU Floods Directive and UK Flood Risk Regulations, LLFAs must prepare FRMPs in formally identified Flood Risk Areas where the risk of flooding from local sources is significant (i.e. surface water, groundwater, ordinary watercourses). The Environment Agency is required to prepare FRMPs for all of England covering flooding from main rivers, the sea and reservoirs.

As such, the Anglian River Basin District FRMP[10] sets out the proposed measures to manage flood risk in the Anglian River Basin District from 2015 and beyond. This document draws on existing reports and plans which have been prepared in the past such as the Catchment Flood Management Plans (CFMP) for the catchments in Braintree identified in Table 2-1.

The Anglian River Basin District covers 27,890 km^2 from Lincolnshire in the north to Essex in the south, and Northamptonshire in the west to the East Anglian coast. The river basin District comprises eleven 'management' catchments. These catchments flow from the high chalk and limestone hills through very low lying fenland areas, before finally reaching the sea.

CFMPs set out polices for the sustainable management of flood risk across particular catchments over the long-term (50 to 100 years) taking climate change into account. Of relevance to the Braintree study area is the North Essex CFMP, within this Sub-area 1 and 2 involve Braintree DC. The preferred policies from these CFMPs for these sub-areas are presented in Table 2-1.

Table 2-1 Summary of CFMP Policies for Braintree[11]

North Essex CFMP
Sub-area 1 Blackwater and Chelmer, Upper Reaches and Coastal Streams – Policy 2 "Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions"
The issues in this sub-area There are a few people and properties at risk in this large rural sub-area. People and properties are located in isolated towns and villages scattered throughout the rural region. River flooding is infrequent and the consequences of flooding are low. There are no formal flood defences in this sub-area. In 2009 there were 328 properties at risk in this sub-area from the 1% annual probability river flood. The properties at risk are concentrated within Blackwater and Chelmer in Villages such as Braintree. Mainly grade three agricultural land is also at risk to flooding. Parts of the A414, A120, A1060 and A12, three electricity sub-stations and three Sewage Treatment plants are also at risk to flooding.

[7] European Union (2007) EU Floods Directive http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0060:EN:NOT
[8] HSMO (2009) The Flood Risk Regulations http://www.legislation.gov.uk/uksi/2009/3042/contents/made
[9] URS Scott Wilson (2011) Preliminary Flood Risk Assessment https://www.essex.gov.uk/Environment%20Planning/Environment/local-environment/flooding/Documents/Preliminary%20Flood%20Risk%20Assessment.pdf
[10] Environment Agency (October 2014) Anglian River Basin District Consultation on the draft Flood Risk Management Plan https://consult.environment-agency.gov.uk/portal/ho/flood/draft_frmp/consult?pointId=3063510
[11] Environment Agency, December 2009, North Essex Catchment Flood Management Plan.

The Key Messages

- Where feasible, flood risk management activities will be reduced as the current activity to manage flooding is out of proportion with the level of flood risk.
- Reducing bank and channel maintenance will help naturalise rivers and improve the flow between the river and its floodplain.
- Maintain flood warning infrastructure (such as river flow gauging stations) to ensure that an effective flood warning service can be provided throughout the catchment.

North Essex CFMP

Sub-area 2 Lower Blackwater and Upper and Mid Tributaries, Mid Colne and Stour – Policy 3 "Areas of low to moderate flood risk where we are generally managing existing flood risk effectively"

The issues in this sub-area

This is a large sub-area where there are a number of settlements at risk. In 2009 there were 1,183 properties at risk from the 1% annual probability river flood. The majority of the properties at risk are located within the Mid Colne and Stour. There is a significant amount of mainly grade three agricultural land at risk in this sub-area. There are sections of A-road, a railway station, four electricity sub-stations and one STW also at from the 1% annual probability river flood. The probability of the river flooding on the Mid Colne and Stour has been reduced though flood banks at White Colne, the Nayland bypass channel on the River Stour, a storage area upstream of Halstead and flood defences at Stratford St. Mary. The probability of the river flooding in the Upper and Mid Tributaries has been reduced through the construction of two brick wall defences at Sudbury.

The Key Messages

- The current level of flood risk management should be continued in this sub-area.
- In some areas there may be alternative, more appropriate ways to manage flood risk at the current level.
- Any new development of re-development t should be resilient to all sources of flooding.

2.5 National Planning Policy Framework

The NPPF is a framework within which councils and local people can produce local and neighbourhood plans that reflect the needs and priorities of their communities. The overall approach of the NPPF to flood risk is broadly summarised in Paragraph 103:

"When determining planning applications, LPAs should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- *Within the site the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location, and*

- *Development is appropriately flood resilient and resistant, including safe access and escape routes where required and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the used of sustainable drainage systems.*

Further detail regarding the Sequential and Exception Tests is included in Section Avoiding Flood Risk – Applying the Sequential Test of this report and Level 2 SFRA.

2.5.1 NPPF Guidance SuDS Policy (April 2015)

Sustainable Drainage Systems (SuDS) are an approach to managing rainwater and surface water that replicates natural drainage, the key objectives being to manage flow rate and volume of runoff to reduce risk of flooding and water pollution. From 6th April 2015, LPAs such as Braintree DC are required to ensure that SuDS are implemented for all major developments where appropriate, and that through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

As the LLFA, ECC is a statutory consultee for SuDS applications. ECC will need to be consulted on the drainage elements of planning applications for major development to ensure they conform to necessary national and local SuDS standards. The Essex SuDS Design Guide[12] should be consulted for the requirements.

2.6 Local Planning Policy

This SFRA will form part of the evidence base for the Council's emerging Local Plan. The Local Plan will cover the period to 2033 and will replace the existing adopted Local Plan Review (2005) and the Core Strategy (2011) which is currently employed. The Core Strategy flood policy with regard to planning is presently covered by Policy C38 which adheres to the national guidance laid out in the former PPS25:

- The Council will minimise exposure of people and property to the risks of flooding. In particular the sequential test will be applied to avoid new development being located in areas of flood risk.
- Where a site lies partially in the flood zone the Sequential Approach will also be rigorously applied and only water compatible or essential infrastructure uses will be permitted in areas demonstrated to be at risk.
- SuDS will be used wherever possible to reduce flood risk, promote groundwater recharge, enhance biodiversity and provide amenity benefit, unless, following an adequate assessment, soil conditions and/or engineering feasibility would render application of SuDS on the site financially unviable.
- Developers must engage in discussions with water and sewerage providers at the earliest opportunity to provide evidence with their planning application that there is capacity for their proposals.

Climate change is likely to result in more extreme weather events, including hotter and drier summers, flooding and rising sea level, leading to permanent changes in the natural environment. In order to develop sustainably, climate change must be considered to ensure flood risk is reduced both now and into the future.

2.6.1 Local Flood Risk Management Strategy

The LFRMS for Essex[13] has organised several settlements that are at greater flood risk into a three-tiered system using the County Wise Prioritisation Methodology. This method considers various sources of flood risk using historic information and Environment Agency data across the county to prioritise areas of locally important flood risk. To provide a consistent approach across the county various sources of information are utilised outlined in Table 2-2.

Table 2-2 Information used to Prioritise Areas of Locally Important Flood Risk

Consideration	Source of Information
Flood risk from surface water	Flood Map for Surface Water and Areas Above Flood Risk Threshold (EA datasets)
Flood risk from groundwater	Areas Susceptible to Groundwater Flooding (EA dataset)
Flood risk from ordinary watercourses	Flood Map for Surface Water, Detailed River Network (EA datasets), local knowledge
Interactions with main rivers and the sea	Flood Map (EA dataset)
Flood history across Essex	Local Knowledge, evidence base from PFRA (collected from a range of sources)

A three-stage process is used to prioritise areas:

1. The Environment Agency 'Areas above Flood Risk Threshold' dataset was created by placing a 1km square grid across England and Wales. Within each 1km square the number of residential buildings, non-residential buildings and critical services that intersected the predicted RoFSW 'Deep' flood extent for the 1 in 200 year rainfall event were counted.

   When a 1km grid square exceeds the criteria detailed below it was labelled 'an area where flood risk is an issue'.

   - 200+ people at risk (2.34 x no. of residential buildings)

[12] Essex County Council, December 2014, Essex SuDS Design Guide. https://www.essex.gov.uk/Environment%20Planning/Environment/local-environment/flooding/View-It/Documents/suds_design_guide.pdf
[13] Capita Symonds (2013) Essex County Council Local Flood Risk Management Strategy

- 20+ non-residential properties at risk
- 1+ critical service at risk

2. To further consolidate and prioritise high-risk areas, groups of adjacent grids squares were clustered in order to identify areas where the risk is concentrated. When five or more 'an area where flood risk is an issue' was touching within a 3km x 3km square, they were joined to form a 'cluster'. Where clusters are adjacent to each other they are grouped to form bigger clusters. These clusters are then ranked based on the criteria detailed in Table 2-3.

Table 2-3 Ranking Criteria used to Establish Proration of Locally Important Flood Risk Areas

Ranking	Criteria
Tier 1	More than 1000 people predicted to be at risk
Tier 2	Between 1000 and 500 people predicted to be at risk
Tier 3	Less than 500 people predicted to be at risk

3. The three tiers within Essex were then manually adjusted based on the consideration of flood history, risk of groundwater flooding, risk of flooding form ordinary watercourses and possible interactions with main rivers or the sea.

Within the Braintree District, both Braintree and Witham constitute as Tier 1 settlements. Braintree has a high surface water flood risk and a history of flooding. Witham also experiences similar risks as well as the additional risk of groundwater flooding. Furthermore the settlements of Halstead, Steeple Bumpstead, Castle Hedingham and Sible Hedingham all classify as Tier 2 areas due to potential surface water flood risk and a history of flooding.

Fundamentally the settlements in Tiers 1 and 2 will require a more stringent approach to surface water management, with developers directed to consult ECC as to whether a SWMP has been prepared.

2.7 Water Cycle Strategy

The purpose of this study is to identify any water related issues that could present significant obstacles to new development. The study examines how much growth can be accommodated within the existing infrastructure. It examines whether sufficient water resources are available to supply the forecast demand, how much growth the existing drainage and Wastewater Treatment Works (WwTW) can accommodate and whether or not the watercourses in the surrounding area can handle the addition discharges with deteriorations in water quality or water dependent habitats[14].

The main outcome of the study has concluded that the Anglian, Essex and Suffolk water companies have plans in pace to secure supplies over the next 25 years, taking into account the proposed levels of growth within the Regional Spatial Strategy. Providing the water companies stick to these plans there should be no restriction in development. The main constraints are the capacity of the receiving water infrastructure[15]. At the time of publishing this Level 1 SFRA, the Braintree District WCS (2011) is currently being updated.

2.8 Summary

Figure 2-1 provides a summary of the documents that have been outlined in this section. The figure demonstrates that the main driver for the SFRA is the NPPF and that the documents and plans prepared by both the Environment Agency and Braintree DC are under the requirements of the Flood and Water Management Act and the Flood Risk Regulations, which provide key inputs to inform the preparation of the revised SFRA and new Local Plan.

[14]Entec (2011) Water Cycle Strategy Braintree District Haverhill and Clare Water Cycle Study
[15] Hyder (2011) *'Braintree District Council Water Cycle Study'*

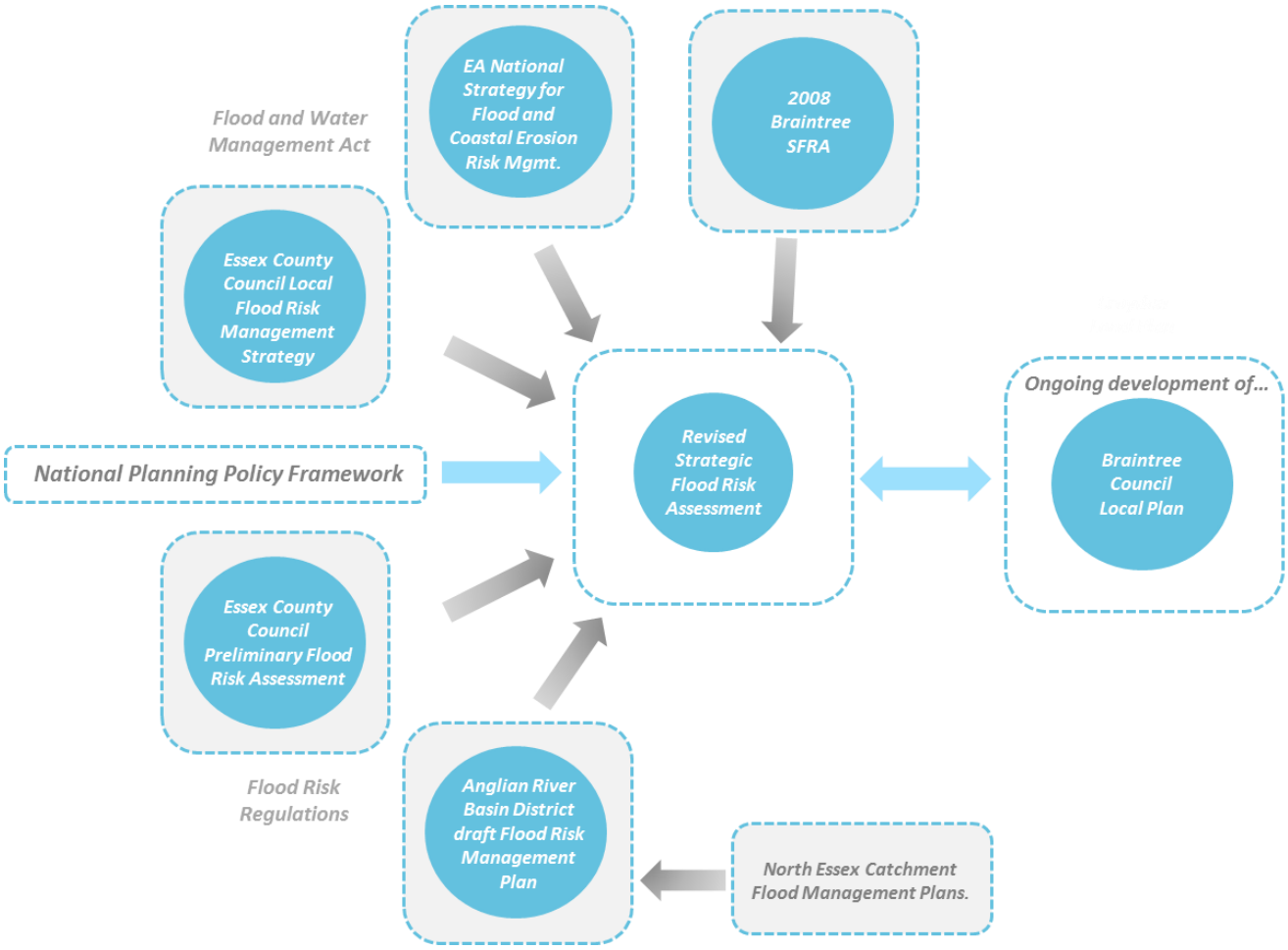


Figure 2-1 Summary of Legislative and Planning Context

3 Assessing Flood Risk

3.1 Introduction

This section provides a strategic assessment of flood risk across the Braintree study area from each of the sources of flooding outlined in the NPPF. For each source of flooding, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This Section should be read with reference to the figures in **Appendix A and B**.

3.2 Study Area

3.2.1 Location

The study area of Braintree District is shown in **Appendix A Figure 1**, together with the location of the principal watercourses and reservoirs. Braintree District forms part of the County of Essex, and is surrounded by the Districts of Uttlesford to the west, Colchester to the east, Chelmsford to the southwest and Malden in the southeast. In the north are the other counties of Cambridgeshire in the northwest and Suffolk in the northeast.

Braintree covers an area of almost 61,200 ha and lies approximately 50 metres above sea level. The District is largely rural in land use with a general downward trend in topography towards the south-east and the sea. Braintree DC has no coastline and therefore tidal flooding is not considered in this report.

3.2.2 Hydrogeology

This section describes the hydrogeology of the Braintree District. Hydrogeology is the area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust (commonly in aquifers). It is important to understand the hydrogeology as it affects the rate of surface runoff and indicates where there is risk of groundwater flooding. Substantial areas of impermeable surface rock are likely to induce rapid runoff, leading to surface water flooding in downstream locations. Furthermore, the presence of aquifers is likely to promote the risk of groundwater flooding and therefore should be located.

The bedrock geology of Braintree District can be separated into three main types:

- The northern section is underlain by the White Chalk Subgroup.
- There is a thin section of Lambeth Group (clay, silt, sand and gravel) through the centre of the District extending from Sudbury in the east to Castle and Sible Hedingham in the centre.
- The southern section of the District is underlain by the Thames Group bedrock, consisting of clay, silt, sand and gravel. Within this there are outcrops of Neogene and Quaternary Rocks and the Thanet Formation.

The overlying superficial deposits consist mainly of the Lowestoft Formation, which comprises Glaciofluvial Deposits, Till and Glaciolacustrine Deposits. It is the main superficial deposit found throughout the District. Its thickness can vary greatly; within buried valleys it could be up to 300m thick.

Around the large river valleys there are outcrops of Kesgrave sand and gravels, River Terrace Deposits, Head Deposits alluvium.

3.3 Summary of Flood Sources

Table 3-1 summarizes the range of potential flood sources and pathways in the study area. Where relevant, each source is discussed in further detail below.

Table 3-1 Potential flood sources and pathways

Flood Type	Source	Pathway	Consider further
Fluvial	River Brain, River Colne, River Blackwater and River Stour	Floodplain ponding / conveyance / breach and overtopping	Yes
Surface Water	Greenfield and urban runoff	Flow paths merging from surrounding fields and built up areas	Yes
Arterial Drainage Network	Sewer network	Surcharged sewers or burst water mains (failure of infrastructure)	Yes
Tidal	Braintree DC has no coastline, therefore there is no tidal flood risk	No coastline	No
Groundwater	Perched within alluvial deposits	Rising water level	Yes
Artificial Sources	Reservoir	Flow paths should a reservoir fail	Yes

3.4 Flooding from Rivers

3.4.1 Sources

The Environment Agency 'Detailed River Network' dataset has been used to identify watercourses in the study area and their designation (i.e. Main River or ordinary watercourse). There are 11 designated main rivers in the study area, the locations of which are shown in **Appendix A Figure 1**. Main rivers are watercourses shown on the statutory main river maps held by the Environment Agency and the Department for Environment, Flood and Rural Affairs (Defra). The Environment Agency has permissive powers to carry out works necessary for flood defence purposes on these rivers. The overall responsibility for maintenance however, lies with the riparian owner.

Figure 3-1 North Essex CFMP area (North Essex CFMP, Environment Agency December 2009)

The Braintree study area falls within the North Essex catchment (Figure 3-1) which is described in the North Essex Catchment Flood Management Plan. The CFMP covers an area of around 3,000 km^2 and includes the catchment of four major rivers: the River Chelmer, Blackwater Colne and Stour. The latter three are the major rivers within the Braintree District. A description of each major river in Braintree is outlined below:

- The **River Brain**, which flows through the towns of Braintree and Witham. Above Braintree it is known as **Pods Brook**, the brook rises near the village of Bardfield Saling. Below Braintree the River Brain joins the Blackwater on the outskirts of Witham. Braintree Town is therefore bounded by two large watercourses to the north and south. Fluvial flooding to the south is limited as the capacity of Pods Brook is sufficient for the 1 in 100 year flows with restricted floodplains. However, fluvial flooding to the north (i.e. the River Blackwater) is more widespread because of the limited channel capacity.

- The **River Blackwater** runs from its source near Saffron Walden in a south-easterly direction, following through Braintree, Coggeshall, Kelvedon and Witham. The confluence of the River Brain with the River Blackwater can be found to the south east of Witham town centre. Subsequently the River Blackwater flows into the neighbouring District of Maldon before discharging into the Blackwater Estuary. The Blackwater catchment as a whole is approximately 313 km^2.

- The **River Pant** flows generally south east to Bocking, near Braintree, via Great Sampford and Great Bardfield. At Bocking, it becomes the River Blackwater, and veers east to flow past Coggeshall. It then veers south flowing past Kelvedon and Witham, before reaching Maldon.

- The **River Colne** is the largest of the river systems located within the District. The watercourse has a catchment area of 862 km^2; however, the majority of this catchment is located within the neighbouring District of Colchester.

- The **River Stour** forms part of the north and east District boundary. It is largely characterised by a rural landscape, much of which is designated as an Area of Outstanding Natural Beauty. Within the District of Braintree the watercourses flow through two small isolated industrial areas and the small village of Bures St. Mary, which is located on the border between Braintree and Colchester District Councils.

- The **River Ter** rises in Stebbing Green and flows via Terling to join the Chelmer and Blackwater near Rushes Lock.

As previously discussed, the headwaters of the large rivers originate in chalk catchments in the north and clay in the south. Due to the permeable nature of chalk deposits, these catchments have a slower response to rainfall events. On the other hand, clay deposits generally encourage rapid runoff, due to their impermeable characteristics, which results in a quicker response to rainfall. A quick catchment response can often lead to large volumes of water reaching the river simultaneously, which may result in a flood event. Nevertheless, all watercourses in the District will exert a level of flood risk on the surrounding area regardless of the immediate geology.

3.4.2 Receptors

The Environment Agency's flood maps show the simulated extent of fluvial flooding in the Braintree District during the estimated 1% AEP (1 in 100 year), 0.1% AEP (1 in 1000 year) and the 1% AEP (1 in 100 year) including an allowance for climate change. The mapping highlights that flooding is generally confined to strips of land adjacent to the floodplain, affecting the neighbouring settlements, such as Belchamp Walter. However, there are areas that experience more widespread flooding with extensive floodplains, as seen along the River Stour to the northeast of the District.

Flooding generally becomes more widespread with increasing distance downstream as larger volumes of water in the system result in wider floodplains. A number of towns and villages are at risk from fluvial flooding within the District, including: Coggeshall, Halstead, Yeldham, Bocking, Kelvedon, Witham, Wakes Colne and Great Yeldham. On the smaller scale many individual dwellings, industrial premises and sewerage works for example are also at fluvial flood risk. In comparison to other watercourses the capacity of Pod's Brook is sufficient in containing the modelled 1% AEP (1 in 100 year) and the 0.1% AEP (1 in1000 year) flood events.

3.4.3 Structures

Throughout the river network there are hydraulic structures such as weirs, mills, bridges and culverts. These may elevate water level and hence exacerbate flood risk in the associated areas. Structures can promote debris dam formation which may reduce the capacity of the watercourse. Moreover, the existence of structures is likely to reduce watercourse capacity themselves.

The Environment Agency fluvial modelling study '*Additional Stour Modelling for Key Structures' (2009)* highlighted that mills and the associated structure have the largest impact on water levels. Keeping mill gates closed at key structures increased the upstream flood water level and decreased the downstream when compared to baseline flows. By adding automated sluice gates to open and close at set stage levels to allow flood flows to pass during high discharge and to retain water levels during low discharge, the river's water levels can be maintained. Different automation control settings can be used to increase or decrease the backwater effect from the mill gates and the amount of flow in the upstream bypass channel. Importantly, even if more flow can be carried by an upstream bypass channel, the flood water level in the main channel may be close to bank top. The automation of sluice gates requires careful consideration of the control settings, and a detailed examination of the local topography and stage level settings should be made[16].

Implementing new operation techniques of the mills can have an impact on the flood water levels along the channel, which inevitably alters the connection between the channel and floodplain, changing the pattern of flood risk. Therefore it is fundamental that mill owners are made aware of their responsibility and potential liability for flood risk management. A set of operating procedures should be drawn up to provide guidance for mill owners.

3.4.4 Historic Records of River Flooding

The Environment Agency has provided an extract from the 'Recorded Flood Outlines' dataset for the study area[17] which details the following historic fluvial flood events in the District:

- River Blackwater, March 1947, December 2001
- River Stour and major tributaries, September 1968
- River Chelmer, January 1947, December 1947
- River Colne and major tributaries, October 2001, 2009
- River Brain, 1970, 2009

[16] JBA Consulting (2009) Additional Stour Modelling for Key Structures

[17] The 'Recorded Flood Outlines' dataset identifies the flood extents associated with specific flood events. The 'Historic Flood Map' shows greatest extent of past flooding and does not identify individual flood events.

In 1947 several rivers in the district experienced flooding, where heavy rain coupled with snow melt on a frozen catchment caused extensive flooding in the River Blackwater, River Colne, Bourne Brook and Rivenhall Brook. During this event there was 2.5 inches of rainfall in Braintree (Coggleshall Road) and 1.93 inches in Witham[18].

In 1970 the River Brain flooded in the south of Witham.

In February and October of 2001 there were significant floods from various rivers in the District. There was flooding along Finchingfield Brook, north of Braintree, in Halstead, Great Yeldham, Earls Colne, Coggeshall, Kelvedon and Witham. The October event was caused by a short-duration high-intenisty rainfall event, in which Braintree was hit with 70mm of rain falling in six-hours. This resulted in vast quantities of runoff from surface water directly resulting in surface water flooding[19]. The February event was caused by long-duration and low-intensity rainfall. In Halstead 41 houses and 22 businesses were flooded. It is understood that the flood defences were constructed within Halstead in response to this incident. A further 21 properties were flooded in Yeldham, 58 in Bocking, 153 in Kelvedon and 55 in Witham.

In 2009 parts of Earls Colne, Witham, Kelvedon, Coggeshall and Great Yeldham were flooded.

The extents associated with each of these flood events are shown in **Appendix A Figure 7**.

There have been several more recent flood events in the Braintree District, these are noted in Section 3.5.

3.4.5 NPPF Flood Zones

The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 3-2.

Table 3-2 Fluvial Flood Zones (extracted from the NPPG, 2014)

Flood Zone	Fluvial Flood Zone Definition	Probability of Flooding
Flood Zone 1	Land having a less than 1 in 1,000 (0.1%) annual probability of river flooding. Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (between 1% and 0.1% annual probability of flooding each year).	Medium
Flood Zone 3a	Land having a 1 in 100 or greater annual probability of river flooding (greater than 1% annual probability of flooding each year).	High
Flood Zone 3b	Land where water has to flow or be stored in times of flood, or land purposely designed to be flooded in an extreme flood event (0.1% annual probability). The identification of the functional floodplain takes into account local circumstances but for the purposes of this SFRA, land modelled to flood during a 5% AEP event or greater in any year has been mapped, in agreement with the Environment Agency and Bedford Group of Internal Drainage Boards.	Functional Floodplain

The 'Flood Map for Planning (Rivers and Sea)' is available on the Environment Agency website[20] and is the main reference for planning purposes as it contains Flood Zones 1, 2 and 3a which are referred to in the NPPF and presented in Table 3-2. The 'Flood Map for Planning (Rivers and the Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain.

The 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling and is now routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys and hydrological and/or hydraulic modelling as well as previous flood events.

Since the preparation of the 2008 SFRA, several modelling studies were completed for watercourses in the Braintree District, as set out in Table 3-3. AECOM has used the outputs of these modelling studies to update the Flood Zone mapping for the District, which is presented in **Appendix A Figure 2-2.7.** The Environment Agency is currently undertaking new modelling studies for the Rivers Stour, Blackwater and Brain; however outputs are not yet available to inform this version of the SFRA for Braintree DC.

[18] Meteorological Office (1949) *'British Rainfall 1947'*
[19] The Guardian (2001) *'Flooding causes chaos in the south'*
[20] Environment Agency Flood Map for Planning (Rivers and Sea) http://apps.environment-agency.gov.uk/wiyby/37837.aspx

The large majority of the District is defined as Flood Zone 1, low probability of flooding from fluvial sources. However, due to the lowland nature of the landscape, floodplains associated with principle watercourses are broad. There are large extents of Flood Zone 2 and 3 around Sible Hedingham, Halstead, Earls Colne, Braintree, Coggeshall, and Witham.

Table 3-3 Hydraulic Modelling Studies in Braintree[21]

Watercourse	Modelling Study
River Stour	Additional Stour Model Runs for Key Structures, EA 2010
River Blackwater	Model Update Hydrology Report, EA 2010
River Colne	River Colne Flood Risk Model Update, EA 2010
River Brain	Model Update Hydrology Report, EA 2010

It should be noted that the scope of these modelling studies typically covers flooding associated with main rivers, and therefore ordinary watercourses that form tributaries to the main rivers may not always be included in the model. Modelling of ordinary watercourses available on the 'Flood Map for Planning (Rivers and Sea)' may be the result of the national generalised modelling carried out by the Environment Agency and may need to be refined when determining the probability of flooding for an individual site and preparing a site-specific FRA. Further detail regarding the scope of site specific FRAs is provided in Section 7.

It is noted that a separate map is available on the Environment Agency website which is referred to as 'Risk of Flooding from Rivers and Sea'[22]. This map takes into account the presence of flood defences and so describes the actual risk of flooding, rather than the residual risk if there were no defences present. While flood defences reduce the level of risk they don't completely remove it as they can be overtopped or fail in extreme weather conditions, or if they are in poor condition. As a result the maps may show areas behind defences which still have some risk of flooding – a residual risk. This mapping has been made available by the Environment Agency as the primary method of communicating flood risk to members of the public, however for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information.

Functional Floodplain Flood Zone 3b

The Functional Floodplain is defined in the NPPF as 'land where water has to flow or be stored in times of flood'. The Functional Floodplain (also referred to as Flood Zone 3b), is not separately distinguished from Flood Zone 3a on the Flood Map for Planning (Rivers and Sea). Rather the SFRA is the place where LPAs should identify areas of Functional Floodplain in discussion with the Environment Agency.

The PPG states that the identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5% AEP) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% AEP) flood, should provide a starting point for consideration. The guidance goes on to say that 'areas which would naturally flood with an annual probability of 1 in 20 or greater, but are prevented from doing so by existing infrastructure or solid buildings will not normally be defined as functional floodplain'.

Flood outlines for the 1 in 20 (5% AEP) event are available for the watercourses identified in Table 3-3 and these outlines have been used to map Functional Floodplain across the Braintree District, as shown in **Appendix A Figure 2**.

Climate Change

A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change may increase peak rainfall intensity and river flow, which could result in more frequent and severe flood events. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime.

In February 2016 the Environment Agency published revised guidance on climate change allowances in an update to the document 'Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities'23. This version of the document reflects an assessment completed by the Environment Agency between 2013 and 2015 using

[21] The Environment Agency is currently undertaking new modelling studies for the Rivers Stour, Blackwater and Brain; however outputs are not yet available to inform this version of the SFRA for Braintree DC.
[22] Environment Agency 'Risk of Flooding from Rivers and Sea' http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=237038&y=161974&scale=1
[23] Environment Agency, February 2016, Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516116/LIT_5707.pdf

United Kingdom Climate Projections 2009 (UKCP09) data, to produce more representative climate change allowances for river basin districts across England. The allowances for the Anglian river basin district are of relevance to Braintree and are set out in Table 3-4.

Table 3-4 Peak river flow allowances for Anglian river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Anglian	Upper end (90th)	25%	35%	65%
	Higher central (70th)	15%	20%	35%
	Central (50th)	10%	15%	25%

In order to determine which range of allowance should be assessed for a proposed development or plan, the flood zone and vulnerability classification should be considered, as set out below.

In Flood Zone 2

- essential infrastructure – use the higher central and upper end to assess a range of allowances
- highly vulnerable – use the higher central and upper end to assess a range of allowances
- more vulnerable – use the central and higher central to assess a range of allowances
- less vulnerable – use the central allowance
- water compatible – use none of the allowances

In Flood Zone 3a

- essential infrastructure – use the upper end allowance
- highly vulnerable – development should not be permitted
- more vulnerable – use the higher central and upper end to assess a range of allowances
- less vulnerable – use the central and higher central to assess a range of allowances
- water compatible – use the central allowance

In Flood Zone 3b

- essential infrastructure – use the upper end allowance
- highly vulnerable – development should not be permitted
- more vulnerable – development should not be permitted
- less vulnerable – development should not be permitted
- water compatible – use the central allowance

The lifetime of the development should be considered when determining which future climate change allowance time period should be used. The lifetime of a proposed development should be judged based on the characteristics of the development. In the case of residential developments, a minimum lifetime of 100 years should be taken when selecting climate change allowance percentages. For other types of development, the applicant should assess how long they anticipate the development to be in place for, and justify the lifetime of the development. Otherwise, a 75 year lifetime should be used.

For the purposes of strategic planning, applicants are required to use the '2070 to 2115' allowances in Table 3-4. The new climate change allowances state that for More Vulnerable development in Flood Zone 3a, the higher central and upper end allowances should be used to assess a range of allowances. This correlates to the 35% and 65%.

As part of the existing hydraulic modelling studies that have been made available for this SFRA for the Rivers Stour, Colne, Blackwater and Brain, simulations have been run for the 1% annual probability (1 in 100 year event) including a standard percentage increase in river flow to account for the implications of climate change. This is typically applied as a 20% increase to fluvial flows based on previous climate change guidance. As a result, modelling results assessing a full suite of allowances such as those presented in Table 3-4 are not currently available.

The Environment Agency is currently undertaking new modelling studies for the Blackwater and Brain, and the River Stour. It is anticipated that these future studies will take account of the new allowances, however in the interim period there will be greater emphasis on site specific FRAs to include for additional modelling scenarios to determine the future risk with respect to climate change.

In the absence of model outputs for the updated climate change allowances, this Level 1 SFRA has adopted a conservative approach to assessing climate change for the purpose of the Sequential Test by using the existing Flood Zone 2 extent (1 in 1000 annual probability of river flooding) as a proxy for the Flood Zone 3a plus climate change. This represents the 'higher central' allowance. The existing 1 in 1000 year plus 20% scenario can been used to provide an indication of the 'upper end' allowance, and as a sensitivity scenario. This approach has been discussed and agreed with Braintree DC and the Environment Agency for the Level 1 SFRA, however all subsequent site specific FRAs will be required to determine the appropriate climate change impact allowances in more detail using modelling.

In September 2016, the Environment Agency produced area specific guidance on how to apply the updated climate change allowances in site specific flood risk assessments. The East Anglia, Essex, Norfolk and Suffolk (ENS) guidance24 provides an indication of the appropriate level of technical assessment of climate change impacts on fluvial flooding for new developments depending on their scale and location. The Level 2 SFRA will use the Environment Agency's ENS guidance[24] to undertake further detailed climate change analysis on a site by site basis.

Developers should note that the Environment Agency guidance[24] should be used as a guide only and the agreed approach should be based on expert local knowledge of flood risk conditions, local sensitivities and other influences. **It is recommended that developers contact the Environment Agency at the pre-planning application stage to confirm the assessment approach, on a case by case basis.**

3.4.6 Flood Risk Management Measures

Flood risk management measures can consist of bunds, walls and other structures that manage flow in times of flooding and therefore reduce the risk of water from entering property. They generally fall into one of two categories; 'formal' or 'informal'.

A 'formal' flood risk management asset has been specifically built to control floodwater. It is maintained by its owner or statutory undertaker so that it remains in the necessary condition to function. In accordance with the Flood and Water Management Act, the Environment Agency has discretionary powers to construct and maintain defences to help against flooding.

An 'informal' flood risk management asset has not necessarily been built to control floodwater and is not maintained for this purpose. This includes road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as water retaining structures or create enclosures to form flood storage areas in addition to their primary function.

A study of informal flood risk management assets has not been made as part of this assessment. Should any changes be planned in the vicinity of road or railway crossings over rivers in the study area it would be necessary to assess the potential impact on flood risk to ensure that flooding is not made worse either upstream or downstream. Smaller scale informal flood defences should be identified as part of site specific FRAs and the residual risk of their failure assessed.

In accordance with the scope of a Level 1 SFRA, a high level review of formal flood defences has been carried out using data from the Environment Agency Asset Information Management System (AIMS). This dataset contains details of flood defence assets associated with main rivers and provides a good starting point for identifying significant local defences and potential areas benefiting from defences, but the quantity and quality of information provided differs considerably between structures. The AIMS is intended to provide a reasonable indication of the condition of an asset and should not be considered to contain consistently detailed and accurate data (this would be undertaken as part of a Level 2 SFRA or site specific FRA where the need arises).

Flood defences in the study area are presented in **Appendix A Figure 2.**

The extent of existing flood defences within the district is limited. Information provided by the Environment Agency indicates that formal flood defences protect areas adjacent to the River Colne. More specifically this relates to the settlements of Halstead and White Colne. The latter protects only a small area, downstream of Colneford Hill. No further flood defences are understood to currently exist within the district[25].

As of 6th April 2016, the Water Resources Act 1991 and associated land drainage byelaws have been amended and flood defence consents will now fall under the Environmental Permitting (England and Wales) Regulations 2010. Any works within 8m of a Main River will be subject to the Environmental Permitting Regulations (EPR). This includes the

[24] Environment Agency (Sept 2016), East Anglia, Essex, Norfolk and Suffolk Area – Flood Risk Assessments: Climate change allowances
[25] Braintree District Council (2008) Strategic Flood Risk Assessment

construction of any buildings, culverts, bridges, footways and outfalls. Further details and guidance are available on the GOV.UK website[26].

In addition, as of 6th April 2012 responsibility for the consenting of works by third parties on Ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) has transferred from the Environment Agency to the LLFA, ECC. ECC is now responsible for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. This includes any works (including temporary) that will affect the cross sectional area of the channel (such as in channel structures or diversion of watercourses).

3.4.6.1 Sible Hedingham

Shortly after the publication of the 2008 SFRA a flood alleviation scheme was installed in Sible Hedingham. The project involved the construction of three flood attenuation lagoons to capture surface water from three converging valleys, followed by its slow release via hydrobrake flow control structures. The scheme was promoted by several local politicians and councillors following serious flooding in the years previous. The River Colne Flood Risk Model Update[27] has shown that there is less flooding around Sible Hedingham due to this defence. This highlights that the reservoirs are working successfully to attenuate the flood water to alleviate flooding in the village.

3.4.6.2 Steeple Bumpstead

In 2014 Braintree District saw the completion of the Steeple Bumpstead flood alleviation scheme. The scheme included work to 8 bridges in the village, removal of the ford at the junction between Church Street and Water Lane, extensive channel widening, clearance works along the brooks and landscaping of the a length of the channel with included 2000 replacement shrubs and trees. The scheme will help alleviate flood risk to the surrounding homes, businesses and roads in the village of Steeple Bumpstead which has been subject to flooding in the previous years.

Following this original scheme, a local (Property Level Protection (PLP)) scheme was completed on Bumpstead Brook at Broad Green, downstream of Steeple Bumpstead. Three properties had freestanding floodwalls with flood gates built around them, and other flood resilient structures in 2015.

3.4.7 Flood Warning Areas

The Environment Agency provides a free Flood Warning Service[28] for many areas at risk of flooding from rivers and the sea. In some parts of England the Environment Agency may be able to provide warnings when flooding from groundwater is possible. The Environment Agency has provided a GIS layer of Flood Warning Areas in the study area which are presented in **Appendix A Figure 6.** There are ten Environment Agency Flood Warning Areas in the District, as identified in Table 3-5.

Table 3-5 Environment Agency Flood Warming Areas

Environment Agency Area	Flood Warning Area	Watercourse
Eastern	Stour Brook at Haverhill & Sturmer and the Bumpstead Brook from Steeple Bumpstead to New England	Bumpstead Brook
Eastern	River Stour from Sudbury to Boxted, inclusive	Henry Meadow Fleet
Eastern	River Stour from downstream of Kedington to Sudbury	River Stour
Eastern	River Pant, from great Bardfield to Braintree, inclusive	River Pant
Eastern	River Colne from Halsted to Lexden	River Colne
Eastern	River Colne from Castle Hedingham to upstream of Halstead	River Colne
Eastern	River Chelmer from the A138 at Chelmsford to Maldon	River Chelmer
Eastern	River Chelmer from Great Dunmow to Rivermead Campus and Industrial Estate in Chelmsford	Wensum
Eastern	River Brain from Black Notley to Witham, inclusive	River Brain
Eastern	River Blackwater from Braintree to Langford, including Coggeshall and Kelvedon	River Blackwater

[26] https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.
[27] Mott McDonald (2011) River Colne Flood Risk Model Update
[28] Environment Agency Flood Warning Service http://apps.environment-agency.gov.uk/wiyby/37835.aspx

3.5 Flooding from Surface Water

Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run quickly off land and result in localised flooding. The NPPG states that an SFRA should identify areas at risk from surface water flooding and drainage issues, taking account of the surface water flood risk published by the Environment Agency as well other available information.

In line with the previous SFRA, for practical purposes, flooding from drains and ditches has been considered in the same category as surface water flooding. Where ordinary watercourses are culverted, trash screens and culverts have the potential to become blocked by items such as plant debris and rubbish. Blockages can restrict the natural flow of water, increasing the chance of water flowing out of bank and causing local flooding due to the reduced conveyance potential of the associated watercourse.

The hydrological response of a particular catchment throughout the country varies, with the geological conditions being a key factor in the determination of hydrological response. The upper part of the Braintree catchment is characterised by Chalk, whilst the lower is London Clay. The two opposing geological conditions will result in significant difference in the catchment hydrological response to rainfall. Catchments characterised by London Clay deposits will permit little infiltration and result in large quantities of overland flow. However, Chalk will promote infiltration and help sustain river water levels via a significant base flow input.

Overall, the flooding from surface waters is considered to be at a smaller risk in relation to inundation and the consequences from fluvial flooding. The pathways of surface water will be defined by the local topography. Natural or unnatural features may influence the route that floodwater will take. In urban areas roads form a common pathway for surface water, helping dictate the area that will be affected by flooding. This is further exemplified where there are steep gradients in the hillslopes. Within site specific scale the risk from this flood source should be identified in a Flood Risk Assessment.

3.5.1 Historic Records

Records of flooding from surface water, drains, ditches and ordinary watercourses have been provided from a number of sources. Reports and datasets included in the previous iterations of the SFRA report have been retained to provide a consistent record. Records of flooding which are georeferenced are presented in **Appendix A Figure 3.** Many of these are concentrated in Bocking, where London Clay characterises the surrounding geology.

Maintenance of ditches should continue to form a large part of the work undertaken to assist in mitigating the potential consequences of overland flow. A flood alleviation project undertaken on a minor watercourse feeding into the River Brain has involved the use of a small reed-bed to form an offline storage area during times of flood. It is understood that the scheme has been successful in reducing the flooding to Brook Walk, Howbridge Road and the surrounding houses. Small scale projects such as these are typically not included on the Environment Agency flood maps due to their small size. A number of small schemes have been identified in Sible Hedingham, Great Yeldham and Coggeshall. Under a severe storm, these small-scale projects are unlikely to prevent widespread flooding, but may help decrease flood magnitudes in localised areas. Therefore it is not considered that these schemes will offer a significant improvement to development opportunities.

Braintree Council Records

Braintree District Council provided flood risk summaries for the towns and villages of Braintree as assessed by the local community. This information has been detailed in the **Appendix B**.

In summary, the most frequency affected areas include the towns of Braintree, Halstead, Witham and Sible Hedingham. In 2015 Braintree and Witham experienced surface water flooding in several locations. However, there are also several surface water flood incidents recorded in the rural areas of Braintree, indicating that this source of flooding is not confined to urban areas.

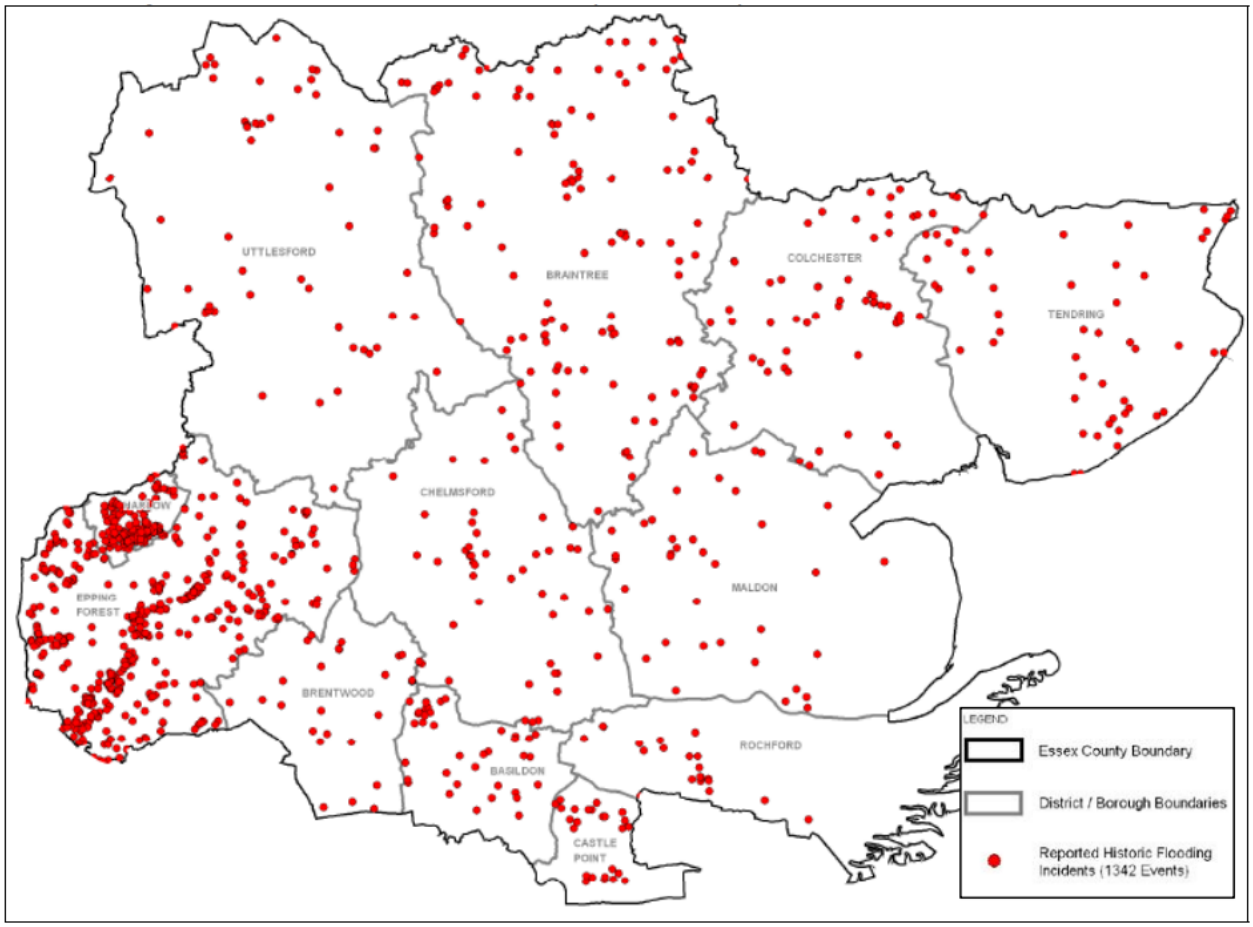
Highways England Records

The Highways Agency also provided information on previous flood records in the Braintree District (**9.1.3Appendix C**). The data shows that the A12 and the A120 are susceptible to flooding. For the A12 this is largely to the southwest of Kelvedon and for the A120 the stretch of road between Braintree and Coggeshall is most susceptible. The information provided is detailed in the table below; no further records have been supplied by Highways England during the consultation as part of the SFRA update.

Essex County Council Records

The PFRA for Essex County Council (2013)[29] includes a map of recorded historic surface water flood incidents across Essex County which has been reproduced in Figure 3-2. There are numerous recorded flood incidents dispersed across the Braintree District, with comparatively similar numbers of incidents to the surrounding Districts.

Figure 3-2 Historic Flood Incidents (all sources) (from PFRA)



ECC has provided records of surface water flooding which are presented in **Appendix A Figure 3.**

In addition, information has been provided of particular known flooding hotspots related to Surface Water and Ordinary Watercourse flooding. This information is presented in **Appendix B Figures 3, 3.1 and 3.2** and was collected from the Environment Agency and Essex County Council as part of the ongoing preparation of the SWMP for Braintree and Witham. In Braintree there have been several flood incidents along the River Blackwater and around Rayne to the southwest. In Witham there have been several flood incidents neighbouring the River Brain.

3.5.2 Risk of Flooding from Surface Water

The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying those areas at risk of surface water flooding during three annual probability events: 1 in 30 year (3.33% annual probability), 1 in 100 year (1% annual probability) and 1 in 1,000 year (0.1% annual probability). The latest version of the mapping is referred to as the 'Risk of Flooding from Surface Water' (RoFSW) and the extents have been made available for the Level 1 SFRA as GIS layers. This dataset is also available on the Environment Agency website, and is referred to as 'Risk of Flooding from Surface Water'.

The RoFSW provides all relevant stakeholders, such as the Environment Agency, LPAs and the public access to information on surface water flood risk which is consistent across England and Wales[30]. The modelling helps the Environment Agency take a strategic overview of flooding, and assists LLFAs in their duties relating to management of surface water flood risk. For the purposes of this SFRA, the mapping allows an improved understanding of areas within the study area which may have a surface water flood risk.

[29] URS Scott Wilson (2011) Essex County Council Preliminary Flood Risk Assessment
[30] Environment Agency (2013) 'What is the updated Flood Map for Surface Water?'

The modelling represents a significant improvement on previous mapping, namely the FMfSW (2010) and the Areas Susceptible to Surface Water Flooding (AStSWF) (2009), for example:

- Increased model resolution to 2m grid,
- Representation of buildings and flow routes along roads and manual editing of the model for structural features such as flyovers,
- Use of a range of storm scenarios, and
- Incorporation of appropriate local mapping, knowledge and flood incident records.

However, it should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas,
- It does not show the susceptibility of individual properties to surface water flooding,
- The mapping has significant limitations for use in flat catchments,
- No explicit modelling of the interaction between the surface water network, the sewer systems and watercourses,
- In a number of areas, modelling has not been validated due to a lack of surface water flood records, and
- As with all models, the RoFSW is affected by a lack of, or inaccuracies, in available data.

The RoFSW for the study area is presented in **Appendix A Figure 3** in combination with historical surface water flooding data.

The RoFSW shows that surface water flooding largely follows the fluvial pathways, yet is much more extensive, often originating upstream of the tributaries. There are also multiple localised surface water flood areas dispersed across the District, this is often where ditches or drains have become blocked. Surface water also accumulates along impermeable surfaces; this is particularly noticeable over the road network.

Climate Change

The RoFSW does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However a range of three annual probability events have been undertaken, 3.3%, 1% and 0.1% and therefore it is considered appropriate to use the 0.1% AEP event as a substitute dataset to provide a worst case scenario and an indication of the implications of climate change.

3.5.3 Braintree and Witham Surface Water Management Plan

A Surface Water Management Plan (SWMP) is currently being produced by AECOM for Braintree and Witham. This will give greater insight into the surface water flood risk of those areas. Developers should seek these maps to assist the layout and design of their development site.

3.5.4 Foxearth Flood Investigation Report

ECC carried out a flood investigation report[31] on Foxearth due to the area experiencing significant flooding several times in the last few years, causing significant internal damage to a number of properties. The report concludes that the flood issue is largely due to the poor condition of the culvert system preventing the water from draining effectively from the area. The flow through the culvert drains a relatively large, predominately agricultural catchment. This promotes rapid runoff from a large area to reach the watercourse quickly, especially during periods when the fields are bare. This large volume of water would have overwhelmed the system due to the blockages and caused flooding.

The Environment Agency Map for Surface water Flood Risk[32] highlights that the road at Foxearth is at high risk of surface water flooding, therefore it is particularly necessary that the drainage system functions effectively here in order to prevent highway and property flooding.

A capital scheme has been implemented to provide additional surface water drainage for the School Street and Mill Road area. A 450mm culvert at the rear of Mill Forge, then run down Mill Road and into School Street where it will terminate at the manhole in the front garden of High Gables. This scheme is coupled with Essex Highways carrying out ditch maintenance and pipe upgrades to system that runs along the Sudbury Road (B1064) finishing at the sewage works.

[31] ECC (2014) Flood Investigation Report, Foxearth
[32] Environment Agency (2015) Map for Surface Water Flood Risk

3.6 Flooding from Groundwater

Groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground.

3.6.1 Areas Susceptible to Groundwater Flooding

As part of the SFRA, an assessment of the risk of groundwater flooding needs to be considered; however, a quantified assessment of risk from groundwater flooding is difficult to undertake, especially on a strategic scale. This is due to lack of groundwater level records, the variability in geological conditions and the lack of predictive tools (such as modelling) that can be used to make assessments of groundwater flow and risk of groundwater flooding following rainfall events.

The Environment Agency Areas Susceptible to Groundwater Flooding (AStGWF) dataset is a strategic scale map showing groundwater flood areas on a 1km square grid. The Environment Agency has provided information with the data and guidance for using it, which is summarised below.

The AStGWF dataset has been prepared primarily as part of the PFRA process, to allow LLFAs across England and Wales such as ECC to obtain a broad feel for the wider areas which might be at risk from groundwater flooding.

The data has used the top two susceptibility bands of the BGS 1:50,000 Groundwater Flood Susceptibility Map and therefore covers consolidated aquifers and superficial deposits. It does not take account of the chance of flooding from groundwater rebound. It shows the proportion of each 1m square where geological and hydrogeological conditions show that groundwater might emerge. The susceptible areas are represented by one of four area categories showing the proportion of each 1km square that is susceptible to groundwater emergence. It does not show the likelihood of groundwater flooding occurring.

The 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 datasets has a number of limitations, as follows:

- The AStGWF dataset has not been formally assessed as appropriate for any other use than the PFRA;
- The data should not be interpreted as identifying areas where groundwater is actually likely to flow or pond, thus causing flooding, but may be of use to LLFAs in identifying, where, for example, further studies may be useful;
- The AStGWF should not be used as the sole evidence for any specific flood risk management, land use planning or other decision at any scale. The data may however help to identify areas for assessment at a local scale where finer resolution datasets exist.

The AStGWF dataset has been mapped in **Appendix A Figure 4**. It highlights that the majority of the District has a susceptibility to surface water flooding of <25%, with the north largely at no risk. Where the major watercourses flow the risk is greater, with significant areas of 25-50%. Where the River Blackwater borders the southern boundary and the River Stour borders the Northern boundary there is much greater risk, which areas susceptible to groundwater flooding at 50-75% and >75%.

3.7 Flooding from Sewers

The sewer system is made up of foul, surface water and combined systems. After a heavy rainfall event the surface water system could reach full capacity resulting in surcharge from manholes and drains (referred to external flooding). Where the surface water and foul systems are combined there is also a risk of full capacity leading to surcharging. However, with the combined sewer system this could result in surcharging within buildings from toilets and drains (referred to as internal flooding).). Basement conversions are particularly prone to sewer flooding, where they lie low relative to the depth of the public sewer.

During heavy rainfall, flooding from the sewer system may occur if:

(1) The rainfall event exceeds the capacity of the sewer system/drainage system:

New sewer systems are typically designed and constructed to accommodate rainfall events with a 3.3% AEP or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While Anglian Water Services (AWS), as the sewerage undertaker for the study area, recognise the impact that more extreme rainfall events may have, it is not cost beneficial to construct sewers that could accommodate every extreme rainfall event. However, many of the sewer systems in England date back to Victorian times, where the capacity could be significantly less than the 1:30 year. This could result in sewer flooding occurring much more frequently in these older systems.

(2) The system becomes blocked by debris or sediment:

Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris (e.g. litter).

(3) The system surcharges due to high water levels in receiving watercourses:

Within the study area there is potential for surface water outlets to become submerged due to high river levels. When this happens, water is unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will overflow into streets and potentially into houses. Where the local area is served by 'combined' sewers i.e. containing both foul and storm water, if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will contain untreated sewage.

This flood occurrence is likely to become a more common occurrence in the future due to climate change and an increase in the number and intensity of convective storms. It is now a widely accepted phenomenon that one of the main effects of climate change in the south east of England will be higher intensity rainfall events and more frequent winter storms, all of which will increase the risk of flooding from all sources.

3.7.1 Water Cycle Study

A Water Cycle Study (WCS) was commissioned by Braintree DC in 2011 to investigate the occurrence of flooding from sewers. Additionally, it investigates the potential increase in sewer flooding as a result of new development and the increased pressure of climate change on the system. The 2011 WCS report made several valuable points for the Braintree District. At the time of publishing this Level 1 SFRA, the Braintree District WCS (2011) is currently being updated.

- Bocking, Coggeshall, Earls Colne and Sible Hedingham Wastewater Treatment Works have recently had the volume of water they are consented to discharge into the river each day increased by the Environment Agency to account for existing flow variations. The implication of this is that any increase in flow resulting from the development in these catchments will require the negotiation of a new consent. The Environment Agency will tighten the quality required when this happens to protect the water quality in the receiving water courses as required under the Water Framework Directive (WFD).

- In Braintree, Halstead, Rayne and Witham it is predicted that the increased flow can be accommodated within the existing consented discharge, therefore there is no immediate constraint to development. The outfall from Witham WwTW to the head of the River Blackwater has sufficient capacity for the proposed growth, and additional flows from here allow greater abstraction in the River Chelmer upstream at Langford, improving the water resource situation.

- There is a risk that the Environment Agency may seek to further tighten quality standards required at WwTW discharges in the future to aid compliance with the WFD. This issue of balancing increased housing and population against environmental constraints such as this is a regional, if not national concern and will be beyond the control of Braintree DC. However, seeking to minimise water use (and reducing water connection to the sewer system) now, through appropriate polices, will be beneficial when decisions such as these are made.

- The potential increase in sewer flood risk due to the increased flows from the WwTW has been shown to be negligible.

3.7.2 Historic Records of Sewer Flooding

Anglian Water provided the location of previous sewer flood records, as listed in Table 3-6 and shown in **Appendix A Figure 5.1 and 5.2**. Sewer flood incidents are arranged in to post code areas and coloured depending on the number of incidents recorded in that area.

Comparisons with the recorded sewer flood incidents and the proposed development sites can help identify the risk local sewers may have on particular sites. It should be noted, however, that all sewers represent a degree of flood risk through restricted capacities for transporting large volumes of water. Therefore regardless of sewer flood history an assessment for flood risk from this sources should be made part of a site specific FRA. Within the FRA the local topography should be taken into account. Where steep urbanised areas exist local to proposed development sites, or where the site is located within a depression, the potential for sewer and surface water flooding should be investigated.

The table below details all the recorded sewer flood incidents in the Braintree District. **Appendix A Figure 5.2** highlights that internal sewer flood incidents are more rare than external, with a couple located in the north area of the District and one located in Witham. On the other hand, external sewer flood events are much more common, with occurrences across the whole district, particularly in the east. In terms of influence on potential sites, there are several large sites surrounding Braintree that are within an area which has experienced two sewer flood incidents previously.

Table 3-6 Recorded Sewer Flood Incidents

Number of Recorded Incidents	Location	Town
2	Earls Colne	Halstead
3	White Colne	Halstead
5	Gosfield	Halstead
3		Halstead
1	Ridgewell	Halstead
2	Cressing	Braintree
3		Witham
2		Braintree
1	Great Bardfield	Braintree
1	Silver End	Witham
2	Belchamp St. Paul	Great Yeldham

3.8 Reservoirs, Canals and Other Artificial Sources

The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The NPPF encourages LPAs to identify any at risk reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment it is located within, and / or whether emergency draw-down of the reservoir will add to the extent of flooding.

The reservoirs present in the Braintree District are listed in Table 3-7. There is no previous record of reservoir flooding and none of the reservoirs present have been classified in terms of risk severity.

Table 3-7 Reservoirs in Braintree (Environment Agency Reservoir mapping)[33]

Reservoir	Location	Reservoir Owner
Powers Hall	Witham	Lord Rayleigh's Farms Ltd
Lavender (Leigh's Lower) |Reservoir	Witham	Lord Rayleigh's Farms Ltd
Lodge (Leigh's Upper) Reservoir	Witham	Lord Rayleigh's Farms Ltd
Feeringbury Farm	Kelvedon	Manning
Halstead Flood Alleviation Reservoir	Halstead	Environment Agency
Gosfield Lake	Halstead	O'Shea, Turp, Symons
Preston's Lake	Halstead	JWP Nott Farms
Meldham Washland	Haverhill	Environment Agency

Reservoirs in the UK have an extremely good safety record. The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir

[33] Environment Agency (2015) Risk of Flooding from Reservoirs

panel engineers. It is assumed that these reservoirs are regularly inspected and essential safety work is carried out. These reservoirs therefore present a managed risk. Braintree DC is responsible for working with members of the Local Resilience Forum (LRF) to develop emergency plans for reservoir flooding and ensuring communities are well prepared.

Risk of Flooding from Reservoirs Mapping

The Environment Agency dataset 'Risk of Flooding from Reservoirs' available online identifies areas that could be flooded if a large[34] reservoir were to fail and release the water it holds. The mapping shows:

- Halstead has three areas at risk of flooding from reservoirs due to Gosfield Lake, Halstead Flood Alleviation Reservoir and Preston's Lake.
- There is a small area at risk below Braintree, due to the Lodge (Leigh's Upper) Reservoir.
- An area south of Coggeshall is at risk of reservoir flood from Feeringbury Farm
- The north of Witham is at risk of flooding from Powers Hall reservoir.

[34] A large reservoir is one that holds over 25,000 cubic metres of water, equivalent to approximately 10 Olympic sized swimming pools.

4 Avoiding Flood Risk – Applying the Sequential Test

4.1 Sequential Approach

This Section guides the application of the Sequential Test and Exception Test in the Plan-making and planning application processes. Not all development will be required to undergo these tests, as described below, but may still be required to undertake a site specific FRA, guidance about which is included in Section 7.

The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to sites at higher risk. This will help avoid the development of sites that are inappropriate on flood risk grounds. The subsequent application of the Exception Test, where required, will ensure that new developments in areas of particular flood risk will only occur where flood risk is clearly outweighed by other sustainability drivers and where development can be made safe from flooding and not increase the risk of flooding elsewhere.

The sequential approach can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new developments (except Water Compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

4.2 Applying the Sequential Test – Plan-Making

As the LPA, Braintree DC must demonstrate that throughout the site allocation process a range of possible sites have been considered in conjunction with the flood risk and vulnerability information from the SFRA, and that the Sequential Test, and where necessary the Exception Test, has been applied. Figure 4-1 illustrates an approach for applying the Sequential Test that Braintree DC could adopt in the allocation of sites as part of the preparation of their Local Plan. In order to ensure that the Sequential Test takes account of flood risk from all sources, Table 4-1 provides a suggested flood risk classification based on available datasets.

The Sequential Test should be undertaken by Braintree DC and accurately documented to ensure decision processes are consistent and transparent.

Table 4-1 Flood Risk Classifications for Sequential Test

Risk	Source of Flooding				
	Fluvial	Surface Water	Groundwater	Sewer	Reservoir
Low	Flood Zone 1	RoFSW Very Low	AStGWF (<25%)	Anglian Water to assess the sewer network for each site	Use EA Flooding from Reservoirs map
Medium	Flood Zone 2	RoFSW Low to Medium	AStGWF (25-50%) AStGWF (50-75%) AStGWF (>75%)		N/A
High	Flood Zone 3a	RoFSW High	Historic records of groundwater flooding		N/A
Very High	Flood Zone 3b	N/A	N/A		N/A

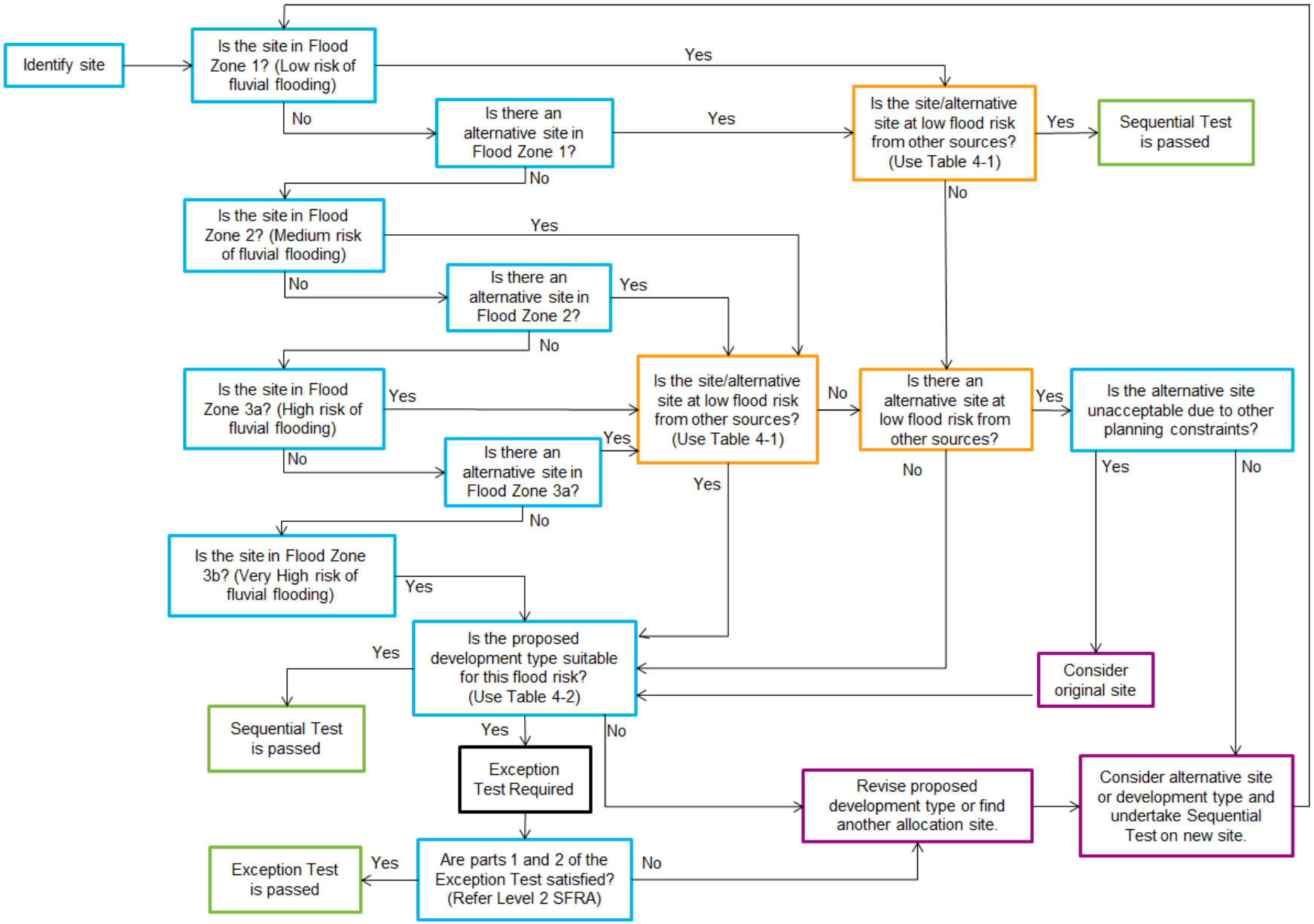


Figure 4-1 Application of Sequential Test for Plan-Making

The Sequential Test requires an understanding of the Flood Zones in the study area, the risk from other sources of flooding, and the vulnerability classification of the proposed developments. Flood Zone definitions are provided in Table 3-2 and mapped in the figures in **Appendix A** (and the Flood Map for Planning (Rivers and Sea) on the Environment Agency website). Flood risk vulnerability classifications, as defined in the NPPG are presented in Table 4-2.

Table 4-2 Flood Risk Vulnerability Classification (PPG, 2014)

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure").
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

The NPPF acknowledges that some areas will (also) be at risk of flooding from sources other than fluvial. All sources must be considered when planning for new development including: flooding from land or surface water runoff; groundwater; sewers; and artificial sources.

If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

The recommended steps in undertaking the Sequential Test are detailed below. This is based on the Flood Zone and Flood Risk Vulnerability. Table 4-3 indicates the compatibility of different development types with the Flood Zones.

Table 4-3 Flood Risk Vulnerability and Flood Zone 'Compatibility' (PPG, 2014)

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

✓ - Development is appropriate × - Development should not be permitted

4.2.1 Recommended stages for LPA application of the Sequential Test in Plan-Making

The information required to address many of these steps is provided in the accompanying GIS layers and maps presented in **Appendix A**.

a. Assign potential developments with a vulnerability classification (Table 4-2). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.

a. The location and identification of potential development should be recorded.

b. The Flood Zone classification of potential development sites should be determined based on a review of the Flood Map for Planning (Rivers and Sea). Where these span more than one flood zone, all zones should be noted.

c. The risk of flooding from other sources should also be identified, based on readily available datasets and local information.

d. Identify existing flood defences serving the potential development sites. (However, it should be noted that for the purposes of the Sequential Test, flood zones ignoring defences should be used).

e. The design life of the development should be considered with respect to climate change:

- 100 years – up to 2116 for residential developments; and
- Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.

f. Highly Vulnerable developments to be accommodated within the LPA area should be located in those sites identified as being within Flood Zone 1 and at low risk of flooding from other sources. If these cannot be located in areas of low flood risk, because the identified sites are unsuitable or there are insufficient sites in areas of low risk, sites in Flood Zone 2 can then be considered. Highly Vulnerable developments in Flood Zone 2 will require application of the Exception Test. If sites in Flood Zone 2 are inadequate then the LPA may have to identify additional sites in Flood Zones 1 or 2 to accommodate development or seek opportunities to locate the development outside their administrative area. Within each flood zone Highly Vulnerable development should be directed, where possible, to the areas at lowest risk from all sources of flooding. It should be noted that Highly Vulnerable development is not appropriate in Flood Zones 3a and 3b.

g. Once all Highly Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as More Vulnerable. In the first instance More Vulnerable development should be located in any unallocated sites in Flood Zone 1 and at low risk of flooding from other sources. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate More Vulnerable development, sites in Flood Zone 3a can

be considered. More Vulnerable developments in Flood Zone 3a will require application of the Exception Test. As with Highly Vulnerable development, within each flood zone More Vulnerable development should be directed to areas at lowest risk from all sources of flooding. It should be noted that More Vulnerable development is not appropriate in Flood Zone 3b.

h. Once all More Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located in any remaining unallocated sites in Flood Zone 1 and at low risk of flooding from other sources, continuing sequentially with Flood Zone 2, then Flood Zone 3a. Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.

i. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied.

j. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however it is appreciated that Water Compatible development by nature often relies on access and proximity to water bodies.

k. Where the development type is Highly Vulnerable, More Vulnerable, Less Vulnerable or Essential Infrastructure and a site is found to be impacted by a recurrent flood source (other than fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test. It is noted that for any development at risk of flooding, a site specific FRA will be required.

4.2.2 Windfall Sites

Windfall sites are those which have not been specifically identified as available in the Local Plan process. They comprise previously-developed sites that have unexpectedly become available. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development, based on past trends and expected future trends. It is recommended that 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.

4.3 Applying the Sequential – Individual Applications

If development is proposed in Flood Zone 2 or 3, and the Sequential Test has not already been carried out for the site for the same development type at the Local Plan level, then it is necessary to undertake a Sequential Test for the site. The Environment Agency publication 'Demonstrating the Flood Risk Sequential Test for Planning Applications'[35] sets out the procedure as follows:

- Identify the geographical area of search over which the test is to be applied; this could be the District area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area identified for regeneration in Local Plan policies).
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan.
- State the method used for comparing flood risk between sites; for example the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources.
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s).
- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- Where necessary, as indicated by Table 4-3, apply the Exception Test.
- Apply the Sequential approach to locating development within the site (as described in Section 5.2).

It should be noted that it is for LPAs, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence to the LPA what area of search has been used when making the

[35] Environment Agency, April 2012, 'Demonstrating the flood risk Sequential Test for Planning Applications', Version 3.1

application. Ultimately, Braintree DC needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere.

4.3.1 Sequential Test Exemptions

It should be noted that the Sequential Test does not need to be applied in the following circumstances:

- Individual developments proposed on sites which have been allocated in development plans through the Sequential Test.
- Minor development, which is defined in the NPPF as:
    - minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m^2;
    - alterations: development that does not increase the size of buildings e.g. alterations to external appearance;
    - Householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats;
- Change of Use applications, unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site;
- Development proposals in Flood Zone 1 (land with a low probability of flooding from rivers or the sea) unless the SFRA, or other more recent information, indicates there may be flooding issues now or in the future (for example, through the impact of climate change);

4.4 Exception Test

The purpose of the Exception Test is to ensure that where it may be necessary to locate development in areas at risk of flooding, new development is only permitted in Flood Zone 2 and Flood Zone 3 where the flood risk is clearly outweighed by other sustainability factors and where the development will be safe during its lifetime, considering climate change.

The NPPF states that for the Exception Test to be passed:

– *Part 1 - "It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by the SFRA where one has been prepared; and*

– *Part 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."*

Both elements of the test will have to be passed for development to be allocated or permitted.

In order to determine Part 1) of the Exception Test, applicants should assess their scheme against the objectives set out in the Sustainability Appraisal as set out in the Braintree DC Core Strategy and reproduced in Table 4-4.

In order to demonstrate satisfaction of Part 2) of the Exception Test, relevant measures, such as those presented within Section 5, should be applied and demonstrated within a site-specific FRA as detailed in Section 7.

Table 4-4 Braintree DC Sustainability Appraisal Objectives[36]

Sustainability Objective	Sustainability Issues	Key Questions - Policy	Potential Indicators
1) Create safe environments which improve quality of life and community cohesion	- Percentage increases in the offences of violence against the person, burglary of dwellings, theft from a motor vehicle, and sexual offences between 2009/10 and 2010/11. - Lack of community facilities for young people - Lack of cultural facilities	Does it seek to improve / supply community facilities for young people? - Does it seek to increase cultural activities or suitable development to stimulate them? - Does it seek to reduce inequalities between areas and support cultural identity? - Will there be measures to increase the safety and security of new development and public realm?	- Recorded key offences - KSI casualties for adults and children - Public perceptions on leisure / community facilities - Street level crime statistics
2) To provide everyone with the opportunity to live in a decent home	- Lack of social housing - 0.1% of housing stock owned by the Local Authority (7.6% nationally). - Housing should respond more to demographics in population growth - Lack of care homes and capacity in existing care homes - Rural affordable housing is currently not suitable for rural areas and those who require them	- Will it increase the range and affordability of housing for all social groups? - Does it respond to the needs of an ageing population? - Does the site respond to a housing type shortage as identified in the SHMA and responding to demographics in population growth? - Does it seek to provide appropriate rural affordable housing? - Does it seek to provide additional capacity in or of care homes? - Will it promote an increase in social housing?	- House Prices - Indices of Multiple Deprivation Score – particularly Housing and Services Domain and the Living Environment Deprivation Domain - Number of affordable dwelling completions - Annual dwelling completions - Population projections and forecasts
3) To improve the health of the District's residents and mitigate/reduce potential health inequalities	- Increases in obesity in Year 6 children and adult obesity higher than the national average - Uptake of sports and leisure facilities. - 35% of households within Braintree District do not have any access to natural greenspace - Greenspace in urban areas to be safeguarded against development for other means - Lack of walking and cycling infrastructure	- Will it improve access to high quality health facilities? - Will it increase access to sport and recreation facilities, open space? - Will it encourage access by walking or cycling, and will it increase the overall rates of walking and cycling?	- Life Expectancy - Indices of Multiple Deprivation – Health and Disability subdomain scores - Residents opinion on availability of open space/leisure facilities - Natural England Accessible Natural Greenspace Standards (ANGSt) - Location and extent of recreational facilities to development site - Location and extent of accessible greenspace to development site - Proximity of site to healthcare facilities - Percentage of population obese - Number of GPs and dentists accepting new patients
4) To promote the vitality and viability of all service centres throughout the District	- Lack of retail and non-commercial office floor space in relation to the total proportion of commercial and industrial floor space – significantly lower than county and national averages	- Does it prevent further loss of retail and other services in rural areas? - Does it promote and enhance the viability of existing centres by focusing development in such centres? - Will retailing in town centres be enhanced in areas of identified need? - Does it seek to increase the proportion of retail and non-commercial office floor space (as a proportion of total commercial and industrial floor space) in the District?	- Amount of retail, leisure and office floor space in town centres. - Implemented and outstanding planning permissions for retail, office and commercial use - Number and type of services from Rural Services Study - Number of post offices closed down - Number of village shops closed down - Pedestrian footfall count
5) To achieve sustainable levels of prosperity and economic growth	- Braintree District has a lower job density than both the region and Britain - The District displays a significantly higher percentage of employment in 'manufacturing' and 'construction' in comparison to the region and the country and significantly lower employees in the 'finance, IT and other business activities' sector. - Factories and warehouses account for the majority of industrial and commercial floor space in 2008. - Too much employment land being developed for other uses, particularly housing - Lack of focus on tourism - Need for rural diversification and increased rural employment opportunities - Need to promote and aid the expansion of small businesses - Broadband inequalities across the District meaning home working and rural employment is stifled	- Will new housing be supported by adequate local employment opportunities? - Does it support small businesses to grow and encourage business innovation? - Will it make land and property available for business development? - Will it enhance the Districts potential for tourism? - Will it encourage the rural economy and diversification of it? - Will it lead to development having an adverse impact on employment for existing facilities? - Does it seek to increase broadband coverage / bandwidth, especially in rural area?	- Employment land availability - Typical amount of job creation (jobs per ha) within different use classes. - Percentage change and comparison in the total number of VAT registered businesses in the area - Businesses by industry type - Amount of vacant industrial floor space - Amount of high quality agricultural land - Travel to work flows - Employment status by residents and job type - Job densities - Economic activity of residents - Average gross weekly pay - Proportion of business in rural locations - Implemented and outstanding planning permissions for retail, office and commercial use
6) To conserve and enhance the biological and geological diversity of the environment	- There are 4 Sites of Special Scientific Interest (SSSIs). 5% of the Bovingdon Hall Woods SSSI is 'unfavourable no change'. Parts of both Belcher's & Bradfield Woods and Elmsford Pits SSSIs are in a state of 'unfavourable recovering'. - There are approximately 251 Local Wildlife Sites (LoWs) - A need to increase the green infrastructure of the District - The fragmentation of habitats	- Will it conserve and enhance natural/semi natural habitats? - Will it conserve and enhance species diversity, and in particular avoid harm to indigenous BAP priority species? - Will it maintain and enhance sites designated for their nature conservation interest? - Will it maintain and enhance the connectivity of habitats and their ability to deliver ecosystem services?	- Spatial extent of designated sites within the District - Achievement of Biodiversity Action Plan targets - Ecological potential assessments - Distance from site to nearest: SSSIs / NNR / LoWS / Ancient Woodland / Protected lanes / Other sensitive designated or non-designated receptors / Other special landscape features - Condition of the nearest sensitive receptors (where viable) - Site visit surveys on typical abundance and frequency of habitats (DAFOR scale)
7) To promote more sustainable transport - choices and uptake	- Higher car ownership in Braintree District compared to county and national levels. - Lack of parking at public transport interchanges, particularly Witham train station - Lack of walking and cycling infrastructure - Lack of public transport infrastructure	- Will it increase and/or improve the availability and usability of sustainable transport modes? - Will it seek to encourage people to use alternative modes of transportation other than private vehicle? - Will it improve rural public transport? Will it lead to the integration of transport modes? - Does it seek to increase the uptake of public transport through parking standards at destinations? - Does it seek to increase the uptake or viability walking and cycling as methods of transportation, through new infrastructure or integration?	- Access to services and business' by public transport - Indices of Multiple Deprivation - Travel to work methods and flows - Car ownership - Network performance on roads - Public transport punctuality and efficiency

[36] Braintree District Council (2014), Sustainability Appraisal for Braintree District Local Plan.

8) Promote accessibility and ensure the necessary transport infrastructure to support new development	- Large commuting outflow of Braintree District residents. - In-commuters filling jobs in the District. - Accessibility of GPs by either walking or using public transport. - Accessibility to employment sites and retail centres - Lack of public transport infrastructure - Lack of major roads and lack of quality in smaller roads.	- Will it contribute positively to reduce social exclusion by ensuring access to jobs, shopping, services and leisure facilities for all? - Does it seek to concentrate development and facilities in town centres or where access via sustainable travel is greatest? - Will it assist in reducing the number of road casualties and ensure ease of pedestrian movement especially for the disabled? - Will it improve parking conditions at destinations, particularly for commuters? - Does it seek to minimise congestion at key destinations/areas that witness a large amount of vehicle movements at peak times? - Would the scale of development require significant supporting transport infrastructure in an area of identified need? - Will planning controls seek to retain garages to reduce conversion to living space to reduce on-street parking?	- Residents opinion on availability of open space/leisure facilities - Access to services by public transport - Indices of Multiple Deprivation – sub-domain scores - Recorded traffic flows - Recorded traffic flows - KSI casualties for adults and children - Car ownership - Location of site with regards to areas of high deprivation Transport Assessments
9) To improve the education and skills of the population	- 4 LSOAs are in the top 5% most deprived nationally in regards to education, skills and training deprivation: 1 in Halstead, 1 in Braintree and 2 in Witham. - Lack of highly skilled jobs in the District - Attainment is an issue across all levels	- Does it seek to improve existing educational facilities and/or create more educational facilities? - Does it seek to improve existing training and learning facilities and/or create more facilities? - Will the employment opportunities available be mixed to suit a varied employment skill base? - Will new housing be supported by school expansion or other educational facilities where necessary?	- Additional capacity of local schools - GCSE or equivalent performance -Level 2 qualifications by working age residents - Level 4 qualifications and above by working age residents - Employment status of residents - Average gross weekly earnings - Standard Occupational Classification
10) To maintain and enhance cultural heritage and assets within the District	- 3,192 designated listed buildings within the District - 40 Scheduled Monuments located throughout the District	- Will it protect and enhance sites, features and areas of historical, archaeological and cultural value in both urban and rural areas? - Does it seek to enhance the range and quality of the public realm and open spaces? - Will it reduce the amount of derelict, degraded and underused land? - Does it encourage the use of high quality design principles to respect local character? - Will any adverse impacts be reduced through adequate mitigation?	- Proximity to nearest (including its setting): Scheduled Monument? / Listed Building? / Conservation Area? / Registered Historic Park or Garden? / Site identified in the Historic Environment Record? / Building of local interest? / Other historic feature? - Number and spatial extent of listed buildings - Number and spatial extent of scheduled monuments - Buildings At Risk Register - Heritage at risk surveys - Percentage of conservation area demolished or otherwise lost - Amount of derelict properties and/or vacant land - Numbers of buildings being removed from the building at risk register - Amount of damage to listed buildings or scheduled monuments
11) To reduce contributions to climatic change	- In 2008 Braintree District consumed more energy than the county average, largely associated with road transport. - Road transport in Braintree District produces the 3rd highest amount of CO_2 per capita across the county's local authorities	- Will it reduce emissions of greenhouse gases by reducing energy consumption? - Will it lead to an increased proportion of energy needs being met from renewable sources? - Does it ensure more sustainable modes of travel are provided? - Will it encourage greater energy efficiency? - Will it improve the efficient use of natural resources? - Will it seek to adhere to the Code for Sustainable Homes?	- Carbon Dioxide emissions - Energy consumption GWh/household - Percentage of energy supplied from renewable sources. - Code for Sustainable Homes certificates
12) To improve water quality and address water scarcity - and sewerage	- The majority of water bodies within Braintree District are given a 'moderate' current overall potential. However the River Blackwater and the River Chelmer are both given a 'poor' current status. - Water scarcity is a major issue in regards to significant development in particular - Sewage capacity	- Will it lead to no deterioration on the quality of water bodies? - Will water resources and sewerage capacity be able to accommodate growth? - Does it ensure the reinforcement of wastewater treatment works or the provision of alternative (where required) to support growth?	- Percentage of water bodies at good ecological status or potential - Percentage of water bodies assessed at good or high biological status - Percentage of water bodies assessed at good chemical status - Water cycle study capacity in sewerage and resources
13) To reduce the risk of flooding	- Potential for development in Flood Risk Zones - Surface water runoff in urban areas	- Does it promote the inclusion of Sustainable Drainage Systems in new developments? - Does it seek to avoid development in areas risk of flooding (fluvial, surface water, groundwater)? - Does it seek to avoid increasing flood (fluvial, surface water, groundwater) in areas away from initial development? - Will developer contributions be utilised for the provision and maintenance of flood defences?	- Spatial extent of flood zones 2 and 3 - Residential properties flooded from main rivers - Planning permission in identified flood zones granted permission contrary to advice from the Environment Agency - Incidences of flooding and location - Distance of site to floodplains - SFRA results - Incidences of flood warnings in site area - Distance to 'Areas susceptible to surface water flooding' – Environment Agency Maps
14) To improve air quality	- The main air quality issues in the District are found to be NO2 and PM10 emissions from vehicles travelling on the A12 and A120. - Meeting National Air Quality Standards. - Five potentially significant junctions with a daily flow of greater than 10,000 vehicles (2004) at Newland Street, Witham; Cressing Road, Witham; Head Street, Halstead; Railway Street, Braintree and Rayne Road, Braintree.	- Will it improve, or not detrimentally affect air quality along the A12 or A120? - Does it ensure that National Air Quality Standards are met at relevant points? -Does it seek to improve or avoid increasing traffic flows generally and in particular through potentially significant junctions?	- Number and spatial extent of potentially significant junctions for air quality in the District - NO_2 emissions - PM10 emissions Recorded traffic flows on A12 and A120
15) To maintain and enhance the quality of landscapes and townscapes	- Much of the District's landscape is sensitive to change and new development - Open skylines with panoramic views - Strong historic integrity with dispersed historic settlement patterns and Conservation Areas - Coalescence between neighbouring settlements and beyond village envelopes - Continuation of development on Previously Developed Land (PDL)	- Will homes be designed to enhance the existing street scene creating a better cultural heritage & public realm? - Will areas of special landscape character be protected? - Will it see a loss of Greenfield land/does it promote development on PDL? - Will development see a disruption in current field boundaries? Will it lead to rural expansion or development outside development boundaries/limits that increases coalescence with neighbouring settlements? - Is the scale/density of development in fitting with the local townscape/landscape?	- Developments permitted contrary to Landscape Character Assessment 'sensitivities to change'. - Number and extent of field boundaries affected - Development on PDL - Number of permitted developments within Conservation Areas

5 Managing and Mitigating Flood Risk

5.1 Overview

The NPPF appreciates that it may not always be possible to avoid locating development in areas at risk of flooding. This Section provides guidance and policy recommendations on the range of measures that could be considered in order to manage and mitigate flood risk. These measures should be considered when preparing a site-specific FRA as described in Section 7.

As noted in Section 3, it is essential that the development control process influencing the design of future development within the District carefully mitigates the potential impact that climate change may have upon the risk of flooding. As a result mitigation measures should be designed with an allowance for climate change over the lifetime of the proposed development as follows:

- 100 years (up to 2115) for residential developments; and
- 75 years (up to 2090) for commercial / industrial developments, or other time horizon specific to the non-residential use proposed.

5.2 Development Layout and Sequential Approach

Policy Recommendation 1: A sequential approach to site planning should be applied within new development sites.

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. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas (considering all sources of flooding) e.g. residential elements should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on lower ground with a higher probability of flooding.

5.3 Riverside Development

Policy Recommendation 2: Retain at least an 8 metre wide undeveloped buffer strip alongside Main Rivers and explore opportunities for riverside restoration. Any proposed development within 8m of a Main River watercourse will require an environmental permit from the Environment Agency.

Retain a 3 metre buffer strip on at least one side of an Ordinary Watercourse. Any development that could impact the flow within an ordinary watercourse will require consent from Essex County Council (as LLFA).

The Environment Agency is likely to seek an 8 metre wide undeveloped buffer strip alongside main fluvial rivers for maintenance purposes, and would also ask developers to explore opportunities for riverside restoration as part of any development. ECC will seek a similar undeveloped buffer strip to be retained alongside Ordinary Watercourses.

As of 6th April 2016, the Water Resources Act 1991 and associated land drainage byelaws have been amended and flood defence consents will now fall under the Environmental Permitting (England and Wales) Regulations 2010. Any works within 8m of a Main River will be subject to the Environmental Permitting Regulations (EPR). Further details and guidance are available on the GOV.UK website[37]. The Environment Agency can be consulted regarding permission to do work on or near a river, flood or sea defence by contacting enquiries@environment-agency.gov.uk.

ECC will seek to ensure that development is set back by at least 3m on one side of an Ordinary Watercourse for ongoing maintenance purposes. As of 6th April 2012 responsibility for the consenting of works by third parties on Ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) has transferred from the Environment Agency to the LLFA, ECC. ECC is now responsible for

[37] https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.

the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. This includes any works (including temporary) that will affect the cross sectional area of the channel (such as in channel structures or diversion of watercourses). It is advised that ECC is consulate early of proposed alterations. Enquiries and applications for ordinary watercourse consent should be emailed to watercourse.regulation@essex.gov.uk with 'Ordinary Watercourse Consent Application' as the subject title, or sent to Flood & Water Management Team, County Hall, Market Road, Chelmsford CM1 1QH.

An application form for Ordinary Watercourse Consent can be found on the Essex CC website: https://www.essex.gov.uk/Environment%20Planning/Environment/local-environment/flooding/Documents/Ordinary_Watercourse_Application.pdf

ECC, as the LLFA, will only approve culverting of ordinary watercourse where deemed necessary, this is explained further in ECC culverting policy. They will be minded to reject applications for culverting in areas identified as being in Flood Zone 2 or 3a/3b and/or in an area of surface water flooding identified within the Environment Agency Flood Maps for Surface Water, due to the potential of proposed works increasing flood risk. Exceptions to this policy will only be considered if the applicant is able to demonstrate that, on the balance of probabilities, the proposed development would not increase flood risk. Where ECC is made aware of breaches to other legislation then it will make the appropriate organisation aware of this.

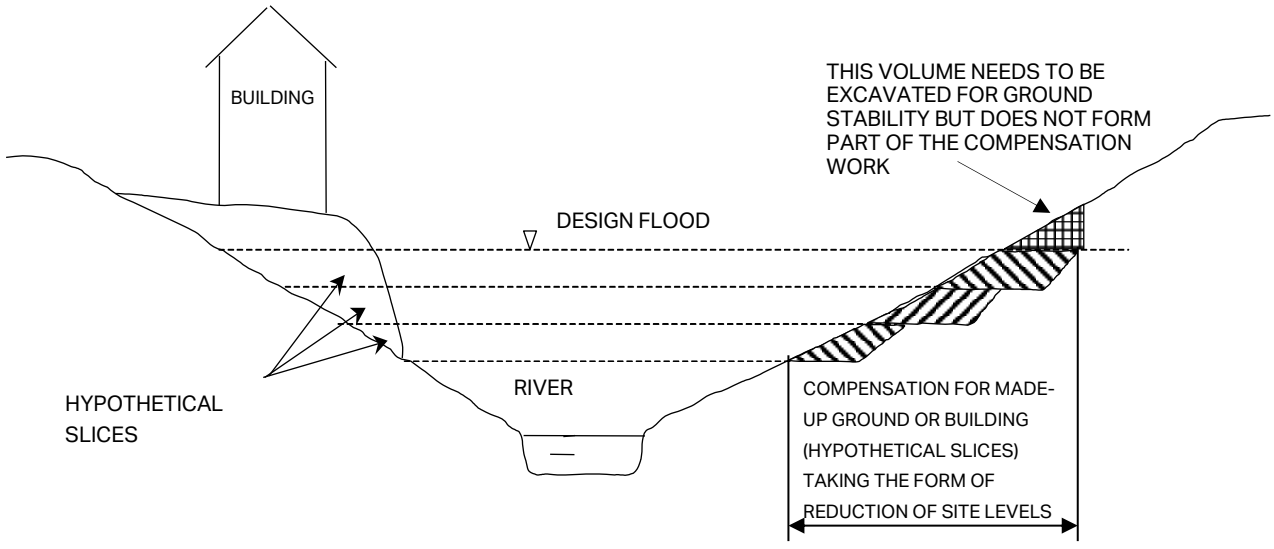
5.4 Floodplain Compensation Storage

Policy Recommendation 3: All new development within Flood Zone 3 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 must ensure that it does not impact upon the ability of the floodplain to store water, and should seek opportunities to provide betterment with respect to floodplain storage. 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 must be provided to ensure that the total volume of the floodplain storage is not reduced.

As depicted in Figure 5-1, floodplain compensation 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 be in the immediate vicinity, in the applicant's ownership and linked to the site. Floodplain compensation must 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 and must not pond. An FRA must 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 C62438.

Figure 5-1 Example of Floodplain Compensation Storage (Environment Agency 2009)



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

The requirement for no loss of floodplain storage means that it is not possible to modify ground levels on sites which lie completely within the floodplain (when viewed in isolation), as there is no land available for lowering to bring it into the floodplain. It is possible to provide off-site compensation within the local area e.g. on a neighbouring or adjacent site, or indirect compensation, by lowering land already within the floodplain, however, this would be subject to detailed investigations and agreement with the Environment Agency to demonstrate (using an appropriate flood model where necessary) that the proposals would improve and not worsen the existing flooding situation or could be used in combination with other measures to limit the impact on floodplain storage.

5.5 Finished Floor Levels

Policy Recommendation 4: All More Vulnerable and Highly Vulnerable development within Flood Zones 2 and 3 should set Finished Floor Levels 300mm above the known or modelled 1 in 100 annual probability (1% AEP) flood level including an allowance for climate change.

Where developing in Flood Zone 2 and 3 is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) and Highly Vulnerable land uses, is to ensure internal floor levels are raised above the design flood level. A freeboard allowance of 300mm is typically applied, to take account of the uncertainties associated with the estimation of the design water level as well as wave effects, construction tolerances and long-term deterioration of the defence or ground floor level for a building.

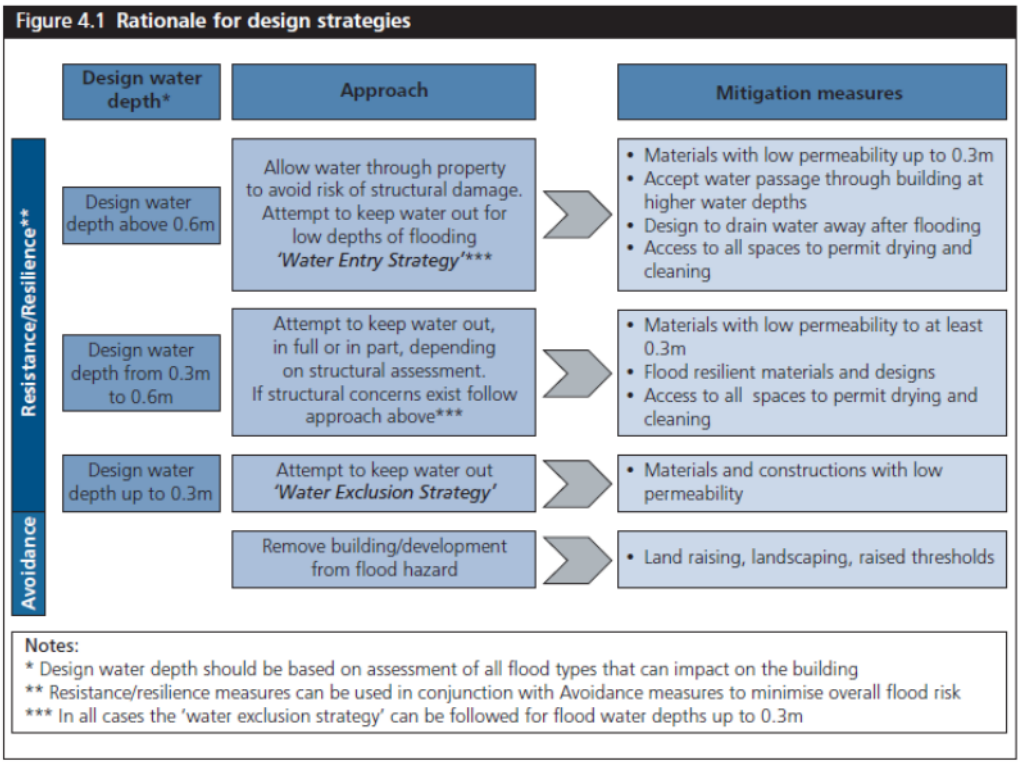
In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. In these cases, the Environment Agency and/or Braintree DC should be approached to discuss options for a reduction in the minimum internal ground floor levels provided flood resistance measures are implemented up to an agreed level. There are also circumstances where flood resilience measures should be considered first. These are described further below. For both Less and More Vulnerable developments where internal access to higher floors is required, the associated plans showing the access routes and floor levels should be included within any site-specific FRA.

5.6 Flood Resistance 'Water Exclusion Strategy'

There are a range of flood resistance and resilience construction techniques that can be implemented in new developments to mitigate potential flood damage. The Department for Communities and Local Government (CLG) have published a document 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[39], the aim of which is to provide guidance to developers and designers on how to improve the resistance and resilience of new properties to flooding through the use of suitable materials and construction details. Figure 5-2 provides a summary of the Water Exclusion Strategy (flood resistance measures) and Water Entry Strategy (flood resilience measures) which can be adopted depending on the depth of floodwater that could be experienced.

[39] CLG (2007) *Improving the Flood Performance of New Buildings, Flood Resilient Construction*

Figure 5-2 Flood Resistant/Resilient Design Strategies, Improving Flood Performance, CLG 2007



Resistance measures are aimed at preventing water ingress into a building (Water Exclusion Strategy); they are designed to minimise the impact of floodwaters directly affecting buildings and to give occupants more time to relocate ground floor contents. These measures will probably only be effective for short duration, low depth flooding, i.e. less than 0.3m, although these measures should be adopted where depths are between 0.3m and 0.6m and there are no structural concerns.

Policy Recommendation 5: In areas at risk of flooding of low depths (<0.3m), the following flood resistance measures could be considered:

- Using materials and construction with low permeability.
- Land raising.
- Landscaping e.g. creation of low earth bunds (subject to this not increasing flood risk to neighbouring properties).
- Raising thresholds and finished floor levels e.g. porches with higher thresholds than main entrance.

Property flood protection devices are available on the market, designed specifically to resist the passage of floodwater (Figure 5-3 and Figure 5-4). These include removable flood barriers and gates designed to fit openings, vent covers and stoppers designed to fit WCs. These measures can be appropriate for preventing water entry associated with fluvial flooding as well as surface water and sewer flooding. The efficacy of such devices relies on their being deployed before a flood event occurs. It should also be borne in mind that devices such as air vent covers, if left in place by occupants as a precautionary measure, may compromise safe ventilation of the building in accordance with Building Regulations.

Figure 5-3 Examples of flood barriers, air bricks and on-return valves

Figure 5-4 Example of flood gates

5.7 Flood Resilience 'Water Entry Strategy'

For flood depths greater than 0.6m, it is likely that structural damage could occur in traditional masonry construction due to excessive water pressures. In these circumstances, the strategy should be to allow water into the building, but to implement careful design in order to minimise damage and allow rapid re-occupancy. This is referred to as the Water Entry Strategy. These measures are appropriate for uses where temporary disruption is acceptable and suitable flood warning is received.

Materials should be used which allow the passage of water whilst retaining their structural integrity and they should also have good drying and cleaning properties. Alternatively sacrificial materials can be included for internal and external finishes; for example the use of gypsum plasterboard which can be removed and replaced following a flood event. Flood resilient fittings should be used to at least 0.1m above the design flood level. Resilience measures are either an integral part of the building fabric or are features inside a building that will limit the damage caused by floodwaters.

Policy Recommendation 6: In areas at risk of frequent or prolonged flooding, the following flood resilience measures could be implemented:

- Use materials with either, good drying and cleaning properties, or, sacrificial materials that can easily be replaced post-flood.
- Design for water to drain away after flooding.
- Design access to all spaces to permit drying and cleaning.
- Raise the level of electrical wiring, appliances and utility metres.
- Coat walls with internal cement based renders; apply tanking on the inside of all internal walls.
- Ground supported floors with concrete slabs coated with impermeable membrane.
- Tank basements, cellars or ground floors with water resistant membranes.
- Use plastic water resistant internal doors.

Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[40].

5.8 Structures

Structures such as (bus, bike) shelters, park benches and refuse bins (and associated storage areas) located in areas with a high flood risk should be flood resilient and be firmly attached to the ground and designed in such a way as to prevent entrainment of debris which in turn could increase flood risk and/or breakaway posing a danger to life during high flows.

5.9 Safe Access and Egress

Safe access and egress is required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out any necessary duties during periods of flood.

A safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g. within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances. This is of particular importance when contemplating development on sites located on dry islands.

Guidance prepared by the Environment Agency[41] uses a calculation of flood hazard to determine safety in relation to flood risk. Flood hazard is a function of the flood depth and flow velocity at a particular point in the floodplain along with a suitable debris factor to account for the hazard posed by any material entrained by the floodwater. The derivation of flood hazard is based on the methodology in Flood Risks to People FD2320, the use of which for the purpose of planning and development control is clarified in the abovementioned publication.

Figure 5-5 Hazard to People Rating (HR=d x (v +0.5) + DF) (Table 13.1 FD2320/TR2)

Flood Hazard	Hazard Rating	Description
Low	Less than 0.75	Very low hazard – Caution
Moderate	0.75 to 1.25	Dangerous for some – includes children, the elderly and the infirm
Significant	1.25 to 2.0	Dangerous for most – includes the general public
Extreme	More than 2.0	Dangerous for all – includes the emergency services

Policy Recommendation 7: For developments located in areas at risk of fluvial flooding, safe access / egress must be provided for new development as follows in order of preference:

- Safe dry route for people and vehicles.
- Safe dry route for people.
- If a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause risk to people.
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles. However the public should not drive vehicles in floodwater.

In all these cases, a 'dry' access/egress is a route located above the 1% annual probability flood level (1 in 100 year) including an allowance for climate change.
Where a site may be affected by flooding from tidal influences (e.g. associated with the downstream extent of the River Blackwater), dry access is a route located above the 0.1% annual probability flood level (1 in 1000 year) including an allowance for climate change.

[40] CLG (2007) Improving the Flood Performance of New Buildings, Flood Resilient Construction. http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf?bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=flood_performance.pdf

[41] Environment Agency (2008) Supplementary note on Flood hazard ratings and thresholds for development planning and control purpose. Clarification of Table 13.1 FD2320/TR2 and Figure 3.2 FD2321/TR1. http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2321_7400_PR_pdf.sflb.ashx

5.12 Safe Refuge

In exceptional circumstances, dry access above the 1% AEP (1 in 100 year) fluvial flood level including climate change (or 0.1% AEP tidal flood level including climate change) may not be achievable. In these circumstances the Environment Agency and Braintree DC should be consulted to ensure that the safety of the site occupants can be satisfactorily managed. This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed egress route. For example, this may entail the designation of a safe place of refuge on an upper floor of a building, from which the occupants can be rescued by emergency services. It should be noted that sole reliance on a safe place of refuge is a last resort, and all other possible means to evacuate the site should be considered first. Provision of a safe place of refuge will not guarantee that an application will be granted. In areas impacted by tidal flooding, safe refuge is defined above the 0.1% annual probability tidal flood level, including an allowance for climate change over the lifetime of the development.

5.13 Car Parks

Where car parks are specified as areas for the temporary storage of surface water and fluvial floodwaters, flood depths should not exceed 300mm given that vehicles may be moved by water of greater depths. Where greater depths are expected, car parks should be designed to prevent the vehicles from floating out of the car park. Signs should be in place to notify drivers of the susceptibility of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary.

5.14 Flood Routing

Policy Recommendation 8: All new development in Flood Zones 2 and 3 should not adversely affect flood routing and thereby increase flood risk elsewhere. Opportunities should be sought within the site design to make space for water, such as:

- Removing boundary walls or replacing with other boundary treatments such as hedges, fences (with gaps).
- Considering alternatives to solid wooden gates, or ensuring that there is a gap beneath the gates to allow the passage of floodwater.
- On uneven or sloping sites, consider lowering ground levels to extend the floodplain without creating ponds. The area of lowered ground must remain connected to the floodplain to allow water to flow back to river when levels recede.
- Create under-croft car parks or consider reducing ground floor footprint and creating an open area under the building to allow flood water storage.

Where proposals entail floodable garages or outbuildings, consider designing a proportion of the external walls to be

In order to demonstrate that 'flood risk is not increased elsewhere', development in the floodplain will need to prove that flood routing is not adversely affected by the development, for example giving rise to backwater affects or diverting floodwaters onto other properties.

Potential overland flow paths should be determined and appropriate solutions proposed to minimise the impact of the development, for example by configuring road and building layouts to preserve existing flow paths and improve flood routing, whilst ensuring that flows are not diverted towards other properties elsewhere.

Careful consideration should be given to the use of fences and landscaping walls so as to prevent causing obstruction to flow routes and increasing the risk of flooding to the site or neighbouring areas.

5.15 Flood Warning and Evacuation Plans

Evacuation is where flood alerts and warnings provided by the Environment Agency enable timely actions by residents or occupants to allow evacuation to take place unaided, i.e. without the deployment of trained personnel to help people from their homes, businesses and other premises. Rescue by the emergency services is likely to be required where flooding has occurred and prior evacuation has not been possible.

Policy Recommendation 9: For all developments (excluding minor developments and change of use) proposed in Flood Zone 2 or 3, a Flood Warning and Evacuation Plan should be prepared to demonstrate what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate their development will not impact on the ability of the local authority and the emergency services to safeguard the current population.

The Environment Agency has a tool on their website to create a Personal Flood Plan[1]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details. Where proposed development comprises non-residential extension <250m^2 and householder development (minor development), it is recommended that the use of this tool to create a Personal Flood Plan will be appropriate.

Flood Warning and Evacuation Plans should include:

How flood warning is to be provided, such as:

- availability of existing flood warning systems (refer Table 3-5);
- where available, rate of onset of flooding and available flood warning time; and
- how flood warning is given.

What will be done to protect the development and contents, such as:

- How easily damaged items (including parked cars) or valuable items (important documents) will be relocated;
- How services can be switched off (gas, electricity, water supplies);
- The use of flood protection products (e.g. flood boards, airbrick covers);
- The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc.; and
- The time taken to respond to a flood warning.

Ensuring safe occupancy and access to and from the development, such as:

- Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate;
- Safe access route to and from the development;
- If necessary, the ability to maintain key services during an event;
- Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible; and
- Expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.)

There is no statutory requirement for the Environment Agency or the emergency services to approve evacuation plans. Braintree DC is accountable via planning condition or agreement to ensure that plans are suitable. This should be done in consultation with emergency planning staff.

6 Guidance for the Application of Sustainable Drainage Systems

6.1 What are Sustainable Drainage Systems?

Policy Recommendation 10: Suitable surface water management measures should be incorporated into new development designs in order to reduce and manage surface water flood risk to, and posed by the proposed development. This should be achieved by incorporating Sustainable Drainage Systems (SuDS).

Sustainable Drainage Systems (SuDS) are surface water drainage solutions designed to manage surface water runoff and mitigate the adverse effects of urban storm water runoff by reducing flood risk and controlling pollution[42]. SuDS techniques allow surface water runoff from development to be controlled in ways that imitate natural drainage by controlling the rate of discharge to a receiving watercourse. SuDS may also provide valuable habitat and amenity value when carefully planned for in development.

The SuDS Manual[43] identifies four processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities for storm water control, flood risk management, water conservation and groundwater recharge:

A. **Infiltration:** the soaking of water into the ground. This is the most desirable solution as it mimics the natural hydrological process. The rate of infiltration will vary with soil type and condition, the antecedent conditions and with time. The process can be used to recharge groundwater sources and feed baseflows of local watercourses, but where groundwater sources are vulnerable or there is risk of contamination, infiltration techniques are not suitable.

   The use of traditional infiltration techniques that infiltrate to the ground is dependent on the underlying ground conditions. However, it is also possible to use shallow infiltration techniques in combination with storage techniques on sites which have impermeable geology, and therefore these techniques should not be overlooked. Guidance on Essex CC's position on the use of deep infiltration systems is provided in Section 6.2.

B. **Detention/Attenuation:** the slowing down of surface flows before their transfer downstream, usually achieved by creating a storage volume and a constrained outlet. In general, though the storage will enable a reduction in the peak rate of runoff, the total volume will remain the same, just occurring over a longer duration.

   Detention measures are not constrained by geology, though in areas of permeable geology, there will also be a degree of infiltration of runoff taking place.

C. **Conveyance:** the transfer of surface runoff from one place to another, e.g. through open channels, pipes and trenches.

D. **Water Harvesting:** the direct capture and use of runoff on site, e.g. for domestic use (flushing toilets) or irrigation of urban landscapes. The ability of these systems to perform a flood risk management function will be dependent on their scale, and whether there will be a suitable amount of storage always available in the event of a flood.

As part of any SuDS scheme, consideration should be given to the long-term maintenance of the SuDS to ensure that it remains functional for the lifetime of the development. Table 6-1 has been reproduced from the SuDS Manual, CIRIA C697 and outlines typical SuDS techniques.

[42] Defra, Environment Agency (March 2015) Cost Estimation for SuDS – Summary of Evidence
[43] CIRIA C697 (2015) SuDS Manual http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

Table 6-1 Typical SuDS Components (Y; primary process. * some opportunities, subject to design)

Technique	Description	Conveyance	Detention	Infiltration	Harvesting
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.		Y	Y	*
Filter Drains	Linear drains/trenches filled with a permeable material, often with perforated pipe in the base of the trench. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site.	Y	Y		
Filter Strips	Vegetated strips of gently sloping ground designed to drain water evenly from impermeable areas and filter out silt and particulates.	*	*	*	
Swales	Shallow vegetated channels that conduct and/or retain water, and can permit infiltration when unlined.	Y	Y	*	
Ponds	Depressions used for storing and treating water.		Y	*	Y
Wetlands	As ponds, but the runoff flows slowly but continuously through aquatic vegetation that attenuates and filters the flow. Shallower than ponds. Based on geology these measures can also incorporate some degree of infiltration.	*	Y	*	Y
Detention Basin	Dry depressions designed to store water for a specified retention time.		Y		
Soakaways	Sub-surface structures that store and dispose of water via infiltration.			Y	
Infiltration Trenches	As filter drains, but allowing infiltration through trench base and sides.	*	Y	Y	
Infiltration Basins	Depressions that store and dispose of water via infiltration.		Y	Y	
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation. It is noted that the use of brown/green roofs should be for betterment purposes and not to be counted towards the provision of on-site storage for surface water. This is because the hydraulic performance during extreme events is similar to a standard roof (CIRIA C697).		Y		
Rainwater Harvesting	Storage and use of rainwater for non-potable uses within a building, e.g. toilet flushing. It is noted that storage in these types of systems is not usually considered to count towards the provision of on-site storage for surface water balancing because, given the sporadic nature of the use of harvested water, it cannot be guaranteed that the tanks are available to provide sufficient attenuation for the storm event.	*	*	*	Y

The application of SuDS is not limited to a single technique per site. Often a successful SuDS solution will utilise a combination of techniques, providing flood risk, pollution and landscape/wildlife benefits. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS. It should be noted, each development site must offset its own increase in runoff and attenuation cannot be "traded" between developments.

Other measures may also be required in relation to water and sewerage infrastructure that might include pipes and below ground storage required as part of a wider strategic scheme, to deal with surface water flood risk. Options may include:

- Increasing capacity in drainage systems;
- Separation of foul and surface water sewers;
- Improved drainage maintenance regimes; and,
- Managing overland flows.

6.2 Management Train

The concept used in the development of drainage systems is the surface water 'management train'[44] whereby different techniques can be used in series to change the flow and quality characteristics of runoff in stages that attempt to mimic natural drainage. The hierarchy of techniques that should be considered in developing the management train are[49]:

1. **Prevention –** the use of good site design and site housekeeping measures to prevent runoff and pollution (e.g. sweeping to remove surface dust and detritus from car parks), and rain water reuse/harvesting. Prevention policies should generally be included within the site management plan.
2. **Source controls –** control of runoff at or very near its source (e.g. soakaways, other infiltration methods, green roods, pervious pavements).
3. **Site controls –** management of water in a local area or site (e.g. routing water from building roofs and car parks to a large soakaway, infiltration or detention basin.)
4. **Regional controls –** management of runoff from a site or several sites, typically in a balancing pond or wetland.

Generally the aim should be to discharge surface water run-off as high up the following hierarchy of drainage options as reasonably practicable:

- Into the ground (shallow infiltration)
- To a surface water body
- To a surface water sewer, highway drain, or another drainage system
- To a combined sewer

Where possible, stormwater should be managed in small, cost-effective landscape features located within small sub-catchments rather than being conveyed to and managed in large systems at the bottom of drainage areas. The techniques that are higher in the hierarchy are preferred to those further down so that prevention and control of water at the source should always be considered before site or regional controls. However, where upstream control opportunities are restricted, a number of lower hierarchy options should be used in series. Water should only be conveyed elsewhere if it cannot be dealt with at the site[49].

The passage of water between stages of the management train should be considered through the use of natural conveyance systems (e.g. swales and filter trenches) wherever possible. Pipework and sub-surface proprietary produce may still be required, especially where space is limited. Pre-treatment (i.e. the removal of silt and sediment loads) and maintenance is vital to ensure the long-term effectiveness of SuDS. Overland flow routes will also be required to convey and control floodwaters safely and effectively during extreme flood events. Generally, the greater the number of techniques used in a series the better the performance is likely to be and the lower the risk of overall system failure.

SuDS can be applied in all development situations, although individual site constraints may limit the potential of some sites achieving full benefits for all functions. The variety of SuDS available allows planners and designers to make full potential of the local land and consider the needs of local people when implementing the drainage design. The wishes of all the relevant stakeholders needs to be balanced in additional to the risk associated with each design option.

Essex CC Position on SuDS

It should be noted that Essex CC will only adopt permeable paving if it is designed to carry pedestrian traffic where there is no adjacent carriageway or where any adjoining carriageway has a speed limit of 30mph or less, which are not a bus route and are anticipated to carry fewer than 1,000 vehicles per day.

Additionally, Essex CC shall only be adopted if appropriate cover is provided with a downstream and upstream inspection chamber and the attenuation system is located within a non-trafficked area within the highway verge or open space

Furthermore, with regard to ponds and wetlands, adoption will occur up to the outfall headwall to the pond or wetland. The pond or wetland area will not be adopted by Essex CC. The Developer may consider asking the district or parish council to adopt this area if it is within an area which is or which will become public open space. Essex CC will consider adoption of any communicating pipe work from the pond/wetland outflow to the sewerage undertakers' demarcation chamber or final outfall upon site specific consideration.

[44] ttp://www.ciria.org.uk/suds/suds_management_train.htm

Finally, any drainage elements proposed for adoption which utilise infiltration will normally only be adopted if infiltration is greater than $1x10^{-5}$m/s, demonstrated through appropriate ground investigation.

Other Highway requirements

The Developer must comply with any other requirement of the local highway authority for the adoption of highways. The local highway authority may require the payment of commuted sums for the adoption of any drainage feature.

6.3 SuDS Costs

6.3.1 Whole Life Costs

Identifying whole life costs associated with SuDS is a complex process, and involves consideration of the following: Procurement and design costs; Capital construction costs; Operation and maintenance costs; Monitoring costs; and Replacement or decommissioning costs. If the incorporation of SuDS is considered early in the design, as part of the wider landscaping and site planning phase, there is greater potential to manage the costs of SuDS effectively.

Information on typical capital costs and maintenance costs are provided below. For further detail, and information on the other associated costs noted above, reference can be made to industry guidance such as the Defra and Environment Agency publication 'Cost Estimation for SuDS- Summary of Evidence' (Defra Environment Agency, March 2015).

6.3.2 Capital Costs

Defra and the Environment Agency have prepared a document containing unit costs for particular SuDS components based on a number of industry references. These have been compiled in Table 6-1. It is noted that these costs are based on actual costs from a number of projects from within the UK and from a wider literature review. If used for cost estimating purposes these costs should be increased to allow for inflation to present day values.

It should be noted that these costs are provided as an indicative cost for each type of SuDS. Whilst they provide a range of costs for each type and a relative assessment between SuDS features, the costs associated with any specific site will depend on a number of factors as follows:

- Scale and size of development;
- Hydraulic design criteria (design event, volume of storage required and impermeable catchment area);
- Inlet/outlet infrastructure design (volume and velocity of anticipated flows and the capacity of drainage system beyond site boundary);
- Water quality design criteria;
- Soil types (permeability and depth of water table), porosity and load bearing capacity;
- Materials availability;
- Density of planting;
- Specific Utilities requirements;
- Proximity to receiving watercourse;
- Amenity / public education / safety requirements

Table 6-2 Indicative costs for SuDS options (Defra, Environment Agency 2015)

Option	Unit cost	Source
Green roofs	£90/m^2 - covered roof with sedum mat £80/m^2 - biodiverse roof (varied covering of plants, growing medium and aggregates) Variable costs for Sedum blanket , turf and growing medium roof options	Bamfield, 2005. Bamfield, 2005. Rawlinson, 2006
Simple rainwater harvesting (water butts)	£100 - £243 per property (includes installation and connection pipe)	Stovin & Swan 2007
Advanced rainwater harvesting	£2,100 - £2,400 per residential property £2,500 - £6,000 per residential property £2,600 - £3,700 per residential property £6,300 - £21,000 per commercial / industrial property £45 per m^2 for residential properties £9 per m^2 for non-residential properties	Woking BC EA, 2007 RainCycle, 2005 RainCycle, 2005 EA, 2007 EA, 2007
Greywater re-use	£1,900 - £3,500 per residential property £3,000 per property	Woking BC EA, 2007
Permeable paving	£30-£40 per m^2 of permeable surface £27 per m^2 of replacement surface £54 per m^2	CIRIA, 2007 Stovin & Swan 2007 EA, 2007
Filter drain / perforated pipes	£100 - £140 per m^3 stored volume £61 per m £120 per m^2	CIRIA, 2007 Stovin & Swan 2007 EA, 2007
Swales	£10-£15 per m^2 swale area £18-£20 per m length using an excavator £12.5 per m^2	CIRIA, 2007 Stovin & Swan 2007 EA, 2007
Infiltration basin	£10-£15 per m^3 stored volume	CIRIA, 2007
Soakaways	>£100 per m^3 stored volume £454 -£552 per soakaway	CIRIA, 2007 Stovin & Swan 2007
Infiltration trench	£55-£65 per m^3 stored volume £74-£99 per m length £60 per m^2	CIRIA, 2007 Stovin & Swan 2007 EA, 2007
Filter strip	£2-£4 per m^2 filter strip area	CIRIA, 2007
Constructed wetland	£25-£30 per m^3 treated volume	CIRIA, 2007
Retention (wet) pond	£15-£25 per m^3 treated volume £80,000 per 5000m^3 pond (£16 per m3)	CIRIA, 2007 SNIFFER, 2007
Detention basin	£15-£20 per m^3 detention volume £35-£55 per m^3 stored volume £18 per m^3	CIRIA, 2007 Stovin & Swan 2007 SNIFFER, 2007
Onsite attenuation and storage	£449-£518 per m^3 for reinforced concrete storage tank. No data available for oversized pipes	Stovin & Swan 2007

6.3.3 Operation and Maintenance Costs

As with any other flood risk management structure, SuDS require ongoing maintenance to ensure the system remains in good working order and the design life of the system is extended as long as possible. Operation and maintenance activities will include the following:

- Monitoring and post-construction inspection;
- Regular, planned maintenance (annual or more frequent); and,
- Intermittent, refurbishment, repair/remedial maintenance;

Additional costs may include the allocation of resources and materials as a result of maintenance activities.

The long-term maintenance costs associated with SuDS are relatively unknown as they are usually absorbed by operators responsible for maintaining the infrastructure as part of their wider asset base.

Whilst the construction of SuDS (e.g. storage ponds) and wetlands are relatively straightforward to calculate, however, maintenance costs are slightly more difficult to estimate due to the lack of information regarding who is responsible for this ongoing maintenance. The key factors that will influence maintenance costs include:

- Type and frequency of maintenance required (e.g. sediment removal, inlet/outlet maintenance, landscaping, and litter removal).
- The costs of maintenance (materials, labour and equipment costs);
- The availability and source of materials and disposal costs; and,
- The responsibility for maintenance (e.g. LA, highways agency, residents, developer).

Table 6-3 outlines some generic SuDS costs based on review of literature and some UK case studies undertaken by HR Wallingford (2004).

Table 6-3 Indicative annual maintenance costs for key SuDS options[45]

Option	Annual Maintenance costs	
Green roofs	£2,500/yr. for first 2 years for covered rood with sedum mat, £600/yr. after. £1,250/yr. for first 2 years for covered rood with biodiverse roof, £150/yr. after.	Bamfield (2005) Bamfield (2005)
Simple rainwater harvesting (water butts)	Negligible	
Advanced rainwater harvesting	£250 per year per property for external maintenance contract	RainCycle
Permeable paving	£0.5 - £1/m^3 storage volume	HR Wallingford, 2004
Filter drain/perforated pipes	£0.2 - £0.1/m^2 of filter surface area	HR Wallingford, 2004
Swales	£0.1/m^2 of swale surface area £350/yr.	HR Wallingford, 2004 Ellis, 2003
Infiltration basin	£0.1 - £0.3/m^2 of detention basin area £0.25 - £1/m^3 of detention volume	HR Wallingford, 2004
Soakaways	£0.1/m^2 of treated area	HR Wallingford, 2004
Infiltration trench	£0.2 - £1/m^2 of filter surface area	HR Wallingford, 2004
Filter strip	£0.1/m^2 of filter surface area	HR Wallingford, 2004
Constructed wetland	£0.1/m^2 of wetland surface area. Annual maintenance of £200-250/yr. for first 5 years (declining to £80 - £100/yr. after 3 year)	HR Wallingford, 2004 Ellis, 2003
Retention (wet) pond	£0.5 - £1.5/m^2 of retention pond surface area £0.1 - £2/m^3 of pond volume	HR Wallingford, 2004 HR Wallingford, 2004 Ellis, 2003
Detention basin	£0.1 - £0.3/m^2 of detention basin area £0.25 - £1/m^3 of detention volume £250-£1000 per basin	HR Wallingford, 2004 HR Wallingford, 2004 Ellis, 2003

6.4 SuDS Specific to Braintree

6.4.1 Geology

The solid geology of the Braintree District can be separated into three main types:

- The northern section of the District is underlain by the Upper Chalk Formation.
- A thin section through the centre of the District extending from Sudbury in the east heading southwest to Castle and Sible Hedingham in the centre of the District and Finchingfield in the east is underlain by the Lower London Tertiaries (Lambeth Group and Thanet Sands).
- The southern area of the District is underlain by the London Clay Formation. Occasional pockets of Crag are located overlying the Chalk within the northern area of the site and one large pocket to the south of Wethersfield.

Drift deposits overlying the solid geology consist mainly of the Lowestoft Formation, which comprises Glaciofluvial Deposits, Till and Glaciolacustrine Deposits. In areas around large river channels outcrops of Kesgrave sands and

[45] Defra, Environment Agency (March 2015) Cost Estimation for SuDS – Summary of Evidence.

gravels, River Terrace Deposits, Head Deposits alluvium are located and in some areas the underlying solid formation has been exposed.

Drift deposits overlying the solid geology consist mainly of the Lowestoft Formation, which comprises Glaciofluvial Deposits, Till and Glaciolacustrine Deposits. In areas around large river channels outcrops of Kesgrave sands and gravels, River Terrace Deposits, Head Deposits alluvium are located and in some areas the underlying solid formation has been exposed.

Table 6-4 highlights the main solid and drift geology deposits with an indication of potential corresponding appropriate SuDS. Specific geological conditions at individual sites should be ascertained from geological maps and where relevant, during more detailed stages of design, verified as part of a site investigation.

It is important to note that various geological formations have variable permeability, which can mean that the particular formation may consist of differing geological deposits. For example, the alluvial deposits of a particular river may consist of widespread sands and gravels characterised by a high permeability, whilst more isolated pockets may exist where the alluvial deposits consist of clay and silts, with a low permeability.

Furthermore, the Upper Chalk Formation located throughout the northern section of the District could potentially form an ideal receptor of surface water generated on an overlying site. However, in many circumstances the solid geology is not exposed at or near ground level and is overlain by drift deposits, which can be in excess of 200 metres. Under these circumstances the presence of the drift deposits could negate the practicality of infiltration techniques.

Table 6-4 Major solid geological deposits found throughout the district

Drift Deposit	Permeability	General Characteristics	Locations	Potential appropriate SuDS techniques
Alluvium	Variably Permeable	Generally clay with some gravel sand and silt	Found within river valleys and tributaries of the River Glem, Stour, Colne, Pant, Brain and Ter and Bourne Brook and Pods Brook	Infiltration and combined infiltration/attenuation systems and attenuation systems e.g. permeable surfaces, sub surface infiltration, basins and ponds, swales and filter strips i.e. a combined system
River Terrace Deposits	Variably Permeable	Sandy gravel, clayey in places local veneer of clayey silt	Found within river valleys and tributaries of the River Glem, Stour, Colne, Pant, Brain and Ter and Bourne Brook and Pods Brook	Infiltration and combined infiltration/attenuation systems and attenuation systems e.g. permeable surfaces, sub surface infiltration, basins and ponds, swales and filter strips i.e. a combined system
Kesgrave Formation	Generally Permeable (dependant fines content)	Sands and sandy gravels with less than 10% clay and silt	Found within river valleys and tributaries of the River Glem, Stour, Colne, Pant, Brain and Ter and Bourne Brook and Pods Brook	Infiltration systems e.g. permeable surfaces, sub surface infiltration, swales and filter strips.
Lowestoft Formation	Variably Permeable	The Lowestoft Formation consists of Glacial deposits comprising Till, Glaciofluvial Deposits and Glaciolacustrine Deposits. Till deposit: sandy clay with chalk fragments (formerly known as Boulder Clay) Glaciolacustrine Deposits: calcareous silt which is found finely interbedded with the Glaciofluvial Deposits which occur below within and above the Till deposits. The Glaciofluvial Deposits consist of gravelly clayey sand with interbeds of clayey sand and silt.	This is the main superficial deposit found throughout the District. Thicknesses of the deposit vary greatly. Within buried valleys it is considered that the formation could potentially extend up to 300m in thickness and within certain areas of current river channels the deposits have been eroded away to expose the soil geology	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc. are likely to be the most suitable techniques. Infiltration systems may be appropriate within more the deposits characterised by sands and gravels.

Head Deposits	Impermeable	Silty or sandy clay	Found within river valleys and tributaries of the River Glem, Stour, Colne, Pant, Brain and Ter and Bourne Brook and Pods Brook	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc.
Peat	Generally impermeable	Brown/ black organic rich clay	Limited isolated pockets associated with the upper reaches of water courses	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc.
The Crags	Variably Permeable	Includes: Mainly fine grained buff to brown, locally shelly, micaceous sands, with local rounded flint gravels	Outcrops are generally located in the northern part of the District overlying the Chalk. A large outcrop is located to the south of the band of The Lower London Tertiaries to the south of Wethersfield.	Infiltration and combined infiltration/attenuation systems and attenuation systems e.g. permeable surfaces, sub surface infiltration, basins and ponds, swales and filter strips i.e. a combined system
The Lower London Tertiaries	Variably Permeable	Comprises the Woolwich and Reading Formation and Thanet Sand Formation. The Woolwich and Reading Formation consists mottled clays sands silts whilst the Thanet Formation comprises silty sands.	The Lower London Tertiaries are located in a band extending from Sudbury in the east heading southwest to Castle and Sible Hedingham in the centre of the District and Finchingfield in the east	Infiltration and combined infiltration/attenuation systems and attenuation systems e.g. permeable surfaces, sub surface infiltration, basins and ponds, swales and filter strips i.e. a combined system
Chalk	Generally permeable (Heavily weathered material can be impermeable)	White and grey chalk, nodular and soft with flint seams in upper part and localised marl bands	Chalk deposits are located within the northern area of the District	Infiltration and combined infiltration/attenuation systems and attenuation systems e.g. permeable surfaces, sub surface infiltration, basins and ponds, swales and filter strips i.e. a combined system
London Clay Formation	Impermeable	Clay, Orange brown becoming blue grey with depth, variably silty with thin sand and rare pebble beds. Some siltstone nodules and bands and Selonite Crystals, occasional shell fragments.	The London Clay Formation is located within the southern area of the District	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc.

6.5 What is the role of the Essex County Council?

Essex County Council is a statutory consultee for surface water drainage as part of their role as LLFAs. From 6th April 2015, all major development should include provision for SuDS and a Sustainable Drainage Strategy will need to be completed and signed by a competent drainage engineer to verify that the proposals conform to the Government's 'Sustainable Drainage Systems: Non-Statutory Technical Standards[46].

The following sections provide an overview of the Technical Standards and items which applicants should include when preparing a Sustainable Drainage Strategy for submission to Essex CC. Further information and guidance is available on the Essex CC website:

http://www.essex.gov.uk/Environment%20Planning/Environment/local-environment/flooding/View-It/Documents/suds_design_guide.pdf?bcsi_scan_ab11caa0e2721250=qo+J8x5MW86pTS9jYKOBFwiIMV8pAAAAmeovPQ==&bcsi_scan_filename=suds_design_guide.pdf

6.5.1 What are the Technical Standards?

A set of non-statutory Technical Standards have been published, to be used in conjunction with supporting guidance in the PPG, which set the requirements for the design, construction, maintenance and operation of sustainable drainage systems (SuDS). The Technical Standards that are of chief concern in relation to the consideration of flood risk to and from development relating to peak flow control and volume control are presented below:

Peak flow control

S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

Volume control

S4 Where reasonably practicable, for Greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the Greenfield runoff volume for the same event.

S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Flood risk within the development

S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.

S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

[46] Sustainable drainage systems: non-statutory technical standards - https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards

All major[1] developments and other development should not result in an increase in surface water runoff, and where possible, should demonstrate betterment in terms of rate and volumes of surface water runoff.

Sustainable Drainage Systems (SuDS) should be used to reduce and manage surface water run-off to and from proposed developments as near to source as possible in accordance with the requirements of the Technical Standards and supporting guidance published by DCLG and Department for the Environment, Food and Rural Affairs (Defra)[1].

6.5.2 What should a Sustainable Drainage Strategy include?

There will be some variation between LLFAs regarding specific requirements for preparing a Sustainable Drainage Strategy, and at the time of writing, requirements are still being developed. The following provides an indication of the type of information that would be required as part of a Sustainable Drainage Strategy:

- A plan of the existing site.
- A topographical level survey of the area to metres Above Ordnance Datum (mAOD).
- Demonstration of a clear understanding of how surface water flows across the site and surrounding area. This could use the topographic survey and the information presented on the 'Flood Map for Surface Water' on the Environment Agency website.
- Plans and drawings of the proposed site layout identifying the footprint of the area being drained (including all buildings, access roads and car parks).
- Calculations of:
    - Changes in permeable and impermeable coverage across the site.
    - The existing and proposed controlled discharge rate for a 1 in 1 year event, 1 in 30 year and a 1 in 100 year event (with an allowance for climate change), which should be based on the estimated greenfield runoff rate.
    - Proposed storage volume (attenuation) including the water storage capacity of the proposed drainage features, with demonstration that they meet the requirements of the Technical Standards.
- Plans, drawings and specification of proposed SuDS measures. This should include detail of hard construction, soft landscaping and planting. A drainage design can incorporate a range of SuDS techniques.
- A design statement describing how the proposed measures manage surface water as close to its source as possible and follow the drainage hierarchy described in Section 6.2.
- Geological information including borehole logs, depth to water table and/or infiltration test results in accordance with BRE365.
- Details of overland flow routes for exceedance events.
- Details of any offsite works required, together with necessary consents (where relevant).
- A management plan for future maintenance and adoption of drainage system for the lifetime of the development.

Applicants are encouraged to discuss their proposals with Essex CC at the pre-application stage and in due course the Flood and Water Management Team at Essex CC will offer pre-application advice to developers on a chargeable basis. Once resources and charging schedules are in place to support this element of the services service stakeholders will be informed. Further updates on the charging schedule will be placed on the website in due course:

http://www.essex.gov.uk/Environment%20Planning/Environment/local-environment/flooding/View-It/Documents/suds_design_guide.pdf?bcsi_scan_ab11caa0e2721250=qo+J8x5MW86pTS9jYKOBFwiIMV8pAAAAmeovPQ==&bcsi_scan_filename=suds_design_guide.pdf

7 Guidance for preparing site-specific FRAs

7.1 What is a Flood Risk Assessment?

A site-specific FRA is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and where possible will reduce flood risk overall in accordance with paragraph 100 of the NPPF and PPG. An FRA must be prepared by a suitably qualified and experienced person and must contain all the information needed to allow Braintree DC to satisfy itself that the requirements have been met.

7.2 When is a Flood Risk Assessment required?

The NPPF states that a site-specific FRA is required in the following circumstances:

- 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).
- Proposals of 1 hectare or greater in Flood Zone 1.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.
- Sites under 1 ha, classified as major development will require the submission of a surface water drainage strategy.

7.3 How detailed should a FRA be?

The PPG states that site-specific FRAs should be proportionate to the degree of flood risk, the scale and nature of the development, its vulnerability classification (Table 4-2) and the status of the site in relation to the Sequential and Exception Tests. Site-specific FRAs should also make optimum use of readily available information, for example the mapping presented within this SFRA and available on the Environment Agency website, although in some cases additional modelling or detailed calculations will need to be undertaken. For example, where the development is an extension to an existing house (for which planning permission is required) which would not significantly increase the number of people present in an area at risk of flooding, Braintree DC would generally need a less detailed assessment to be able to reach an informed decision on the planning application. For a new development comprising a greater number of houses in a similar location, or one where the flood risk is greater Braintree DC may require a more detailed assessment, for example, the preparation of site-specific hydraulic modelling to determine the flood risk to and from the site pre and post-development, and the effectiveness of any management and mitigation measures incorporated within the design.

As a result, the scope of each site-specific FRA will vary considerably. Table 7-1 presents the different levels of site-specific FRA as defined in the CIRIA publication C624[47] and identifies typical sources of information that can be used. Sufficient information must be included to enable the Council and where appropriate, consultees, to determine that the proposal will be safe for its lifetime, not increase flood risk elsewhere and where possible, reduce flood risk overall. Failure to provide sufficient information will result in applications being refused.

[47] CIRIA (2004) Development and flood risk – guidance for the construction industry C624.

Table 7-1 Levels of Site-Specific Flood Risk Assessment

Description
Level 1 Screening study to identify whether there is any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information. The screening study will ascertain whether a FRA Level 2 or 3 is required. Typical sources of information include: • Strategic Flood Risk Assessment (SFRA) • Flood Map for Planning (Rivers and Sea) • Environment Agency Standing Advice • NPPF Tables 1, 2 and 3
Level 2 Scoping study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include: • An appraisal of the availability and adequacy of existing information; • A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; and • An appraisal of the scope of possible measures to reduce flood risk to acceptable levels. • The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development. Typical sources of information include those listed above, plus: • Local policy statements or guidance. • Catchment Flood Management Plan. • Essex County Council PFRA and LFRMS. • Data request from the Environment Agency to obtain result of existing hydraulic modelling studies relevant to the site and outputs such as maximum flood level, depth and velocity. • Consultation with Environment Agency/Essex CC/sewerage undertakers and other flood risk consultees to gain information and to identify in broad terms, what issues related to flood risk need to be considered including other sources of flooding. • Historic maps. • Interviews with local people and community groups. • Walkover survey to assess potential sources of flooding, likely routes for floodwaters, the key features on the site including flood defences, their condition. • Site survey to determine general ground levels across the site, levels of any formal or informal flood defences.
Level 3 Detailed study to be undertaken if a Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include: • Quantitative appraisal of the potential flood risk to the development; • Quantitative appraisal of the potential impact of the development site on flood risk elsewhere; and • Quantitative demonstration of the effectiveness of any proposed mitigations measures. Typical sources of information include those listed above, plus: • Detailed topographical survey. • Detailed hydrographic survey. • Site-specific hydrological and hydraulic modelling studies which should include the effects of the proposed development. • Monitoring to assist with model calibration/verification. • Continued consultation with the LPA, Environment Agency and other flood risk consultees.

7.3.1 Environment Agency Data Requests

The Environment Agency offers a series of 'products' for obtaining flood risk information suitable for informing the preparation of site-specific FRAs as described on their website https://www.gov.uk/planning-applications-assessing-flood-risk.

- Products 1 – 4 relate to mapped deliverables including flood level and flood depth information and the presence of flood defences local to the proposed development site;
- Product 5 contains the reports for hydraulic modelling of the Main Rivers;
- Product 6 contains the model output data so the applicant can interrogate the data to inform the FRA.
- Product 7 comprises the hydraulic model itself.

Products 1 – 6 can be used to inform a Level 2 FRA. In some cases, it may be appropriate to obtain Product 7 and to use as the basis for developing a site-specific model for a proposed development as part of a Level 3 FRA. This can be requested via either their National Customer Contact Centre via enquiries@environment-agency.gov.uk or the Essex, Norfolk and Suffolk Customers and Engagement Team via ensenquiries@environment-agency.gov.uk.

7.3.2 Modelling of Ordinary Watercourses

It should be noted that the scope of modelling studies undertaken by the Environment Agency typically cover flooding associated with Main Rivers, and therefore Ordinary Watercourses that form tributaries to the Main Rivers may not always be included in the model. Where a proposed development site is in close proximity to an Ordinary Watercourse and either no modelling exists, or the available modelling is considered to provide very conservative estimates of flood extents (due to the use of national generalised JFLOW modelling), applicants may need to prepare a simple hydraulic model to enable more accurate assessment of the probability of flooding associated with the watercourse and to inform the site-specific FRA. This should be carried out in line with industry standards and in agreement with the Environment Agency and Essex County Council (as the LLFA).

7.4 What needs to be addressed in a Flood Risk Assessment?

The PPG states that the objectives of a site-specific flood risk assessment are to establish:

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

7.5 Flood Risk Assessment Checklist

Appendix D provides a checklist for site-specific FRAs including the likely information that will need to be provided along with references to sources of relevant information. As described in Section 7.3, the exact level of detail required under each heading will vary according to the scale of development and the nature of the flood risk.

7.6 Pre-application Advice

At all stages, Braintree DC, and where necessary the Environment Agency, Essex CC and/or the Statutory Water Undertaker may need to be consulted to ensure the FRA provides the necessary information to fulfil the requirements for planning applications.

The Environment Agency, Essex CC and Braintree DC each offer pre-application advice services which should be used to discuss particular requirements for specific applications.

- **Braintree DC** offer free pre-application advice. Enquiries can be submitted by completing the Preliminary Enquiries Form available online at https://www.braintree.gov.uk/downloads/file/232/pre-app_form-application

- **Environment Agency** offers one free 'preliminary opinion' for development proposals. This will highlight the types of issues that the application should address. A request for a preliminary opinion can be made using the form at: https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion. Further detailed advice, including a review of an FRA, is offered as part of a charged for cost recovery service. Information on this is available at: https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals.

8 Flood Risk Management Policy Considerations

8.1 Overview

In order to encourage a holistic approach to flood risk management and ensure that flooding is taken into account at all stages of the planning process, this Section builds on the findings of the SFRA to set out key recommendations for consideration by Braintree DC in relation to flood risk planning policy and with respect to development management decisions on a day-to-day basis.

8.2 Policy Considerations

It is recommended that the following flood risk objectives are taken into account by Braintree DC during the policy making process. Guidance on how these objectives can be met throughout the development control process for individual development sites is included within Section 5.

8.2.1 Seeking Flood Risk Reduction through Spatial Planning and Site Design

- Use the Sequential Test to locate new development in areas of lowest risk, giving highest priority to areas within Flood Zone 1. Locating new development away from the most vulnerable flood risk areas would minimise the cost of installing and maintaining new flood defences and land drainage measures.
- Use the Sequential Test within development sites to inform site layout by locating the most vulnerable elements of a development in the lowest risk areas. For example, the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide an effective means of flood risk management as well as providing connected green spaces with consequent social and environmental benefits.
- Avoid development immediately downstream of flood storage reservoirs which will be at high hazard areas in the event of failure.
- Seek opportunities for new development to achieve reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features.
- Identify long-term opportunities to remove development from the floodplain through land swapping.
- Build resilience into a site's design (e.g. flood resistant or resilient design, raised floor levels).
- Ensure development is 'safe'. For residential developments to be classed as 'safe', dry pedestrian egress out of the floodplain and emergency vehicular access should be possible. Dry pedestrian access/egress should be possible for the 1 in 100 year return period event including an allowance for climate change associated with fluvial flooding. For areas affected by tidal flooding, dry access or safe refuge is defined as above the 0.1% AEP tidal flood level, including an allowance for climate change.

8.2.2 Reducing Surface Water Runoff from New Developments

- All sites require the following:
    - Use of SuDS (where possible use of strategic SuDS should be made).
    - Discharge rates should be restricted to Greenfield runoff rates.
    - 1 in 100 year attenuation of surface water, taking including an allowance for climate change.
- Space should be specifically set aside for SuDS and used to inform the overall layout of development sites.
- Surface water drainage proposals should have a clear plan for the long term maintenance and adoption of the systems, prior to approval of any planning permission in line with national planning policy.
- Large potential development areas with a number of new allocation sites will be required to develop a strategy for providing a joint SuDS scheme. This will need to be on an integrated and strategic scale and where necessary will require the collaboration of all developers involved in implementing a specific expansion area or site.

- Careful assessment of the potential impact of surface water drainage from new developments will be necessary in areas with constrained drainage networks, particularly those networks that are dependent upon sewers and culverted watercourses with limited capacity.
- Further work is necessary to understand the full extent of risk from surface water flooding in Braintree, including the preparation of Surface Water Management Plans.
- Reducing the potential impacts of sewer flooding may require the installation of Sustainable Drainage Systems in both new and existing developments. The risk of foul sewer flooding that result from the misconnection of surface water drainage to the foul sewer network could be addressed if opportunities to disconnect surface water from foul sewers are taken.
- Consideration may need to be given to further use of rural Sustainable Drainage Systems to reduce both the risk of flooding and the risk of rivers drying out (smoothing out the peaks and troughs of local rainfall).

8.2.3 Enhancing and Restoring the River Corridor

- An assessment of the condition of existing assets (e.g. bridges, culverts, river walls) should be made. Refurbishment and/or renewal of the asset should ensure that the design life is commensurate with the design life of the development. Developer contributions should be sought for this purpose.
- Those proposing development should look for opportunities to undertake river restoration and enhancement as part of a development to make space for water. Enhancement opportunities should be sought when renewing assets (e.g. de-culverting, the use of bio-engineered river walls, raising bridge soffits to take into account climate change).
- Avoid further culverting and building over culverts. Where practical, all new developments with culverts running through their site should seek to de-culvert rivers for flood risk management and conservation benefit. Any culverting or works affecting the flow of a watercourse requires the prior written consent of either the Environment Agency (for main rivers), or Essex CC (for ordinary watercourses) under the terms Environmental Permitting Regulations 2010 and Flood and Water Management Act 2010 respectively. These regulatory bodies seek to avoid culverting, and their consent for such works will not normally be granted except as a means of access.
- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip for development by all watercourses including those where the Flood Zone does not exist. Under the terms of the Water Resources Act 1991 and the Land Drainage Byelaws, the prior written consent of the Environment Agency or Essex CC is required for any proposed works or structures in, under, over or within 8m of a main river, or within 8m of ordinary watercourse asset or structure. This is to allow easy maintenance of the water course, and includes consent for fencing, planting and temporary structures.

8.2.4 Protecting and Promoting Areas for Future Flood Alleviation Schemes

- Protect Greenfield functional floodplain from future development (our greatest flood risk management asset) and reinstate areas of functional floodplain which have been developed (e.g. reduce building footprints or relocate to lower flood risk zones).
- Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

8.2.5 Improving Flood Resilience and Emergency Planning

Braintree's towns and villages are at greater surface water flood risk than the surrounding Districts in north Essex[48], particularly in Steeple Bumpstead, Little Yeldham, Sible Hedingham, Shalford, Braintree, Kelvedon, Finchingfield and Hatfield Peverel. This is due to the location of these settlements in the headwaters of the catchment where steeper slopes cause rapid runoff[49].

As previously identified in the Essex County Wise Prioritisation Methodology several settlements in the Braintree District constitute as the higher risk Tier 1 and Tier 2 flood risk classifications. This includes Braintree and Witham (Tier 1) and Halstead, Steeple Bumpstead, Castle Hedingham and Sible Hedingham (Tier 2). It is fundamental that the settlements in Tiers 1 and 2 apply a more stringent approach to surface water management, with developers directed to consult Essex CC as to whether a SWMP has been prepared.

[48] Environment Agency (2015) Risk of Flooding from Surface Water
[49] Essex County Council (2012) Essex Local Flood Risk Management Strategy

Due to this high level of flood risk affecting numerous properties it is recommended that funding is invested in flood mitigation infrastructures, especially those that reduce the risk of surface water flooding. Where funding is not viable for flood-related purposes it is necessary to consider flood resilience measures, including:

- Seek to improve the emergency planning process using the outputs from the SFRA.
- Encourage all those within existing Flood Zone 3a and 3b (residential and commercial occupiers) to sign up to Flood Warning Service operated by the Environment Agency.
- Ensure robust emergency (evacuation) plans are implemented for new developments.

8.3 Development Management Considerations

8.3.1 Flood Zone 3b Functional Floodplain

The Functional Floodplain has been defined within this SFRA. These areas should be safeguarded from development, with exemptions where development could reduce flood risk overall or improve floodplain storage.

Only Water Compatible developments are permitted in Flood Zone 3b, and Essential Infrastructure developments require the Exception Test (refer to Table 4-3). Where Water Compatible or Essential Infrastructure development cannot be located elsewhere, it must:

- Remain operational and safe for users in times of flood;
- Result in no net loss of flood storage;
- Not impede water flows; and
- Not increase flood risk elsewhere.

Proposals for the change of use or conversion to a use with a higher vulnerability classification should not be permitted. Basements, basements extensions, conversions of basements to a high vulnerability classification or self-contained units should not be permitted.

Where minor development is proposed, schemes should not affect floodplain storage or flow routes through the incorporation of the following mitigation measures in line with CIRIA guidance on SuDS:

- Raised finished floor levels;
- Voids and where possible;
- Direct or indirect floodplain compensation;
- Flood resilience measures;
- The removal of other non-floodable structures;
- Replacement of impermeable surfaces with permeable;
- Improved surface water drainage through the implementation of SuDS features such as water butts/rainwater harvesting;
- Living roofs;
- Infiltration trenches/soakaways; and
- Below ground attenuation tanks.

8.3.2 Flood Zone 3a High Probability

Flood Zone 3a High Probability comprises land having a 1% (1 in 100 year) annual probability or greater. Water Compatible and Less Vulnerable developments are permitted in Flood Zone 3a; Essential Infrastructure and More Vulnerable developments require the Exception Test and Highly Vulnerable development is not permitted in this flood zone (see Table 4-3). Where development is proposed opportunities should be sought to:

- Relocate existing development to land in zones with a lower probability of flooding;
- Reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques;

- Ensure it remains safe for users in times of flood; and
- Create space for flooding to occur by restoring natural floodplain and flood flow paths and by identifying, allocating and safeguarding open space for flood storage.

8.3.3 Flood Zone 2 Medium Probability

Flood Zone 2 Medium Probability comprises land having between a 1% (1 in 100 year) and 0.1% (1 in 1000) annual probability of flooding from fluvial watercourses. Water Compatible, Essential Infrastructure, Less Vulnerable and More Vulnerable developments are permitted in the Flood Zone 2 and Highly Vulnerable development requires the Exception Test (see Table 4-3). Where development is proposed in areas of Flood Zone 2, the planning policy approach is similar to Flood Zone 3a. Opportunities should be sought to:

- Relocate existing development to land in zones with a lower probability of flooding;
- Reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques;
- Ensure it remains safe for users in times of flood; and
- Create space for flooding to occur by restoring natural floodplain and flood flow paths and by identifying, allocating and safeguarding open space for flood storage.

8.3.4 Flood Zone 1 Low Probability

Flood Zone 1 Low Probability comprises land having a less than 0.1% (1 in 1000 year) annual probability of flooding from fluvial watercourses. All development vulnerability classifications are permitted in Flood Zone 1 (see Table 4-3). Where development over 1ha is proposed or there is evidence of flooding from another localised source in areas of Flood Zone 1, opportunities should be sought to:

- Ensure that the management of surface water runoff from the site is considered early in the site planning and design process;
- Ensure that proposals achieve an overall reduction in the level of flood risk to the surrounding area, through the appropriate application of sustainable drainage techniques.

8.3.5 Changes of Use

Where a development undergoes a change of use and the vulnerability classification of the development changes, there may be an increase in flood risk. For example, changing from industrial use to residential use will increase the vulnerability classification from Less to More Vulnerable (Table 4-2).

For change of use applications in Flood Zone 2 and 3, applicants must submit a FRA with their application. This should demonstrate how the flood risks to the development will be managed so that it remains safe through its lifetime including provision of safe access and egress and preparation of Flood Warning and Evacuation Plans where necessary. Further guidance will be provided within the Level 2 SFRA Report.

As changes of use are not subject to the Sequential or Exception Tests (unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site), Braintree DC could consider when formulating policy what changes of use will be acceptable, having regard to paragraph 157 (6th bullet) of the NPPF and taking into account the findings of this SFRA. This is likely to depend on whether developments can be designed to be safe and that there is safe access and egress.

8.4 Summary of Policy Recommendations

Policy Recommendation	Description
1	A sequential approach to site planning should be applied within new development sites.
2	Retain at least an 8 metre wide undeveloped buffer strip alongside Main Rivers and explore opportunities for riverside restoration. Any proposed development within 8m of a Main River watercourse will require an environmental permit from the Environment Agency. Retain a 3 metre buffer strip on at least one side of an Ordinary Watercourse. Any development that could impact the flow within an ordinary watercourse will require consent from Essex County Council (as LLFA).
3	All new development within Flood Zone 3 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.
4	All More Vulnerable and Highly Vulnerable development within Flood Zones 2 and 3 should set Finished Floor Levels 300mm above the known or modelled 1 in 100 annual probability (1% AEP) flood level including an allowance for climate change.
5	In areas at risk of flooding of low depths (<0.3m), the following flood resistance measures could be considered: • Using materials and construction with low permeability. • Land raising. • Landscaping e.g. creation of low earth bunds (subject to this not increasing flood risk to neighbouring properties). • Raising thresholds and finished floor levels e.g. porches with higher thresholds than main entrance. • Flood gates with waterproof seals.
6	In areas at risk of frequent or prolonged flooding, the following flood resilience measures could be implemented: • Use materials with either, good drying and cleaning properties, or, sacrificial materials that can easily be replaced post-flood. • Design for water to drain away after flooding. • Design access to all spaces to permit drying and cleaning. • Raise the level of electrical wiring, appliances and utility metres. • Coat walls with internal cement based renders; apply tanking on the inside of all internal walls. • Ground supported floors with concrete slabs coated with impermeable membrane. • Tank basements, cellars or ground floors with water resistant membranes. • Use plastic water resistant internal doors.
7	For developments located in areas at risk of fluvial flooding, safe access / egress must be provided for new development as follows in order of preference: • Safe dry route for people and vehicles. • Safe dry route for people. • If a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause risk to people. • If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles. However the public should not drive vehicles in floodwater.

	In all these cases, a 'dry' access/egress is a route located above the 1% annual probability flood level (1 in 100 year) including an allowance for climate change.
8	All new development in Flood Zones 2 and 3 should not adversely affect flood routing and thereby increase flood risk elsewhere. Opportunities should be sought within the site design to make space for water, such as: • Removing boundary walls or replacing with other boundary treatments such as hedges, fences (with gaps). • Considering alternatives to solid wooden gates, or ensuring that there is a gap beneath the gates to allow the passage of floodwater. • On uneven or sloping sites, consider lowering ground levels to extend the floodplain without creating ponds. The area of lowered ground must remain connected to the floodplain to allow water to flow back to river when levels recede. • Create under-croft car parks or consider reducing ground floor footprint and creating an open area under the building to allow flood water storage. Where proposals entail floodable garages or outbuildings, consider designing a proportion of the external walls to be committed to free flow of floodwater.
9	For all developments (excluding minor developments and change of use) proposed in Flood Zone 2 or 3, a Flood Warning and Evacuation Plan should be prepared to demonstrate what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate their development will not impact on the ability of the local authority and the emergency services to safeguard the current population. The Environment Agency has a tool on their website to create a Personal Flood Plan[1]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details. Where proposed development comprises non-residential extension <250m^2 and householder development (minor development), it is recommended that the use of this tool to create a Personal Flood Plan will be appropriate.
10	Suitable surface water management measures should be incorporated into new development designs in order to reduce and manage surface water flood risk to, and posed by the proposed development. This should be achieved by incorporating Sustainable Drainage Systems (SuDS).

9 Next Steps

9.1.1 Sequential Test

Using the strategic flood risk information presented within this Level 1 SFRA, Braintree DC should undertake the Sequential Test for their potential development sites to document the process whereby future development is steered towards areas of lowest flood risk.

9.1.2 Level 2 SFRA

Where it is not possible to accommodate all the necessary development outside those areas identified to be at risk of flooding, a Level 2 SFRA may be required to provide information to support the application of the Exception Test for future development sites. The scope of the Level 2 SFRA would be to consider the detailed nature of the flood characteristics within a flood zone including; flood depth, velocity, rate of onset and duration of flooding.

The Level 2 SFRA would provide a more detailed assessment of the flood risk for specific development sites which may require the application of the Exception Test.

9.1.3 Future Updates to the SFRA

This SFRA has been updated building heavily upon existing knowledge and newly available datasets with respect to flood risk within the district, made available by the Environment Agency. In the future, new modelling studies or new information may influence future development management decisions within the district. Therefore it is important that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk within the district.

Appendix A. Figures

Figure 1 Study Area
Figure 2 District Wide Flood Zone Map
Figure 2.1 Flood Zone Map
Figure 2.2 Flood Zone Map
Figure 2.3 Flood Zone Map
Figure 2.4 Flood Zone Map
Figure 2.5 Flood Zone Map
Figure 2.6 Flood Zone Map
Figure 2.7 Flood Zone Map
Figure 3 District Wide Risk of Flooding from Surface Water Map (RoFSW)
Figure 3.1 Braintree Risk of Flooding from Surface Water
Figure 3.2 Witham Risk of Flooding from Surface Water
Figure 4 District Wide Areas Susceptible to Ground Water Flooding Map (AStGWF)
Figure 5.1 Anglian Water External Sewer Flood Incidents
Figure 5.2 Anglian Water Internal Sewer Flood Incidents
Figure 6 Environment Agency Flood Warning Areas
Figure 7 Environment Agency Historic Flood Outlines

Appendix B. Braintree District County Flood Records

Date	Location	Severity	Comment
2006	Lilly Corner, Steeple Bumpstead		Works to be carried out by the Environment Agency
2006	Broad Green		Flooding from fields and ditch opposite, water can't get away under road culvert also from stream behind houses to the road bridge
2006	Rectory Road, Sugar Loaves and Alderford Street Sible Hedingham		Storage lagoon now installed
2006	Leather Lane, Great Yeldham	Highway flooding	The issues have been taken on by the Environment Agency as part of their responsibilities and they will continue to survey the brook and build on improvements already secured by BRAINTREE DC officers
2006	Bocking Church Street	Flooding in Alms Houses. Water from surface water drains cannot get away into river as a direct result of blocked culvert beneath the road	Culvert improvement under the S.106 agreement
2006	Bovington Road, Braintree	Highway flooding	Improved during the construction of the new development
	Goulds Road, Pebmarsh	Surface Water	
	Plum Cottage, Crows Green	Surface water flooding Pollards Villas	
2001	Gages Road, Belchamp	At risk from the River Stour, some properties at risk from surface water flooding	FloodSax have been purchased by the Parish Council
2009	Ditch behind Belchamp St Paul School	At risk from the River Stour, some properties at risk from surface water flooding	FloodSax have been purchased by the Parish Council
	Ridgewell Road	At risk of flooding from the Stour Brook & Bumpstead Brook Baythorne End properties at risk of flooding from surface water	
2001	Bakers Lane, Black Notley Bulford Lane, which links to the B1018, is vulnerable to flooding.	At risk of flooding from the River Brain 10 properties at risk of surface water flooding	
2012	Pond at Panners Parade, Great Notley	Pond overflow	Damage occurred to one of the shops and a communal area to the flats. The rear car park was also flooded.
2000	Bovingdon Road, Alms houses	At risk from flooding from the River Pant/River Blackwater	Some re-routing of surface water drainage from High Garrett/top of Church Lane across Dorewards Farm.
2001	Church Lane, Kings Bridge, Church Street, Bovingdon Road, Rivermead, Bradford Street, Broad Road	At risk from flooding from the River Pant/River Blackwater	Some re-routing of surface water drainage from High Garrett/top of Church Lane across Dorewards Farm.
2003	Bovingdon Road, Church Lane, Bradford Street	At risk from flooding from the River Pant/River Blackwater	Some re-routing of surface water drainage from High Garrett/top of Church Lane across Dorewards Farm.
2009	Church Lane	At risk from flooding from the River Pant/River Blackwater	Some re-routing of surface water drainage from High Garrett/top of Church Lane across Dorewards Farm.
2001	Blackwater Mill, Church Road, Coggeshall Road	Bradwell is at risk from flooding from the River Blackwater	
2003	Coggeshall Road	Bradwell is at risk from flooding from the River Blackwater	
2014	A120 (Dip in the road between Braintree and Bradwell)	Bradwell is at risk from flooding from the River Blackwater	
2000	A120 (Dip in the road between Braintree and	Braintree is at risk from flooding from the River Brain, Blackwater, and River	

Date	Location	Severity	Comment
	Bradwell)	Pant. 490 properties remain at risk from surface water flooding.	
2001	Dover Close, Thistley Green Road, Notley Road, Birch Close, Rivermead, Church St, Megs Way, Bradford St, Sun Lido Gdns,	Braintree is at risk from flooding from the River Brain, Blackwater, and River Pant. 490 properties remain at risk from surface water flooding.	George Yard, Town Centre Braintree purchased Flood Sax
2003	Notley Road	Braintree is at risk from flooding from the River Brain, Blackwater, and River Pant. 490 properties remain at risk from surface water flooding.	George Yard, Town Centre Braintree purchased Flood Sax
2009	Notley Road, Church Lane, Pods Brook Road	Braintree is at risk from flooding from the River Brain, Blackwater, and River Pant. 490 properties remain at risk from surface water flooding.	George Yard, Town Centre Braintree purchased Flood Sax
2014	Some surface water flooding on new Riverside development.	Braintree is at risk from flooding from the River Brain, Blackwater, and River Pant. 490 properties remain at risk from surface water flooding.	George Yard, Town Centre Braintree purchased Flood Sax
2001/2	Main Road and pub, Bures	Bures is at risk from flooding from the River Stour. Unknown number of properties remains at risk from surface water flooding.	
2006	Water Lane, Bures	Bures is at risk from flooding from the River Stour. Unknown number of properties remains at risk from surface water flooding.	
2000 & 2001	Bridge St West Street Gurton Road Jaggards Road Colne Road Bridge Street Hill Road Mount Road The Gravel	Coggeshall is at risk from flooding from the River Blackwater. 510 properties remain at risk of surface water flooding.	No recorded Flood Sax purchased by Parish Council or private property owners BRAINTREE DC has flood sax which are available for residents to purchase and limited sandbags are available.
2003	Monksdown Road Church Ponds	Coggeshall is at risk from flooding from the River Blackwater. 510 properties remain at risk of surface water flooding.	No recorded Flood Sax purchased by Parish Council or private property owners BRAINTREE DC has flood sax which are available for residents to purchase and limited sandbags are available.
2009	Coggeshall Road (by bridge) Bridge Street West Street (by nursery)	Coggeshall is at risk from flooding from the River Blackwater. 510 properties remain at risk of surface water flooding.	No recorded Flood Sax purchased by Parish Council or private property owners BRAINTREE DC has flood sax which are available for residents to purchase and limited sandbags are available.
2014	Bottom of Grange Hill	Coggeshall is at risk from flooding from the River Blackwater. 510 properties remain at risk of surface water flooding.	No recorded Flood Sax purchased by Parish Council or private property owners BRAINTREE DC has flood sax which are available for residents to purchase and limited sandbags are available.
2001	Mill Lane and Colne Park Road, Colne Engaine	Colne Engaine is at risk from flooding from the River Colne. Unknown number of properties remains at risk from surface water flooding.	
2001	Witham Road, Cressing	Cressing is at risk from flooding from the River Brain. An unknown number of properties remain at risk from surface water flooding.	
2000	Upper Holt Street, Earls	Earls Colne is at risk from flooding from	

Date	Location	Severity	Comment
	Colne	the River Colne. 30 properties remain at risk from surface water flooding.	
2001	Tey Road, Coggeshall Road, Upper Holt Street, Earls Colne	Earls Colne is at risk from flooding from the River Colne. 30 properties remain at risk from surface water flooding.	
2009	Colneford Bridge, Earls Colne	Earls Colne is at risk from flooding from the River Colne. 30 properties remain at risk from surface water flooding.	
2001	Bardfield Road, Duckend	Finchingfield is at risk from flooding from Finchingfield Brook	
2009	Finchingfield Road	Finchingfield is at risk from flooding from Finchingfield Brook	
2003	Sudbury Road, Gestingthorpe	Gestingthorpe is at risk from flooding from the Belchamp Brook. An unknown number of properties remain at risk from surface water flooding.	Some individual residents have purchased flood sax from BRAINTREE DC
2006	Little Maplestead Road, Gestingthorpe	Gestingthorpe is at risk from flooding from the Belchamp Brook. An unknown number of properties remain at risk from surface water flooding.	Some individual residents have purchased flood sax from BRAINTREE DC
2001	Bridge End, Plum Lane and Mill Road, Great Bardfield	Great Bardfield is at risk from flooding from the River pant. 50 properties remain at risk from surface water flooding.	BRAINTREE DC has FloodSax which are available for residents to purchase and limited sandbags are available.
2009	B1057/Bridge End, great Bardfield	Great Bardfield is at risk from flooding from the River pant. 50 properties remain at risk from surface water flooding.	BRAINTREE DC has FloodSax which are available for residents to purchase and limited sandbags are available.
2014	Bridge Street, North Road, Great Yeldham	Great Yeldham is at risk from flooding from the River Colne. 150 properties remain at risk from surface water flooding.	Some homeowners have purchased FloodSax and limited sandbags are available. Environment Agency manage the river alongside (2 sides of) Bowtells Meadow to ensure clear from major debris Land owner clears ditches (run under road) which runs next to field next to White Hart pub
2009	High Street, Dicketts Hill and Bridge Street, Great Yeldham	Great Yeldham is at risk from flooding from the River Colne. 150 properties remain at risk from surface water flooding.	Some homeowners have purchased FloodSax and limited sandbags are available. Environment Agency manage the river alongside (2 sides of) Bowtells Meadow to ensure clear from major debris Land owner clears ditches (run under road) which runs next to field next to White Hart pub
2003	North End, Great Yeldham	Great Yeldham is at risk from flooding from the River Colne. 150 properties remain at risk from surface water flooding.	Some homeowners have purchased FloodSax and limited sandbags are available. Environment Agency manage the river alongside (2 sides of) Bowtells Meadow to ensure clear from major debris Land owner clears ditches (run under road) which runs next to field next to White Hart pub
2001	Church Road, North End, School Road, Great Oak Crescent, Poole Street, Great Yeldham	Great Yeldham is at risk from flooding from the River Colne. 150 properties remain at risk from surface water flooding.	Some homeowners have purchased FloodSax and limited sandbags are available. Environment Agency manage the river alongside (2 sides of) Bowtells Meadow to ensure clear from major debris Land owner clears ditches (run under road) which runs next to field next to White Hart pub
2000	Leather Lane, Great Yeldham	Great Yeldham is at risk from flooding from the River Colne. 150 properties remain at risk from surface water flooding.	Some homeowners have purchased FloodSax and limited sandbags are available. Environment Agency manage the river alongside (2 sides of) Bowtells Meadow to ensure clear from major debris Land owner clears ditches (run under road) which runs next to field next to White Hart pub
2000	Greenstead Green, Halstead	Halstead is at risk from flooding from the River Colne. 360 properties remain	Halstead Flood Alleviation Scheme at Box Mill Plantation

Date	Location	Severity	Comment
		at risk from surface water flooding.	
2001	Stanley Road, Oak Road, Fuller St, Halstead	Halstead is at risk from flooding from the River Colne. 360 properties remain at risk from surface water flooding.	Halstead Flood Alleviation Scheme at Box Mill Plantation
2003	Riverside Court, Halstead	Halstead is at risk from flooding from the River Colne. 360 properties remain at risk from surface water flooding.	Halstead Flood Alleviation Scheme at Box Mill Plantation
2001	Thorn Road, Riverside Way, Church Road, Croft Road, Fern Close, Kelvedon	Kelvedon is at risk from flooding from the River Colne. 390 properties remain at risk from surface water flooding.	Recent clearing of ditches across meadows adjacent to river to improve flow of runoff into main river.
2000	School Road, Little Maplestead	An unknown number of properties remain at risk from surface water flooding.	
2001	Water Lane, Shalford	Shalford is at risk from flooding from the River Pant. An unknown number of properties remain at risk from surface water flooding.	
2004	Church Green. Shalford	Shalford is at risk from flooding from the River Pant. An unknown number of properties remain at risk from surface water flooding.	
2009	Shalford Mill, Shalford	Shalford is at risk from flooding from the River Pant. An unknown number of properties remain at risk from surface water flooding.	
1999	A604 at Sugar Loaves junction, Swan St, Rectory Rd, Wethersfield Rd, Sible Hedingham	Sible Hedingham is at risk from flooding from the River Colne. 170 properties remain at risk from surface water flooding.	2 Flood ponds at Cuckoo Hill, Sible Hedingham
2003	Station Rd, Swan St, Sible Hedingham	Sible Hedingham is at risk from flooding from the River Colne. 170 properties remain at risk from surface water flooding.	2 Flood ponds at Cuckoo Hill, Sible Hedingham
2000	Western Lane, Tey Green, Silver End	Silver End is at risk from flooding from the River. 40 properties remain at risk from surface water flooding.	
2001	Mayling Crescent, Western Road, Magdalene Crescent, Temple Lane, Silver End	Silver End is at risk from flooding from the River. 40 properties remain at risk from surface water flooding.	
2006	Magdalene Crescent, Silver End	Silver End is at risk from flooding from the River. 40 properties remain at risk from surface water flooding.	
2009	Magdalene Crescent, Silver End	Silver End is at risk from flooding from the River. 40 properties remain at risk from surface water flooding.	
2000	Lilly Corner, Steeple Bumpstead	Steeple Bumpstead is at risk from flooding from the Bumpstead Brook. An unknown number of properties remain at risk from surface water flooding.	
2003	Water Lane, Steeple Bumpstead	Steeple Bumpstead is at risk from flooding from the Bumpstead Brook. An unknown number of properties remain at risk from surface water flooding.	
2009	Church Street and Helions Bumpstead Road	Steeple Bumpstead is at risk from flooding from the Bumpstead Brook. An unknown number of properties remain at risk from surface water flooding.	
2003	Water Lane, Stisted	Stisted is at risk from flooding from the River Blackwater and an unknown number of properties are at risk from surface water flooding.	

Date	Location	Severity	Comment
2009	Back Lane, Stisted	Stisted is at risk from flooding from the River Blackwater and an unknown number of properties are at risk from surface water flooding.	
2009	Terling Ford, Terling	Terling is at risk from flooding from the River Ter. Less than 10 properties remain at risk from surface water flooding.	
2005	Church Lane, Toppesfield	Surface water	
2001	Gosfield Road, Waterhole Lane Rotten End, Wethersfield	Wethersfield is at risk from flooding from the River Pant and from surface water flooding. (unknown number of properties at risk from SW flooding).	Anglian Water has re-routed surface water drains. Not aware of any flooding in Wethersfield village since this work was carried out.
2001	The Green, The Street, White Notley	White Notley is at risk from flooding from the River Brain. An unknown number of properties remain at risk from surface water flooding.	
2001	Bridge St, Mill Lane, Elderberry Gardens, Forest Road, Holly Walk, Newland St, Ebenezer Close, Bronte Road, Yew Close, Saul's Road, Witham	Witham is at risk from flooding from the River Blackwater & River Brain. 630 properties remain at risk from surface water flooding.	River Blackwater and work carried out at Brook Walk Flood Sax purchased for Bridge Court, Hill Lane
2003	Newlands Street, Witham	Witham is at risk from flooding from the River Blackwater & River Brain. 630 properties remain at risk from surface water flooding.	River Blackwater and work carried out at Brook Walk Flood Sax purchased for Bridge Court, Hill Lane
2009	Conrad Road, Blue Mills Rd, Guithaven Rd, Guithaven Bridge, Bridge St, Riverwalk, Helford Court, Powers Hall End, Witham	Witham is at risk from flooding from the River Blackwater & River Brain. 630 properties remain at risk from surface water flooding.	River Blackwater and work carried out at Brook Walk Flood Sax purchased for Bridge Court, Hill Lane
2011	Brook Walk, Helford Court, Witham	Witham is at risk from flooding from the River Blackwater & River Brain. 630 properties remain at risk from surface water flooding.	River Blackwater and work carried out at Brook Walk Flood Sax purchased for Bridge Court, Hill Lane
2012	Guithavon Road and Mill Lane, Witham	Witham is at risk from flooding from the River Blackwater & River Brain. 630 properties remain at risk from surface water flooding.	River Blackwater and work carried out at Brook Walk Flood Sax purchased for Bridge Court, Hill Lane
2014	Chipping Hill, Riverwalk, High Street, Colne Chase, Guithaven Road, Hawthorne, Witham	Witham is at risk from flooding from the River Blackwater & River Brain. 630 properties remain at risk from surface water flooding.	River Blackwater and work carried out at Brook Walk Flood Sax purchased for Bridge Court, Hill Lane
Date	Location	Severity	Cause
25/04/2012	Halstead	Flooding to road	
29/04/2012	Ridgewell	Until at least 03-May-12 Flooding to front garden, driveway and garage Sought emergency help from highways/District	
29/04/2012	Silver End	1 property flooded,	Surcharging surface water from manhole
01/05/2012	Braintree	Flooding has occurred in gardens of a number of dwellings alongside the new culvert and access to the open space beyond	
01/05/2012	Halstead	>2 hours, 30cm	Blocked surface Gully
01/05/2012	Halstead	>2 hours, 10cm	Surcharging manhole
01/05/2012	Silver End	Road flooded	Surcharging surface water from manhole
01/05/2012	Fairstead		Pipe blocked under road, but it couldn't cope with this amount of flow if it was clear

Date	Location	Severity	Comment
01/05/2012	Bocking		Water from fields
01/05/2012	Rayne	Gardens flooded	
01/05/2012	Rayne		
01/05/2012	Braintree		Water on road also filled in ditch so unable to drain
03/05/2012	Braintree		Water on road also filled in ditch so unable to drain
03/05/2012	Stisted	Floors had to be replaced	
03/05/2012	Coggeshall	Gardens Flooded	Water from fields at rear
03/05/2012	Stanbourne	Road flooded EDF energy called due to collapsed cable	
03/05/2012	Silver End	3 hrs until stabilised 5 properties flooded	
03/05/2012	Gestingthorpe	Road flooded	Ordinary Watercourse
03/05/2012	Witham		
03/05/2012	Gt Yeldham	Road flooded	
03/05/2012	Rayne		
03/05/2012	Witham	2 properties flooded	River
03/05/2012	Gt Yeldham		River
03/05/2012	Stisted		
03/05/2012	Braintree	Garden flooded into property	Surcharge from drains
03/05/2012	Halstead		Surcharging manhole and runoff from fields
03/05/2012	Silver End		surcharging m/h
03/05/2012	Braintree	1 property flooded	Water from road flooding cellar
03/05/2012	Gt Notley		Pond
03/05/2012	Hatfield Peverel		Pond taking highway water
03/05/2012	Halstead		
03/05/2012	Bradwell		highway drain
04/05/2012	Panfield		blocked ditches
04/05/2012	Coggeshall	Residents hired pump	Fields
04/05/2012	Great Notley	Road flooded	Collapsed Culvert
15/05/2012	kelvedon		Highway Drainage
31/05/2012	Great Notley	24hrs, knee deep Shop, car park and cars flooded	surface water
10/12/2012	Hatfield Peverel		Surface water
21/12/2012	Coggeshall		Blocked ordinary watercourse
25/12/2012	Kelvedon		groundwater from land behind has undermined paved drive
30/01/2013	Cressing	days	overflowing watercourse
23/11/2014	Wethersfield	20 hours 12" deep Large barn flooded	Brook and surface water flooding
23/11/2014	Braintree		Drains and surface water flooding
23/11/2014	Bures Hamlet		Field runoff, ditch overflowing
23/11/2014	Great Yeldham	12 hours 4" deep	Blocked culvert then river
24/11/2014	Cressing	4" deep	
26/11/2014	Shalford	6.5 hours	Pods brook
23/11/2014	Steeple Bumpstead	24 hours 2 ft. deep	Brook and surface water runoff
23/11/2014	Wethersfield	3" deep	Blocked gully
Date	Location	Severity	Cause
25/04/2012	Halstead	Flooding to road	
29/04/2012	Ridgewell	Until at least 03-May-12	

Date	Location	Severity	Comment
		Flooding to front garden, driveway and garage Sought emergency help from highways/District	
29/04/2012	Silver End	1 property flooded,	Surcharging surface water from manhole
01/05/2012	Braintree	Flooding has occurred in gardens of a number of dwellings alongside the new culvert and access to the open space beyond	
01/05/2012	Halstead	>2 hours, 30cm	Blocked surface Gully
01/05/2012	Halstead	>2 hours, 10cm	Surcharging manhole
01/05/2012	Silver End	Road flooded	Surcharging surface water from manhole
01/05/2012	Fairstead		Pipe blocked under road, but it couldn't cope with this amount of flow if it was clear
01/05/2012	Bocking		Water from fields
01/05/2012	Rayne	Gardens flooded	
01/05/2012	Rayne		
01/05/2012	Braintree		Water on road also filled in ditch so unable to drain
03/05/2012	Braintree		Water on road also filled in ditch so unable to drain
03/05/2012	Stisted	Floors had to be replaced	
03/05/2012	Coggeshall	Gardens Flooded	Water from fields at rear
03/05/2012	Stanbourne	Road flooded EDF energy called due to collapsed cable	
03/05/2012	Silver End	3 hrs until stabilised 5 properties flooded	
03/05/2012	Gestingthorpe	Road flooded	Ordinary Watercourse
03/05/2012	Witham		
03/05/2012	Gt Yeldham	Road flooded	
03/05/2012	Rayne		
03/05/2012	Witham	2 properties flooded	River
03/05/2012	Gt Yeldham		River
03/05/2012	Stisted		
03/05/2012	Braintree	Garden flooded into property	Surcharge from drains
03/05/2012	Halstead		Surcharging manhole and runoff from fields
03/05/2012	Silver End		surcharging m/h
03/05/2012	Braintree	1 property flooded	Water from road flooding cellar
03/05/2012	Gt Notley		Pond
03/05/2012	Hatfield Peverel		Pond taking highway water
03/05/2012	Halstead		
03/05/2012	Bradwell		highway drain
04/05/2012	Panfield		blocked ditches
04/05/2012	Coggeshall	Residents hired pump	Fields
04/05/2012	Great Notley	Road flooded	Collapsed Culvert
15/05/2012	kelvedon		Highway Drainage
31/05/2012	Great Notley	24hrs, knee deep Shop, car park and cars flooded	surface water
10/12/2012	Hatfield Peverel		Surface water
21/12/2012	Coggeshall		Blocked ordinary watercourse
25/12/2012	Kelvedon		groundwater from land behind has undermined paved drive
30/01/2013	Cressing	days	overflowing watercourse
23/11/2014	Wethersfield	20 hours 12" deep	Brook and surface water flooding

Date	Location	Severity	Comment
		Large barn flooded	
23/11/2014	Braintree		Drains and surface water flooding
23/11/2014	Bures Hamlet		Field runoff, ditch overflowing
23/11/2014	Great Yeldham	12 hours 4" deep	Blocked culvert then river
24/11/2014	Cressing	4" deep	
26/11/2014	Shalford	6.5 hours	Pods brook
23/11/2014	Steeple Bumpstead	24 hours 2 ft. deep	Brook and surface water runoff
23/11/2014	Wethersfield	3" deep	Blocked gully
Date	Location	Severity	Cause
25/04/2012	Halstead	Flooding to road	
29/04/2012	Ridgewell	Until at least 03-May-12 Flooding to front garden, driveway and garage Sought emergency help from highways/District	
29/04/2012	Silver End	1 property flooded,	Surcharging surface water from manhole
01/05/2012	Braintree	Flooding has occurred in gardens of a number of dwellings alongside the new culvert and access to the open space beyond	
01/05/2012	Halstead	>2 hours, 30cm	Blocked surface Gully
01/05/2012	Halstead	>2 hours, 10cm	Surcharging manhole
01/05/2012	Silver End	Road flooded	Surcharging surface water from manhole
01/05/2012	Fairstead		Pipe blocked under road, but it couldn't cope with this amount of flow if it was clear
01/05/2012	Bocking		Water from fields
01/05/2012	Rayne	Gardens flooded	
01/05/2012	Rayne		
01/05/2012	Braintree		Water on road also filled in ditch so unable to drain
03/05/2012	Braintree		Water on road also filled in ditch so unable to drain
03/05/2012	Stisted	Floors had to be replaced	
03/05/2012	Coggeshall	Gardens Flooded	Water from fields at rear
03/05/2012	Stanbourne	Road flooded EDF energy called due to collapsed cable	
03/05/2012	Silver End	3 hrs until stabilised 5 properties flooded	
03/05/2012	Gestingthorpe	Road flooded	Ordinary Watercourse
03/05/2012	Witham		
03/05/2012	Gt Yeldham	Road flooded	
03/05/2012	Rayne		
03/05/2012	Witham	2 properties flooded	River
03/05/2012	Gt Yeldham		River
03/05/2012	Stisted		
03/05/2012	Braintree	Garden flooded into property	Surcharge from drains
03/05/2012	Halstead		Surcharging manhole and runoff from fields
03/05/2012	Silver End		surcharging m/h
03/05/2012	Braintree	1 property flooded	Water from road flooding cellar
03/05/2012	Gt Notley		Pond
03/05/2012	Hatfield Peverel		Pond taking highway water
03/05/2012	Halstead		
03/05/2012	Bradwell		highway drain

Date	Location	Severity	Comment
04/05/2012	Panfield		blocked ditches
04/05/2012	Coggeshall	Residents hired pump	Fields
04/05/2012	Great Notley	Road flooded	Collapsed Culvert
15/05/2012	Kelvedon		Highway Drainage
31/05/2012	Great Notley	24hrs, knee deep Shop, car park and cars flooded	surface water
10/12/2012	Hatfield Peverel		Surface water
21/12/2012	Coggeshall		Blocked ordinary watercourse
25/12/2012	Kelvedon		groundwater from land behind has undermined paved drive
30/01/2013	Cressing	days	overflowing watercourse
23/11/2014	Wethersfield	20 hours 12" deep Large barn flooded	Brook and surface water flooding
23/11/2014	Braintree		Drains and surface water flooding
23/11/2014	Bures Hamlet		Field runoff, ditch overflowing
23/11/2014	Great Yeldham	12 hours 4" deep	Blocked culvert then river
24/11/2014	Cressing	4" deep	
26/11/2014	Shalford	6.5 hours	Pods brook
23/11/2014	Steeple Bumpstead	24 hours 2 ft. deep	Brook and surface water runoff
23/11/2014	Wethersfield	3" deep	Blocked gully

Appendix C. Highways England Flood Records

Reported	Road	Initial Action	Impact On
02 Jul 2008 19:30	A12	-	-
12 Aug 2008 07:10	A12	-	-
12 Aug 2008 08:38	A12	-	-
12 Aug 2008 08:47	A12	-	-
05 Oct 2008 08:05	A12	-	-
05 Oct 2008 08:05	A12	-	-
10 Nov 2008 14:00	A12	-	-
05 Feb 2009 15:16	A12	-	-
09 Feb 2009 20:35	A12	-	-
10 Feb 2009 07:00	A12	-	-
07 Jun 2009 11:12	A120	-	-
05 Jul 2009 06:20	A12	-	-
17 Jul 2009 13:30	A12	-	-
21 Oct 2009 19:20	A12	-	-
01 Nov 2009 11:30	A120	-	-
29 Nov 2009 05:30	A120	-	-
16 Feb 2010 11:46	A12	-	-
25 Feb 2010 10:50	A12	-	-
26 Feb 2010 17:58	A12	-	-
28 Feb 2010 13:00	A120	-	-
20 May 2010 08:26	A12	-	-
08 Jun 2010 11:19	A120	-	-
08 Jun 2010 11:21	A120	-	-
22 Jun 2010 05:19	A12	-	-
03 Oct 2010 07:44	A120	-	-
19 Oct 2010 16:46	A12	-	-
09 Nov 2010 10:04	A12	-	-
09 Nov 2010 15:03	A120	-	-
09 Nov 2010 16:07	A120	-	-
06 Jan 2011 11:20	A120	-	-
12 Jan 2011 14:00	A12	-	-

Reported	Road	Initial Action	Impact On
13 Jan 2011 18:00	A120	-	-
17 Jan 2011 10:20	A120	-	-
18 Jan 2011 05:20	A12	-	-
18 Jan 2011 06:11	A12	-	-
18 Jan 2011 09:50	A12	-	-
25 May 2011 08:45	A12	Ardleigh 2 contacted by Adam to put out flood signs and to check the gullies are clear	None
16 Jul 2011 14:00	A120	Put flood signs out	None
11 Aug 2011 18:51	A12	Attend and clear side entry gullies	None
04 Nov 2011 07:30	A120	Attend, check gullies & place out signs. Gullies not blocked upon inspection.	None
03 Jan 2012 14:00	A12	Liaise with Adam Bones as to further action.	Commercial property
04 Apr 2012 11:25	A12	Attend and clear gullies if poss.	[Not Determined]
11 Apr 2012 17:28	A12	ISU to attend and assess. Sign if need be. More details entered in action log.	None
29 Apr 2012 11:26	A120	Attend and assess	None
03 May 2012 03:40	A120	Attend and assess. Assist police with traffic management.	None
27 Dec 2012 11:36	A120	Contractor instructed to attend site to pump water out of resident's garden.	Residential property / critical infrastructure
30 Jan 2013 08:46	A12	SWAT team assessed site and confirmed flooding within underpass (off network).	Residential property / critical infrastructure
01 Feb 2013 10:19	A12	SWAT attended site to verify an assess flooding.	Residential property / critical infrastructure
19 Mar 2013 11:58	A12	Attend and assess.	Residential property / critical infrastructure
25 Mar 2013 10:08	A12	Attend and Assess.	Residential property / critical infrastructure
28 Mar 2013 07:12	A12	Contractor called to carry out repairs to pumping station.	Residential property / critical infrastructure
21 Apr 2013 10:31	A120	Attend and assess. Take any action possible to alleviate flooding.	Residential property / critical infrastructure
29 May 2013 10:39	A12	Contractor attended site and reset pump.	Residential property / critical infrastructure
15 Jun 2013 22:01	A12	Contractor called to attend and repair pumping station.	Residential property / critical infrastructure
25 Jun 2013 17:26	A12	Contractor attended site and repaired control panel for pumping station.	Residential property / critical infrastructure
21 Aug 2013 09:55	A12	Pump failure reported to control centre. Automatic	Residential property / critical

Reported	Road	Initial Action	Impact On
		switch unable to rectify problem.	infrastructure
30 Oct 2013 16:00	A12	Contractor attended site and reported power outage in area. Stayed on site until power was restored by utility contractors to confirm pump was working.	Residential property / critical infrastructure
24 Dec 2013 06:05	A12	Gullies cleared to alleviate standing water.	None
17 Jan 2014 09:39	A12	Flood warning signs placed on site. No works were possible to prevent the water entering the trunk road carriageway.	Agricultural land only
29 Jan 2014 11:39	A12	SWAT cleared blocked gullies to alleviate standing water.	None
07 Feb 2014 07:52	A120	SWAT crew attended to clear drains to alleviate standing water.	None
11 Jun 2014 00:00	A12	ICE attended	None
23 Nov 2014 00:00	A12	None (No "Flood" boards)	None
08 Jan 2015 00:00	A12	Attended and diagnosed issue	None
08 Jan 2015 00:00	A12	Attended site and diagnosed issues	None

Appendix D. Flood Risk Assessment (FRA) Checklist

What to Include in the FRA		Source(s) of Information
1.Site Description		
Site address	-	-
Site description	-	-
Location plan	Including geographical features, street names, catchment areas, watercourses and other bodies of water	SFRA Appendix A
Site plan	Plan of site showing development proposals and any structures which may influence local hydraulics e.g. bridges, pipes/ducts crossing watercourses, culverts, screens, embankments, walls, outfalls and condition of channel	OS Mapping Site Survey
Topography	Include general description of the topography local to the site. Where necessary, site survey may be required to confirm site levels (in relation to Ordnance datum). Plans showing existing and proposed levels.	Site Survey
Geology	General description of geology local to the site.	BGS geological data Ground Investigation Report
Watercourses	Identify Main Rivers and Ordinary Watercourses local to the site.	SFRA Appendix A, Figure 1
Status	Is the development in accordance with the Council's Spatial Strategy?	Braintree Council website
2. Assessing Flood Risk		
The level of assessment will depend on the degree of flood risk and the scale, nature and location of the proposed development. Refer to Table 4-3 regarding the levels of assessment. Not all of the prompts listed below will be relevant for every application.		
Flooding from Rivers	Provide a plan of the site and Flood Zones. Identify any historic flooding that has affected the site, including dates and depths where possible. How is the site likely to be affected by climate change? Determine flood levels on the site for the 1% annual probability (1 in 100 chance each year) flood event including an allowance for climate change. Determine flood hazard on the site (in terms of flood depth and velocity). Undertake new hydraulic modelling to determine the flood level, depth, velocity, hazard, rate of onset of flooding on the site.	SFRA Appendix A Environment Agency Flood Map for Planning (Rivers and Sea). New hydraulic model.
Flooding from Land	Identify any historic flooding that has affected the site. Review the local topography and conduce a site walkover to determine low points at risk of surface water flooding. Review the Risk of Flooding from Surface Water mapping. Where necessary, undertake modelling to assess surface water flood risk.	SFRA Area Assessments. Topographic survey. Site walkover. Risk of Flooding from Surface Water mapping (Environment Agency website). New modelling study.
Flooding from Groundwater	Desk based assessment based on high level BGS mapping in the SFRA. Ground survey investigations. Identify any historic flooding that has affected the site.	SFRA Appendix A, Figure 4. Ground Investigation Report
Flooding from Sewers	Identify any historic flooding that has affected the site.	Refer SFRA Section 3.7, Appendix A Figures 5. Where appropriate an asset location survey can be

What to Include in the FRA		Source(s) of Information
		provided by Anglian Water Services.
Reservoirs, canals and other artificial sources	Identify any historic flooding that has affected the site. Review the Risk of Flooding from Reservoirs mapping.	Risk of Flooding from Reservoirs mapping (Environment Agency website). Refer SFRA Section 3.8.
3. Proposed Development		
Current use	Identify the current use of the site.	-
Proposed use	Will the proposals increase the number of occupants / site users on the site such that it may affect the degree of flood risk to these people?	-
Vulnerability Classification	Determine the vulnerability classification of the development. Is the vulnerability classification appropriate within the Flood Zone?	SFRA Table 4-2 SFRA Table 4-3
4. Avoiding Flood Risk		
Sequential Test	Determine whether the Sequential Test is required. Consult Braintree DC to determine if the site has been included in the Sequential Test. If required, present the relevant information to Braintree DC to enable their determination of the Sequential Test for the site on an individual basis.	SFRA Section 4.
Exception Test	Determine whether the Exception Test is necessary. Where the Exception Test is necessary, present details of: Part 1) how the proposed development contributes to the achievement of wider sustainability objectives as set out in the Braintree DC Sustainability Appraisal Report. (Details of how part 2) can be satisfied are addressed in the following part 5 'Managing and Mitigating Flood Risk'.)	SFRA Table 4-3 Refer to Braintree SA objectives presented in SFRA Table 4-4
5. Managing and Mitigating Flood Risk		
Section 6 of the SFRA presents measures to manage and mitigate flood risk and when they should be implemented. Where appropriate, the following should be demonstrated within the FRA to address the following questions: How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime? How will you ensure that the proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere? Are there any opportunities offered by the development to reduce flood risk elsewhere? What flood-related risks will remain after you have implemented the measures to protect the site from flooding (i.e. residual risk) and how and by whom will these be managed over the lifetime of the development (e.g. flood warning and evacuation procedures)?		
Development Layout and Sequential Approach	Plan showing how sensitive land uses have been placed in areas within the site that are at least risk of flooding.	SFRA Section 5.2
Riverside Development Buffer Zone	Provide plans showing how a buffer zone of relevant width will be retained adjacent to any Main River or Ordinary Watercourse in accordance with requirements of the Environment Agency or Essex County Council.	SFRA Section 5.3
Floodplain Compensation Storage	Provide calculations or results of a hydraulic modelling study to demonstrate that the proposed development provides compensatory flood storage and either will not increase flood risk to	SFRA Section 5.4

What to Include in the FRA		Source(s) of Information
	neighboring areas or will result in an overall improvement. This should be located and designed to achieve level for level and volume for volume compensation, should be provided on land that is in hydrological continuity with the site within the applicant's ownership and subject to appropriate maintenance regimes for its lifetime. Include cross sectional drawings clearly showing existing and proposed site levels.	
Finished Floor Levels	Plans showing finished floor levels in the proposed development in relation to Ordnance Datum taking account of indicated flood depths.	SFRA Section 5.5
Flood Resistance	Details of flood resistance measures that have been incorporated into the design. Include design drawings where appropriate.	SFRA Section 5.6
Flood Resilience	Details of flood resilience measures that have been incorporated into the design. Include design drawings where appropriate.	SFRA Section 5.7
Safe Access / Egress	Provide a figure showing proposed safe route of escape away from the site and/or details of safe refuge. Include details of signage that will be included on site. Where necessary this will involve mapping of flood hazard associated with river flooding. This may be available from Environment Agency modelling, or may need to be prepared as part of hydraulic modelling specific for the proposed development site.	SFRA Section 5.9
Flow Routing	Provide evidence that proposed development will not impact flood flows to the extent that the risk to surrounding areas is increased. Where necessary this may require modelling.	SFRA Section 5.14
Flood Warning and Evacuation Plan	Where appropriate reference the Flood Warning and Evacuation Plan or Personal Flood Plan that has been prepared for the proposed development (or will be prepared by site owners).	SFRA Section 5.15
Surface Water Management	Completion of SuDS Drainage Statement, as described in Section 7.	SFRA Section 6. Essex County Council website - https://www.essex.gov.uk/Environment%20Planning/Environment/local-environment/flooding/Flood-water-management-strategies/Pages/Surface-Water-Management-Plan.aspx

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Midpoint
Alençon Link
Basingstoke
Hampshire
RG21 7PP
United Kingdom
+44 1256 310200