Brentwood Borough Council

Strategic Flood Risk Assessment

Level 1

November 2018

Amec Foster Wheeler Environment
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Report for

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Document revisions

No.	Details	Date
1	Final report	09/11/2017
2	Final report v2	25/01/2018
3	Final report V3	09/11/2018

Executive summary

An SFRA was developed for Brentwood Borough Council in 2011, and updated in 2017. This 2017 update incorporates new data for strategic level flood risk assessment, and updates to planning policy and guidance including the introduction of the National Planning Policy Framework and National Planning Practice Guidance, and updates to the Environment Agency guidance on climate change allowances.

The SFRA is intended to inform decisions regarding development within the Borough, including any review of policy related to flood risk management and the allocation of land for future development. In addition, the SFRA provides a description of flood risk from all sources across the Borough, including:

- Flooding from rivers, and the identification of Flood Zones 1, 2 and 3;
- Flooding from surface water, and the risk/likelihood of occurrence;
- Flooding from other sources, including groundwater, and artificial sources; and
- Flooding as a result of the impacts of climate change.

The fluvial flood extent in the Borough appears to be limited, with surface water or "pluvial" flooding presenting the most significant risk of flooding. Surface water flooding occurs from intense rainfall events which results in large volumes of runoff in urban areas where the potential for infiltration is reduced due to man-made surfaces. The runoff may then exceed the capacity of road drains and sewers to convey the water away, resulting in surface water ponding. The Brentwood Surface Water Management Plan (SWMP) is the vehicle for assessing such risk and identifying potential solutions, and lists West Horndon, Ingatestone and Brentwood Town Centre as key surface water flooding hotspots.

The SFRA uses site information provided in Brentwood's Housing and Economic Land Availability Assessment (HELAA[1]), containing a dataset of potential and discounted sites put forward for consideration.

The approach outlined in this SFRA follows the sequential risk based approach advocated by NPPF. The SFRA outlines avoidance as the principal method of managing flood risk through the spatial planning process described within. If, in exceptional circumstances, development is proposed in areas of flood risk, the SFRA proposes guidance on managing the risk through site layout and building design.

The Brentwood SWMP recommends that all new development uses Sustainable Drainage Systems to maintain Greenfield runoff rates, and ideally reduce runoff by 20% in urban areas, reducing the risk of downstream fluvial or surface water flooding. The SFRA has identified that for much of the urban area of Brentwood the infiltration potential of the soil is high, meaning that infiltration SuDS are likely to be suitable. Infiltration options control runoff at source and are high up in the SuDS hierarchy. The feasibility of infiltration on site will need to be determined through a site specific drainage assessment.

Information to support application of the Sequential Test is provided in Section 5 of the report, with accompanying maps in Appendix A. Together they form a toolkit which enables the Council to prioritise development to areas of lower flood risk taking into account the vulnerability of the land use proposed to flood risk. Guidance has been provided should the situation occur where the Sequential Test has revealed that no suitable alternative sites are available and that development is to be located in an area of flood risk in conflict with the vulnerability of the land use proposed. In this case the Exception Test would need to be passed for the development to proceed.

Finally, the report provides guidance on how the SFRA should be monitored to ensure it remains current, including any triggers that would trigger an update requirement.

[1] This dataset was updated on 17/10/18 following the receipt of shapefile 34fbaf4d-2540-4e1d-a597-85161932356e.shp from Brentwood Borough Council

Purpose of this report

This report has been produced for the purpose of providing a strategic overview of flood risk in the Borough that will support the Council in decisions relating to development and future policy. This is achieved through characterising flood risk in the borough, and assessing climate change at a strategic (high) level and providing guidance based on national and local policy, which can inform future development and policy updates.

Guidance on the application of the Sequential Test, to aid the Council in prioritising development in areas of lower flood risk is also provided with accompanying mapping to clearly present areas of risk against proposed development sites.

Contents

*All Appendices have been supplied as separate documents.

1. Introduction

1.1 SFRA overview

1.1.1 This report is an update to the Level 1 Strategic Flood Risk Assessment (SFRA) of the Borough of Brentwood in the county of Essex.

1.1.2 The National Planning Policy Framework (NPPF) requires local planning authorities to assess the risk of flood in their areas through undertaking an SFRA.

1.1.3 The SFRA is intended to inform the development of policies related to flood risk management and the allocation of land for future development. This is achieved through a thorough analysis of flood risk within the Borough, enabling a more informed response to development proposals and planning, and helping to identify strategic solutions to flood risk.

1.2 Purpose of this Strategic Flood Risk Assessment

1.2.1 A SFRA is produced with the purpose of providing an evidence base to support spatial planning decisions at a Borough wide scale. The Level 1 SFRA is intended to:

- Identify main rivers, ordinary watercourses and flood zones within the Borough;
- Assess the potential impact of climate change on flood risk;
- Identify areas at risk from other sources of flooding such as surface and groundwater;
- Identify flood risk management measures including their location and standard;
- Provide guidance on the application of the Sequential Test; and
- Provide guidance on flood risk management through the design process.

1.2.2 Changes and additions to legislation, planning policy and strategy since the SFRA of 2011 are accounted for within this update, such as the National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG).

1.2.3 The SFRA takes account of newly available data such as updates to the Environment Agency's Risk of Flooding from Surface Water (RoFSW), the Essex Local Flood Risk Management Strategy (LFRMS), South Essex, North Essex and Thames Catchment Flood Management Plans (CFMPs), Brentwood Surface Water Management Plan (SWMP), The Thames and Anglian River Basin Management Plans (RBMP) and updates to the Environment Agency flood zone mapping.

1.2.4 The SFRA provides an updated review of the flood risk within the Borough, enabling strategic planning for the allocation of potential future development and underpinning any amendments to planning policy.

1.2.5 The SFRA provides updated guidance to prospective developers who will require a site specific Flood Risk Assessment (FRA) to support a planning application. This includes guidance on the appropriate use of SuDS.

1.3 Scope of update

1.3.1 The scope of the update was agreed with Brentwood Borough Council representatives. The objectives of the SFRA update are to account for new policy and strategy, update the District-wide mapping and use in conjunction with the most recent development sites to provide visual clarity on the location of the new sites in relation to flood risks.

1.3.2 Future pressures on flood risk as a result of new development and climate change are to be appraised to allow the application of the Sequential Test.

1.3.3 The locations and current condition of flood defence infrastructure are to be clarified, with an update to management policy with regard to maintenance and upgrade.

1.3.4 Policy recommendations for meeting NPPF requirements are to be provided, and are presented in Chapter 5.

1.3.5 Policy recommendations for minimising the risk from flooding of new development, including through SuDS, are to be provided, and presented in Chapter 7.

1.3.6 The study findings are to be summarised, providing key conclusions and recommendations, presented in Chapter 9.

1.3.7 The Level 1 Screening Assessment of HELAA Sites will take into account all sources of flooding. The sites will be referenced against the collated flood risk information, and presented in map and tabular form, and presented in Appendix C.

1.3.8 The sequence of tasks undertaken in this SFRA update was:

- Inception meeting with Brentwood Borough Council;
- Data request to stakeholders;
- Collation and review of data;
- Mapping of available flood sources and flood risk, against potential development sites; and
- Review of draft reporting and mapping.

1.4 Using the SFRA

1.4.1 The SFRA is a tool to inform the spatial planning process and guide safe development, from a flood risk perspective. The information has been presented in such a way to facilitate this objective. Appendix A is a key component of the report, as it includes detailed mapping sufficient to inform the application of Sequential Test.

1.4.2 For the purposes of informing the Sequential Test, the key pieces of information are:

- Figures A3a-d in Appendix A in conjunction with Table 5.1, showing flood zones and detailing appropriate land uses by zone;
- Section 5 – Information to support the Sequential Test; and
- Sections 6 and 7 – Guidance on appropriate flood risk management.

1.5 Report structure

1.5.1 The structure of this report is aligned with delivering the key aim of providing information to perform the Sequential Test. As such, the report comprises the following sections:

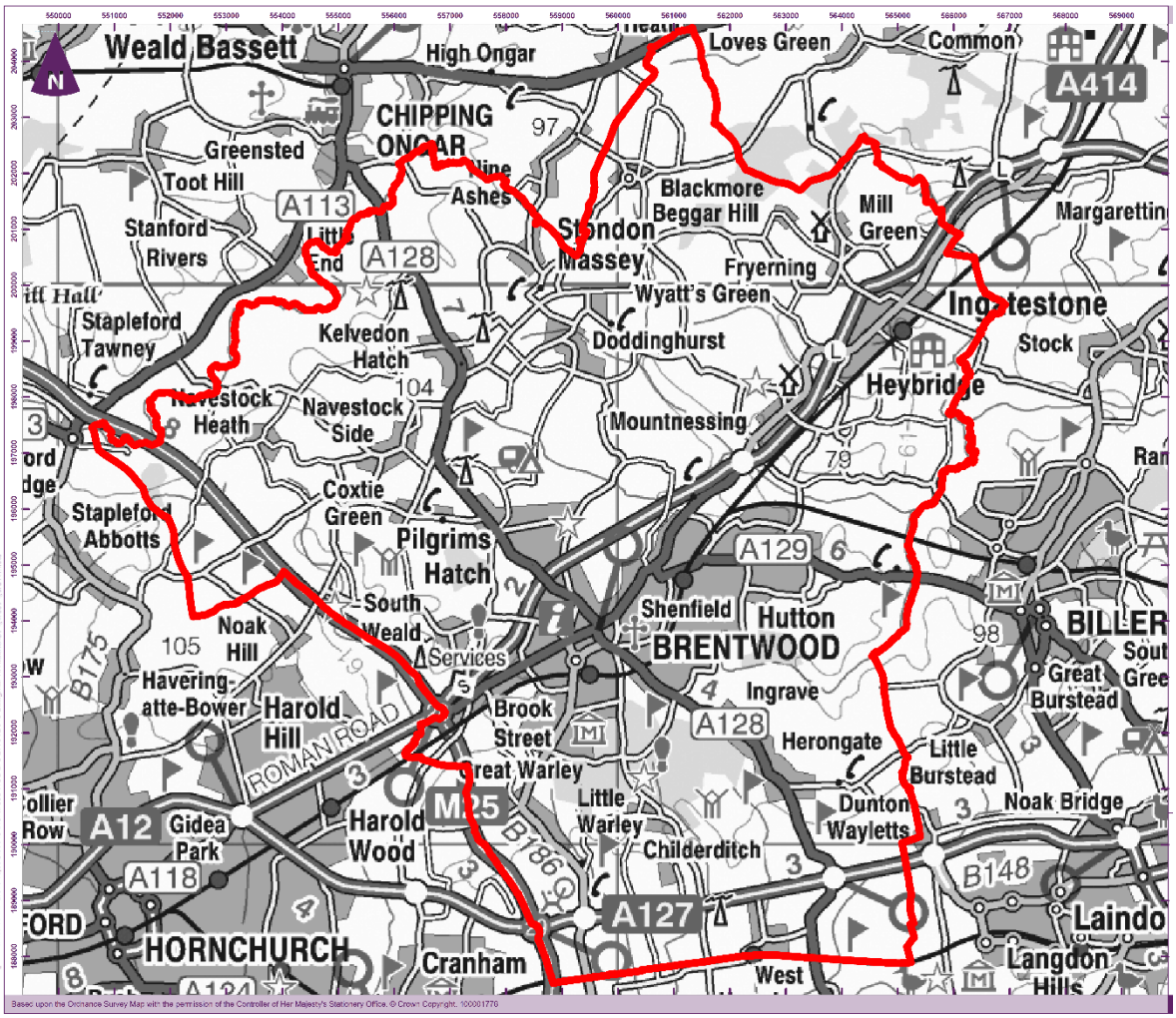
- Section 1 – provides an overview of the SFRA, its purpose and structure. The introduction is also designed to provide guidance on how to extract the most information from the SFRA;
- Section 2 – provides a geographical overview of Brentwood Borough;
- Section 3 – sets the SFRA within national and local planning policy, in light of multiple changes in recent years;
- Section 4 – provides an overview of all the sources of flood risk that have been identified within Brentwood;

- Section 5 – describes flood risk management in Brentwood through the planning process
- Section 6 – details how flood risk can be managed through the design process;
- Section 7 – outlines the principles of sustainable surface water management in Brentwood;
- Section 8 - describes the need for Flood Risk Assessments and processing windfall site applications; and
- Section 9 – summaries the key findings and implications of the SFRA, and outlines the circumstances that would trigger a revisit and update to the report.

2. Geographical overview

2.1.1 The Borough of Brentwood (hereafter referred to as 'the Borough') covers an area of 153 square kilometres in South West Essex. Located in the metropolitan Green Belt, it has a population of around 76,000, the majority of whom live in the main urban centre of Brentwood itself. Other notable settlements within the Borough include Ingatestone, Doddinghurst, Kelvedon Hatch, Blackmore and West Horndon. Less than 20% of the Borough is built up, and there is considerable pressure for development for both housing and employment, and increasingly for leisure and recreational purposes. The Borough Council Boundary is shown on Figure 2.1 below.

Figure 2.1 Brentwood Borough Council Boundary



2.1.2 Key road infrastructure in the Borough includes a 3 km length of the M25 motorway in the west, the A127 and the A12 trunk road which crosses the Borough from north east to south west and routes to the north of Brentwood town.

2.1.3 Land elevation within the Borough of Brentwood typically ranges from below 10 mAOD in the south to over 100 mAOD in the north and central area. Due to its relatively high elevations, the Borough forms the headwaters of the four key watercourse systems which drain the area:

- The catchment of the River Wid and associated tributaries cover 50% of the total area of Brentwood Borough and is located in the east of the Borough. The River Wid itself forms much of the eastern boundary of the Borough. The Wid system flows approximately from

south to north joining with the River Can in Chelmsford which itself joins the River Chelmer becoming the River Blackwater before entering the North Sea;

- The River Roding and associated tributaries drain the west of the Borough (approximately 15% of the total Borough area) and form its north-western boundary. The river flows in an approximate south-westerly direction eventually joining the River Thames via Barking Creek;
- The Ingrebourne system drains the south-western part of the Borough (approximately 15% of the total area of the Borough). The river flows south and joins the Thames at Rainham; and
- The River Mardyke system which drains the extreme south of the Borough via numerous small tributaries (approximately 15% of the total area of the Borough). The Mardyke flows south then to the west and joins the Thames near Purfleet.

2.1.4 Figure A1 in Appendix A provides an overview of the Borough and the key river catchments which drain the Borough. The topography based on airborne LiDAR survey is shown in Figure A2.

3. Planning framework and flood risk policy

3.1 Introduction

3.1.1 This section provides an overview of policy relevant to flood risk in the Borough of Brentwood.

3.1.2 This SFRA has been prepared in accordance with national planning legislation and policy guidance. The planning process is driven by legislation and guidance developed at a national, regional and local level, of which flood risk is just one of many factors requiring consideration when making decisions relating to land use and development.

3.1.3 The challenge and measure of success for a SFRA is to develop pragmatic principles for steering future development towards areas of lower flood risk within the context of and adhering to other planning policies and local drivers.

3.1.4 There have been significant changes to the policy framework used in informing SFRAs since the previous SFRA was published in January 2011. At the national level, Planning Policy Statement 25 (PPS25) was replaced with the National Planning Policy Framework (NPPF) in 2012. An update to the NPPF was released in 2018.

3.1.5 At local level, the Essex Local Flood Risk Management Strategy (LFRMS) was developed in 2013, providing local flood risk management coordination for Essex. The South Essex, North Essex and Thames Catchment Flood Management Plans (CFMPs) give an overview of flood risk across each river catchment and recommend ways of managing those risks now and over the next 100 years. The Thames and Anglian RBMPs ensure the protection and improvement of the water environment.

3.2 National planning policy

NPPF (2018) and NPPG (2014)

3.2.1 National planning policy is set out in the NPPF, published by the Government in 2012 and updated in 2018. The NPPF is accompanied by online National Planning Practice Guidance (NPPG), published in 2014, which provides further guidance on specific issues such as flood risk. The NPPF and NPPG supersede PPS25.

3.2.2 The NPPF covers a full range of planning issues, focusing on the core issue of sustainable development. Highlighted issues are the re-use of previously developed land of low environmental value, promoting economic growth, and transitioning to a low carbon future, with full consideration of any flood risk.

3.2.3 Local planning authority planning processes are underpinned by NPPF. NPPF dictates that:

"All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change – so as to avoid where possible, flood risk to people and property. They should do this, and manage any residual risk by:

- applying the sequential test and then, if necessary, the exception test as set out below;
- safeguarding land from development that is required, or likely to be required, for current or future flood management;
- using opportunities offered by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations."

3.2.4 The Sequential and Exception Tests are detailed in Section 5.

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

3.2.5 The Flood Risk Regulations (2009) place responsibility for the management of localised flood risk upon Lead Local Flood Authorities (LLFAs), in this case Essex County Council.

3.2.6 The management of all flood risk outside of flooding from rivers, the sea and reservoirs rests with the LLFA.

3.2.7 The duties for the LLFA, as described in the Water Management Act (2010) are as follows:

- Develop, maintain, apply and monitor a Local Flood Risk Management Strategy (LFRMS);
- Investigate and report on flooding incidents;
- Establish and maintain a register of structures or features that are likely to have a significant effect on flood risk;
- Designate structures and features that affect flood risk, thereby requiring the owner to seek consent for any alterations to or removal of the structure; and
- Perform consenting of works on ordinary watercourses.

SuDS

3.2.8 As of April 2015[2], LLFAs have the responsibility of ensuring any Sustainable Drainage Systems (SuDS) are of appropriate design standards and have clear arrangements for maintenance over the development's lifetime. Essex County Council must therefore be consulted to provide technical advice on all new major developments, defined as residential development of 10 dwellings or more, or with a site area of 0.5 hectares or more, and non-residential development where floor space created is 1,000 square metres or more, or with a site area of 1 hectare or more.

3.3 Local policy

Essex Local Flood Risk Management Strategy (2013)

3.3.1 The Essex LFRMS summarises information on flood risk in Essex and explains the distribution of responsibility for flood risk management. This includes the instruction to include assessment of local flood risk in SFRAs to inform local planning decisions.

3.3.2 Brentwood is identified within the Essex LFRMS as a Tier 1 Flood Risk Area, meaning that more than 1,000 people are predicted to be at risk from flooding. This is due to a surface water flood risk and history of flooding.

3.3.3 The LFRMS makes the following recommendations for Tier 1 areas:

- "Local planning policy should place emphasis on the requirement for appropriate measures to reduce surface water runoff from all new development. Site specific Flood Risk Assessments should inform the detailed design of surface water systems for new development, particularly within those areas that have been identified at high risk of flooding";
- "Raising community awareness of flooding and local flood risk, particularly within locally important flood risk areas (Tier 1, Tier 2 and Tier 3 areas), should be initiated as a priority. It is important to be able to communicate effectively and engage with local communities, parish

[2] http://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf

councils and members of the public in order to set realistic expectations and achievable outcomes of local flood risk management";

- "It is recommended that a general approach to improving community resilience is adopted across the study area, particularly in areas that have been identified as being at greater risk (Tier 1 and Tier 2 areas of locally important flood risk). This should include encouraging property resilience through the installation of individual property resilience measures, such as raised driveways, the use of flood gates or air brick covers, as well as a general increase in awareness and preparedness for a flood event. Options for funding of property protection measures should also be investigated, including the possibility of offering grants or subsidies for individual properties who are interested in installing such measures"; and
- "Key strategic actions that are currently in progress include of delivery Surface Water Management Plans in Tier 1 areas and targeted Critical Drainage Area option investigations."

Surface Water Management Plan (2015)

3.3.4 The Essex LFRMS recommends the delivery of a Surface Water Management Plan for Tier 1 areas such as Brentwood.

3.3.5 The Brentwood Surface Water Management Plan was published in January 2015, following the four stages of:

- Preparation;
- Risk assessment;
- Options; and
- Implementation.

3.3.6 The areas of West Horndon, Ingatestone and Brentwood Town Centre were identified as surface water flooding hotspots within the Borough.

3.3.7 Critical Drainage Areas (CDAs) were identified in the SWMP, and are included in the screening assessment of the HELAA sites.

Catchment Flood Management Plans (CFMPs) (2009)

3.3.8 Brentwood Borough Council spans areas of the North Essex, South Essex and Thames Catchment Flood Management Plans. The CFMPs place the rivers of Brentwood Borough and surrounding areas into Flood Risk Management Policy Option 6, defined as:

"Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.
This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation."

3.3.9 Policy Option 6 focuses on storage of water in the floodplain to reduce flood risk to settlements downstream. It is suggested that development affecting the ability of the floodplain to retain water be prevented, and planners are encouraged to ensure new development is resilient to flooding.

Replacement Local Plan (2005)

3.3.10 Brentwood Borough Council is currently preparing a new Local Plan, which will supersede policies in the current Replacement Local Plan of 2005.

3.3.11 Areas where flooding issues have been identified will require detailed policies and/or constraints in the local development plan. This updated SFRA will form part of the statutory evidence base to support planning policies and the application of the sequential approach in the context of flood risk.

4. Overview of flood risks

4.1 Introduction

4.1.1 This section of the report provides the context for the Brentwood SFRA and associated assessments of flood risk undertaken for this study. Assessments undertaken as part of a Level-1 SFRA are not location or site-specific, rather they involve an assessment of each identified source of risk across the whole Borough.

4.2 Responsibility for watercourses

4.2.1 Essex County Council as the LLFA are responsible for managing flood risk from local sources within the Council boundary, such as surface water, groundwater, and ordinary watercourses. Environment Agency guidance[3] states that for any watercourse that is included on the deeds to a property or land it is the owner of that deed who assumes a responsibility to:

- Report flooding, blockage, pollution unusual flow changes or collapsed or damaged banks to the Environment Agency; and
- Let water flow naturally, potentially through the removal of blockages such as fallen trees, should these reduce flow or cause flooding to another landowner's property. All maintenance work on main rivers is the responsibility of the owner.

4.2.2 The management of flooding from main rivers, the sea and from reservoirs are the responsibility of the Environment Agency.

4.2.3 In England the Environment Agency retains permissive powers to carry out maintenance and improvement works on watercourses classified as Main River. These are usually larger streams and rivers, but also include smaller watercourses of strategic drainage importance. A main river is defined as a watercourse shown as such on a main river map, and can include any structure or appliance for controlling or regulating the flow of water in, into or out of a main river.

4.2.4 A map showing the extent of main rivers and the associated catchment areas in the Borough is provided in Figure A1 of Appendix A.

4.3 Historic flooding

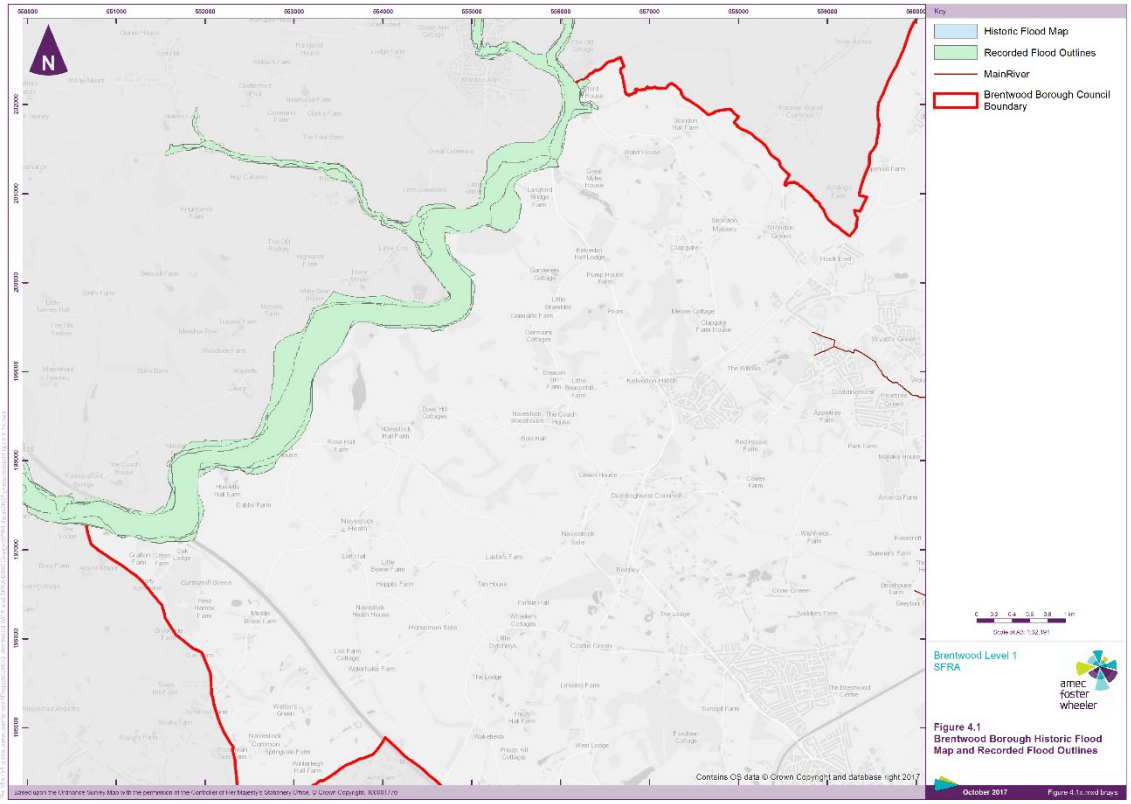
4.3.1 Previous flood incidents in Brentwood are largely a result of rapid surface water runoff and ponding in areas such as low lying roads. Surface water incidents were recorded in 2000, 2004, 2010 and 2011 (Essex Fire and Rescue), notably a vehicle stuck in 2ft of water in Ingatestone in 2010.

4.3.2 Historic fluvial flooding was reported by Essex Fire & Rescue in 2001, at multiple locations in Ingatestone. The Environment Agency Historic Flood and Recorded Flood Outlines datasets show the only recorded flood extents within the Borough were from flooding of the River Roding in the north-east, as shown in Figure 4.1 below. The dataset includes recorded flood outlines on the River Roding for multiple flood events, from 1968 – 2001.

4.3.3 Further historic fluvial flooding is shown in Environment Agency mapping in Appendix E. A flood extent from the 1958 event is shown on along the River Wid, and along the River Mardyke for the 1968 event.

[3] See https://www.gov.uk/guidance/owning-a-watercourse

Figure 4.1 Historic flood map and recorded flood outlines



4.4 Fluvial risk and flood zones

Flood zones and functional floodplain

4.4.1 Flood Zones are described throughout this SFRA and they refer to flood extent datasets held by the Environment Agency. The published datasets are updated on a quarterly basis to capture any refinements as a result of detailed hydraulic modelling projects commissioned by the EA.

4.4.2 NPPG definitions of the Flood Zones are presented below:

- **Zone 1**/Low Probability
  Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
- **Zone 2**/Medium Probability
  Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map).
- **Zone 3a**/High Probability
  Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding (Land shown in dark blue on the Flood Map).
- **Zone 3b**/The Functional Floodplain
  This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map).

4.4.3 Figures A3a-3d (in Appendix A) illustrate the extent of the Environment Agency's Flood Zones 2 and 3 (accessed online via the Environment Agency Spatial Data Catalogue September 2017).

4.4.4 Flood Zone 3 is typically subdivided into Zones 3a and 3b through use of detailed hydraulic modelling to inform flood extents. In the absence of detailed hydraulic models for the majority of the Borough, it has not been possible to delineate areas of functional floodplain for the whole Borough. Therefore, in line with NPPG this SFRA recommends that all Flood Zone 3 in areas outside of the extents of the Rivers Wid and Mardyke models should be considered as Flood Zone 3b for the purposes of spatial planning, until demonstrated otherwise through site specific flood risk assessments. In line with NPPG (Table D.3 – Appendix D), this approach would exclude all but essential infrastructure (pending application of the Exception Test) and water compatible uses from Flood Zone 3. This designation should remain until that time when either a Level 2 SFRA or a site specific FRA defines Flood Zones 3a and 3b in the affected sites. The definition of Flood Zones 3a and 3b will be necessary if development is proposed within areas of Flood Zone 3.

4.4.5 The Environment Agency holds detailed hydraulic models covering stretches of the rivers Wid and Mardyke. These include an assessment of the 1 in 20 annual probability event, giving an indication of the subdivision of Flood Zone 3 into Zones 3a and 3b. At these locations, the detailed model outputs can be used to map the functional floodplain.

4.4.6 The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses. Climate change allowances based on guidance on NPPF are detailed in Section 4.7.

4.4.7 Flood Zones are determined without consideration to the presence of flood defences. The Flood Zones are intended to provide an appreciation of potential flood risks that exist, and indicate the areas which should be considered in the planning process. However, there are no formal flood defence structures operated by the Environment Agency in Brentwood.

4.4.8 Overall, the Flood Zones are confined close to the watercourses from which they originate and are not extensive in Brentwood Borough. These flood zone extents are subject to change as part of the Environment Agency's ongoing programme of Flood Map improvements. Current Flood Zone extents are sufficient to inform spatial planning; however, it is advised that for site specific applications, the Environment Agency always be consulted to ascertain the exact Flood Zone delineation at a given location.

Flood zonation for unmodelled main rivers or ordinary watercourses

4.4.9 It is possible that there is a flood risk associated with other stretches of unmodelled main river and 'ordinary watercourses' in the Borough, which are not currently modelled or mapped by the Environment Agency, an example of which is provided in Figure 4.2. In this instance, the flood risk from surface water maps may be used to provide some insight to the risk posed by the unmodelled watercourse, as shown in Figure 4.3. Although there is therefore no associated flood zone with this watercourse, it does drain through an urban area and is most likely subject to rapid surface water runoff during storms and channel constrictions such as culverts which may be prone to blockage.

4.4.10 It would be prudent to use the extent of the surface water maps along the courses of these unmodelled main rivers and all ordinary watercourses as a proxy for Flood Zone 3 in lieu of more detailed modelling or site-specific assessment.

4.4.11 For development in areas where the Environment Agency do not have model coverage, the developer will be required to create their own model in order to accurately establish the risk to the development in terms of potential depths and locations of flooding. This should include a range of return period events with and without climate change allowances.

Figure 4.2 An example of an unmodelled watercourse

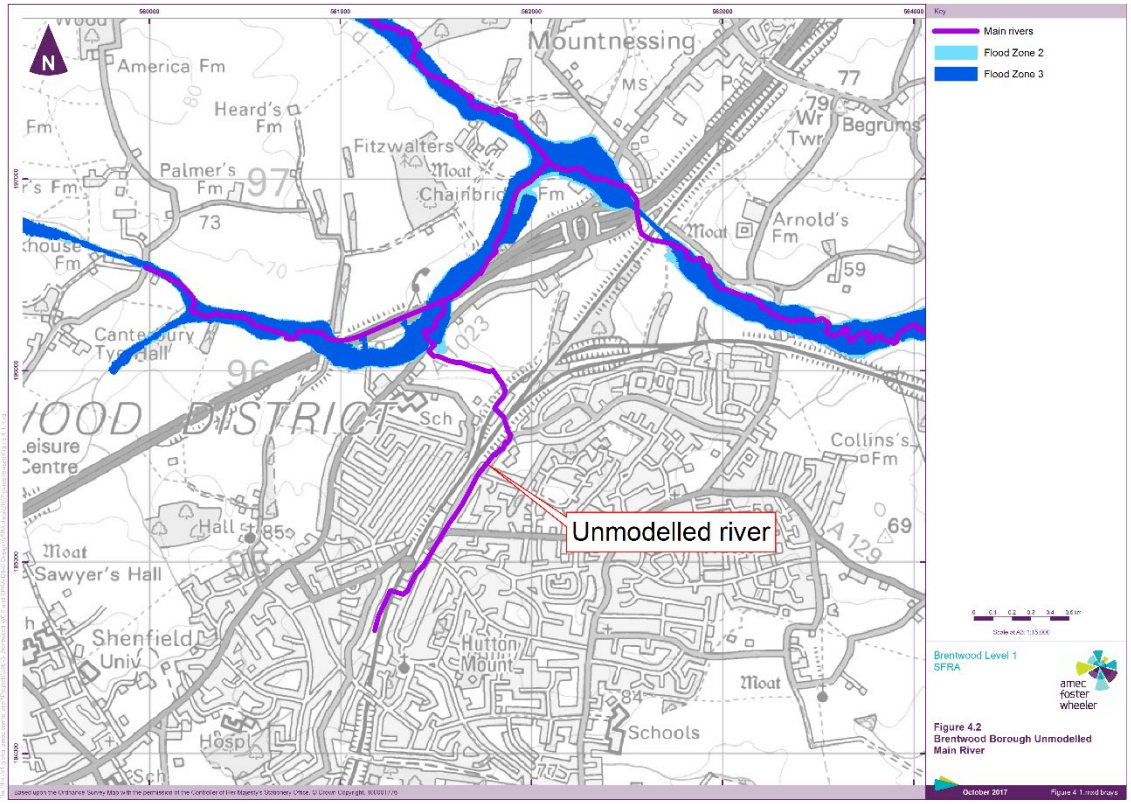
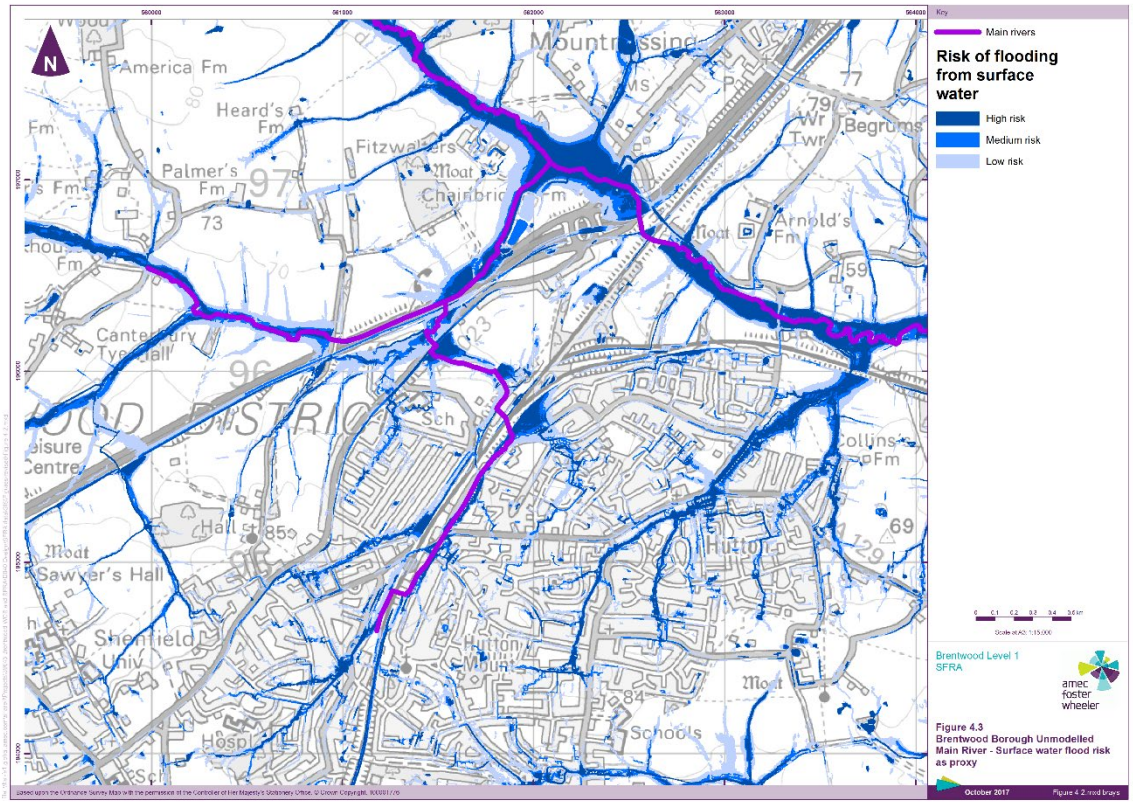


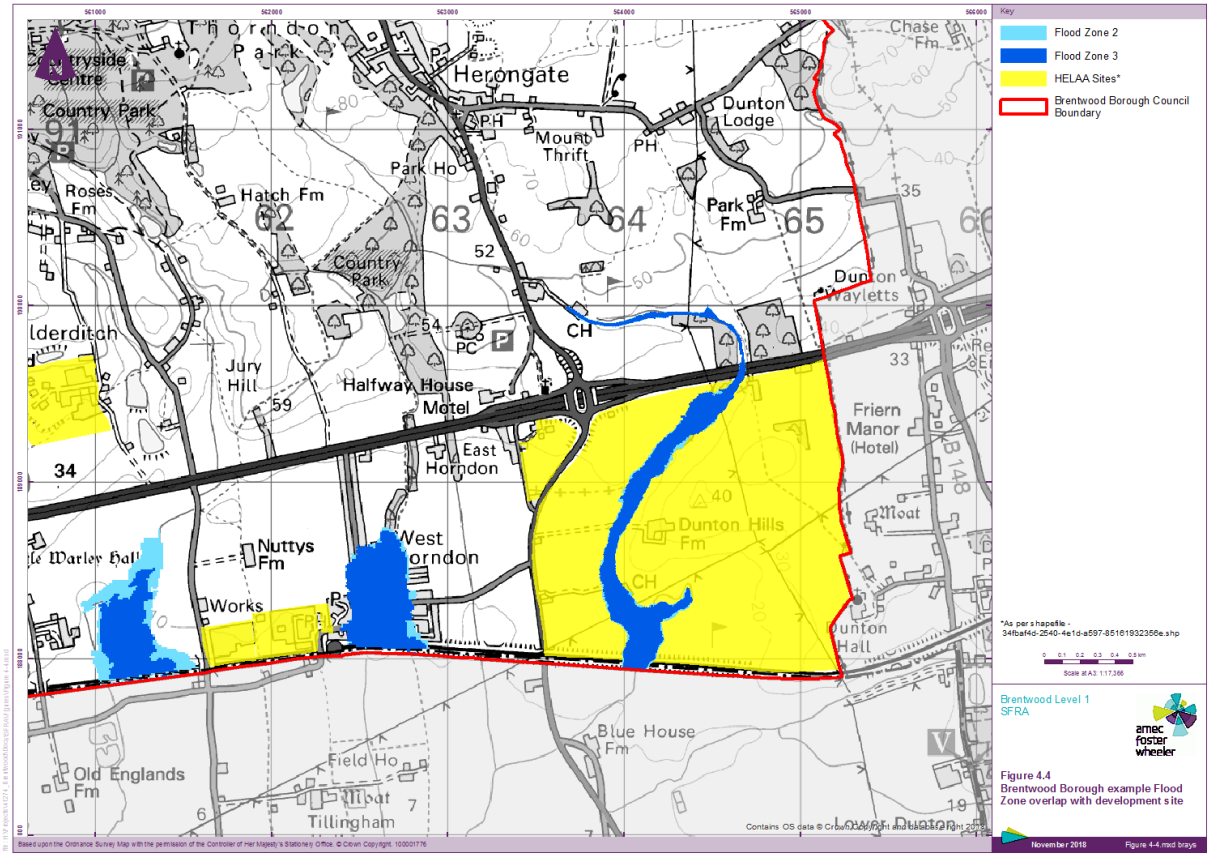
Figure 4.3 Using surface water flood risk maps as proxy for unmodelled watercourses



Fluvial flood risk

4.4.12 Environment Agency fluvial Flood Zones within the Borough generally do not extend far beyond the boundaries of the respective watercourses from where the flooding is shown to originate. This is typical for areas located in the headwaters of hydrological catchments where streams tend to be incised and peak flows are smaller than lower in the catchments. Fluvial flood risk is displayed in Figures A3a-d, with a selected example of fluvial risk coinciding with proposed HELAA development sites shown below in Figure 4.4.

Figure 4.4 Fluvial flood risk and proposed development



4.4.13 Detailed hydraulic models for fluvial flood risk exist only for sections of the River Wid in the north-east of the Borough, and the Mardyke along the southern boundary. Elsewhere, the mapped Flood Zones are based on the relatively coarse JFLOW model runs undertaken by the Environment Agency, on a national scale for all catchments with an upstream area greater than 3 km^2. JFLOW is a type of river model, which produces flood extent predictions without the inclusion of river channel features or structures. This approach was adopted for use in the Environment Agency's national mapping programme, which has recently been improved through the addition of a more detailed terrain model for the area, however it cannot be considered to provide a detailed, local assessment,. Detailed modelling studies can be used to refine flood extents where the existing resolution is deemed too coarse. Such modelling may be undertaken on main rivers by the Environment Agency as part of their national Strategic Flood Risk Mapping programme. Site specific Flood Risk Assessments (FRAs) may also include detailed modelling at the local scale to refine flood risk information at the site.

4.5 Other sources of flood risk

Tidal

4.5.1 The Borough of Brentwood is not at risk from tidal flooding and this is not considered further in this SFRA.

Groundwater

4.5.2 Historically, groundwater flooding has not always been considered in sufficient detail in the SFRA process, principally as a result of a lack of data to support strategic level decision making. However, the potential flood risk associated with groundwater flooding is increasingly being recognised.

4.5.3 The North Essex, South Essex and Thames Catchment Flood Management Plans (CFMPs) states that there have been no records of groundwater flooding in the Borough although it notes that the areas of Thurrock and Tilbury to the south of the Borough are at risk from groundwater flooding due to high groundwater levels in the underlying chalk.

4.5.4 Limited groundwater contour data is available for the extreme west of the Borough. These give groundwater levels typically between -10m and 10m AOD where ground levels range from 30m-70m AOD indicating that there is no risk from groundwater flooding.

4.5.5 The Essex County Council Preliminary Flood Risk Assessment (PRFA) confirms that the two incidences of reported groundwater flooding occurred within the county but these were both outside of the Borough boundary.

Surface water

4.5.6 Surface water flooding is the term applied to flooding when intense rainfall overwhelms the ability of the land to infiltrate water, or in urban areas for the sewers and road drains to drain the water away, resulting in surface water runoff and consequent flooding. It is a particular problem in urban areas where the excess water will often travel along streets and paths, between and through buildings and across open space. It can result in indiscriminate flooding to properties when not controlled. The high profile flooding across the UK in the summer of 2007 was largely attributed to excess runoff where the capacity of the drains was exceeded by intense summer rain storms and led to the Government commissioning an independent review (see Box 1).

Box 1 The Pitt Review

In response to widespread and severe flooding in the UK during the summer of 2007, much of it from surface water, the Government commissioned an independent review on the lessons to be learned. The Pitt Review was comprehensive and considered all stages of flooding - preparedness, response and recovery - as well as the coordination, responsibilities, and legislation necessary to ensure the United Kingdom can advance in the area of flood risk management. A total of 92 recommendations were made. Amongst other recommendations the Review emphasised the need to consider surface water flooding in more detail, and recommended that local authorities should take the lead in managing local flood risk. The basis for this should be through a Surface Water Management Plan.

4.5.7 Since the last SFRA, significant updates to the available data on surface water flood risk has been made available through the Environment Agency. This is displayed in Figures A4 a-d, where it can be seen that the settlements of Brentwood, Blackmore, Doddinghurst, Heybridge, Ingatestone may all contain areas which are potentially vulnerable to surface water flooding. Key infrastructure such as the A12 to the north west of Brentwood is also shown to be vulnerable in places and it is known that this road has been flooded by surface water in the past (e.g. March 2010).

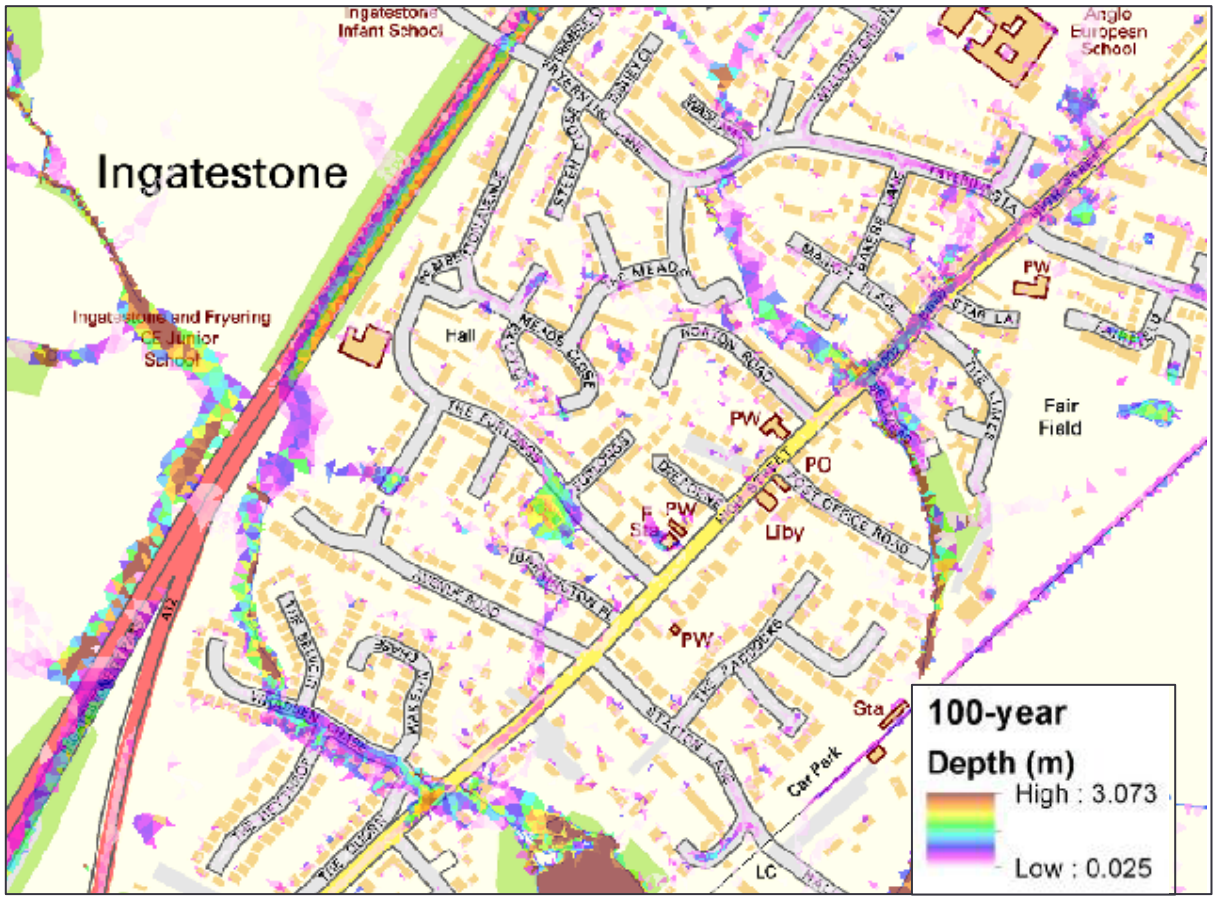
Surface Water Management Plan[4]

4.5.8 This SFRA has mapped the surface water flood maps using the data available on the Environment Agency mapping services. The previous SFRA summarises settlements that contained areas that are potentially vulnerable to surface water flooding, and provided guidance for a Surface Water Management Plan (SWMP) to provide a more detailed assessment of risk from surface water flooding.

4.5.9 The SWMP, conducted by JBA Consulting in 2015, identified surface water flooding hotspots at West Horndon, Ingatestone and Brentwood Town Centre. These hotspots were then assessed in further detail using the hydraulic modelling software Infoworks ICM. Surface and sewer flood risk sources were considered, using sewer network data provided by Anglian Water. A range of rainfall events and durations were assessed to produce flood depth and hazard maps for the Borough, giving detailed information about potential surface water flood risk.

4.5.10 In these three areas where detailed hydraulic assessment of surface water flood risk was undertaken, the results of the modelling undertaken in the SWMP supersede the Environment Agency Risk of Flooding from Surface Water maps. The mapping is available in the SWMP, with Figure 4.5 below showing an example of the model output, for the 1 in 100 annual probability event at Ingatestone High Street.

Figure 4.5 Flood Depth in the vicinity of Ingatestone High Street for the 1 in 100 annual probability event. Reproduced from the Brentwood SWMP



4.5.11 A number of Critical Drainage Areas were identified in the SWMP which show a complex interaction of surface and sewer water flooding. These areas are used in the screening assessment of the HELAA development sites.

[4] http://www.brentwood.gov.uk/pdf/29052015103139u.pdf

Reservoirs and other artificial sources

4.5.12 A visual survey of OS50k mapping data has shown that no significant water bodies exist either within Borough or at any locations upstream. As described in Section 2, and as can be seen from Figure A1, Brentwood is situated at the head of four river basin catchments and as such residual risk from reservoir failure does not feature as a consideration in this SFRA. The Environment Agency Flood Risk from Reservoirs mapping shows that there are only small areas at risk from reservoir flooding within the Borough. This is confined to an area associated with an unnamed water course flowing from Herongate to the River Wid being at risk from the failure of Herongate reservoir, and also an area to the south of Childerditch being at risk from Dartridge.

4.5.13 Flooding from sewers occurs when the sewer network cannot cope with the volume of water entering it. This is typically experienced in times of very high rainfall, or by a blockage or siltation. There is one recorded instance of sewer flooding in the Borough, at Ingatestone, as reported in the Brentwood SWMP.

4.6 Flood management infrastructure

4.6.1 There are no formal flood defences owned and operated by the Environment Agency within Brentwood Borough, although there are sections of main river where the EA carries out maintenance activities such as along lengths of the River Wid and its associated tributaries.

4.6.2 If planning for future flood risk management infrastructure it is important to be aware of investment and maintenance plans under the wider flood risk management approach. The South Essex Catchment Flood Management Plan[5] (CFMP) identifies long term flood risk management policy and strategy for the wider region with Brentwood Borough being located within an area to which Policy 6 is applied (see below):

> 'Take action to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits.'

4.6.3 The North Essex[6] and Thames[7] CFMPs, covering the Rivers Wid and Roding respectively, identify flood management infrastructure, such as river flow gauging stations, as important to maintain to ensure flood warning systems are able to function properly. Both watercourses are assigned Flood Risk Management Policy 6:

"Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits."

4.6.4 The focus of the CFMPs' policy designations for the Borough is on water storage and risk reduction. This should be incorporated in the design of any additional flood management infrastructure required by the development sites identified in the HELAA.

4.7 Climate change

4.7.1 Climate change is frequently cited as being one of the most significant threats to the long-term sustainability of our environment. It is essential that the likely impact of climate change on the extent of the future Flood Zones is considered if development is to be sustainable over the long term.

[5] https://www.gov.uk/government/publications/south-essex-catchment-flood-management-plan
[6] http://webarchive.nationalarchives.gov.uk/20140328154517/http://cdn.environment-agency.gov.uk/gean0909bpcf-e-e.pdf
[7] http://webarchive.nationalarchives.gov.uk/20140328155012/http://cdn.environment-agency.gov.uk/geth1209bqyl-e-e.pdf

Climate change policy

4.7.2 The NPPF provides guidance on how the planning system should minimise vulnerability and provide resilience to the impacts of climate change. Flood Risk Assessments should demonstrate how flood risk will be managed over the development's lifetime, taking climate change into account.

4.7.3 The climate change allowances provided by the Environment Agency and included in NPPG set out estimates of climate change allowances to be used in Strategic Flood Risk Assessments and site specific Flood Risk Assessments.

4.7.4 Peak river flow climate chance allowances are specific to each river basin district. The main rivers in the Borough fall into the following river basin districts:

- Rivers Roding and Ingrebourne – **Thames River Basin District; and**
- Rivers Wid and Mardyke – **Anglian River Basin District.**

4.7.5 Peak rainfall intensity allowances apply across the entirety of England.

4.7.6 Both allowances guidance provide climate change uplifts for periods of time over the next century. Table 4.1 and Table 4.2 below set out the estimates for climate change impacts on river flows and rainfall, reproduced from NPPF.

Table 4.1 Peak river flow allowances

River Basin District	Allowance category	Total potential change anticipated 2015 - 2039	Total potential change anticipated 2040 - 2069	Total potential change anticipated 2070 - 2115
Thames	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	25%

Table 4.2 Peak rainfall intensity allowances

Applies across all of England	Total potential change anticipated 2015 - 2039	Total potential change anticipated 2040 - 2069	Total potential change anticipated 2070 - 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Assessment of climate change impacts

4.7.7 Managing climate change and the associated heightened flood risks are key components of NPPF. This SFRA assesses climate change at the strategic scale by considering its impacts resulting in increased flood extents. All Flood Risk Assessments to be undertaken within the Borough should take into account climate change, for at least the next 100 years, unless it can be demonstrated that the development will have lifespan of less than 100 years in which case a shorter horizon would be considered acceptable, upon agreement with the Environment Agency.

4.7.8 Figure A5 provides an indicative assessment of how climate change may influence the extent of Flood Zone 3. It focuses on the residual difference between Flood Zone 3 and Flood Zone 2. The difference is highlighted to show that in these areas an increase in river flow may result in a notable difference in flood extent.

4.7.9 For the ordinary and unmodelled watercourses in the Borough, Figures A6a-d provide an indicative assessment of areas potentially vulnerable to climate change, by using the Risk of Flooding from Surface Water extents. The difference in extent between the 1 in 100 annual probability event and the 1 in 1,000 annual probability event is highlighted, acting as a proxy in lieu of detailed hydraulic analysis with climate change uplift. Where watercourses and unmodelled, these will need to be modelled by any future developers.

4.7.10 Sections of the River Wid in the north east of the Borough and the River Mardyke in the south have been assessed through detailed hydraulic modelling, including assessing the potential impacts of climate change. The model outputs as provided by the Environment Agency are supplied in Appendix E. It should be noted that the climate change uplifts applied are no longer current, and the results are therefore indicative only, with further hydraulic assessment required for any proposed development.

Spatial planning response

4.7.11 All flood risk assessments should factor in an assessment of climate change. If sites are located in or partially within Flood Zones 2 or 3 then the FRA should assess how the 1 in 100 year flood extent will be affected by climate change following guidance laid down in NPPF and on advice from the Environment Agency. If no such assessment is made then a precautionary approach should be adopted whereby it should be assumed that Flood Zone 2 represents the extent of the 1 in 100 year with climate change design flood, for spatial planning purposes only. For site specific FRAs, full assessment of climate change impacts beyond this proxy approach should be considered. In the absence of detailed hydraulic modelling for the majority of the Borough, the proxy approach is used in this instance for initial screening of the HELAA sites.

4.8 Summary of flood risks

4.8.1 Fluvial flood risk in the Borough of Brentwood is not extensive and is largely limited to areas in very close proximity to local watercourses. Risk of flooding from surface water presents a more extensive zone of risk than the fluvial flood zones in Brentwood; this is because the fluvial flood zones in Brentwood are relatively narrow owing to the 'headwater' nature of most of the watercourses. The most likely mechanism for surface water runoff generation is when heavy rainfall exceeds the capacity of the local drainage network and of the ground to infiltrate water.

4.8.2 Table 4.3 summarises the flood risk in Brentwood.

Table 4.3 Flood risk summary

Type/Source of Flooding	Risk?	Description
Fluvial Flooding	Yes	Some flooding along eastern boundary of Borough from the River Wid and from Stondon Hall Brook and the River Roding in the north west of the Borough.
Surface Water Flooding	Yes	Affects numerous areas across the Borough. Mostly consists of land drainage issues causing flooding to public highway most notably on the A12 north west of Brentwood and on roads around Ingatestone.
Groundwater Flooding	No	No historic records of this type of flooding within the Borough. Available data suggests this is not thought to be a source of flooding.

Type/Source of Flooding	Risk?	Description
Tidal Flooding	No	Elevations put Borough outside of any tidal flood risk zone.
Artificial	No	Not at risk from reservoir sources, limited data on sewer flooding but appears to be due to surface water risk.

5. Flood risk management through planning

5.1 Introduction

5.1.1 The approach outlined in this SFRA follows the sequential risk based approach advocated by NPPF. This chapter discuss how flood risk can be managed through the spatial planning process. Avoidance is the principal method of managing flood risk through the spatial planning process and is discussed further in this chapter. If, in exceptional circumstances, development is proposed in areas of flood risk, Chapter 6 proposes guidance on managing the risk through site layout and building design.

5.2 Sequential approach

5.2.1 Through the planning process, NPPF aims to reduce the flood risks faced by future developments, and advocates a risk avoidance approach to spatial planning. The flood risk tables from NPPG on Flood Risk and Coastal Change have been reproduced in Appendix D of this SFRA for reference purposes. A sequential risk-based approach to determining the suitability of land for development in flood risk areas is central to the Policy Statement and should be applied at all levels of the planning process.

5.2.2 Application of the sequential approach to spatial planning reinforces the most effective risk management measure – that of avoidance.

5.2.3 The sequential approach offers a simple decision making tool that is designed to ensure that areas of little or no risk of flooding are developed in preference to areas at higher risk. NPPF notes that LPAs should make the most appropriate use of land to minimise flood risk, by planning the most vulnerable development in the lowest known risk areas. However, it is recognised that there are cases when development within higher risk zones is unavoidable.

5.2.4 Sites which the Level 1 SFRA has identified as being in Flood Zone 1 should be assessed for delivering projected growth over the plan period, before sites within Flood Zones 2 and 3. Only if there are insufficient sites, or because other sites located within flood risk areas need to be developed for wider sustainability reasons, should sites within Flood Zones 2 and 3 be considered.

Sequential test

5.2.5 The Sequential Test is a key component of the hierarchical approach to avoiding and managing flood risk. The SFRA has mapped flood risk zones in the Borough (Figures A3 a-d in Appendix A). Table 5.1 presents details of land use types appropriate[8] for each zone. Further guidance on the appropriateness of land use types for each zone are presented in Table D.2 (in Appendix D). There are several key points that the Council should consider when applying the Sequential Test, these are outlined below.

- Increasing the vulnerability of a site by proposing an alternative use of a higher vulnerability (even if consistent with the risk) is considered an increase in flood risk and not in line with the principles of NPPF;
- The most vulnerable land uses should be allocated first, in areas of least risk; and
- Placing less vulnerable uses in low risk areas and thus reducing the amount of available space for more vulnerable uses in the lower risk zones is not appropriate. Such a situation can only be considered if it can be demonstrated that the only suitable site for the low vulnerability land-use, is in the area of low risk.

[8] Appropriate = as defined by Table D.2 in Appendix D of this report, reproduced from NPPF

Data to support allocation of the sequential test

5.2.6 Flood risk classifications defined for the Borough are presented in Figures A3 a-d (in Appendix A). The Borough is coloured from dark blue (highest flood risk) to white (lowest flood risk). Table 5.1 presents guidance on appropriate land use guidance for each of the flood risk zones. Figures A3 a-d and Table 5.1 can be used to guide the decision making process when the Council is presented with windfall sites.

5.2.7 In the Borough the SFRA recommends that 'Functional Floodplain' status is applied to all of Flood Zone 3 extent (as described in Section 4.4), with the exception of the areas for which the EA hold detailed modelled data (Rivers Wid and Mardyke). From a spatial planning and development control perspective, all areas of Flood Zone 3 should have the Flood Zone 3b planning restrictions applied, as per Table D.2 in Appendix D. This designation should remain in place until that time when it is proven otherwise through the use of detailed hydraulic models which adequately define the actual extent of the Functional Floodplain. It is recommended that a 1D-2D linked model would be the most appropriate modelling approach for this. As part of this modelling it is recommended that the model defines the flood depth, velocities and hazard rating associated with flood return periods up to and including the 1 in 100 year (plus climate change) event. This will enable a sequential approach to be applied to the spatial distribution of land uses within the floodplain.

Table 5.1 Attribution of Flood Risk to Development Sites

Environment Agency Flood Zone Name	Probability	NPPF Land use Guidance
Flood Zone 3b	Functional Flood Plain	Only the water compatible uses and essential infrastructure listed in Table D.2 (Appendix D) should be permitted in this zone. Development should be designed and constructed in such a way to: ► remain operational and safe for users in times of flood; ► result in no net loss of floodplain storage; ► not impede water flows; and ► not increase flood risk elsewhere Essential Infrastructure in this zone should pass the Exception Test
Flood Zone 3a	High	Water compatible and less vulnerable uses of land are appropriate in this zone. Subject to the Sequential Test being applied, more vulnerable and essential infrastructure are only appropriate in this zone if the Exception Test is passed. All development proposals in this zone should be accompanied by a FRA.
Flood Zone 2	Medium	Water compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone. Subject to the Sequential Test being applied, the highly vulnerable uses in table D.2 are only appropriate in this zone if the Exception Test is passed. All development proposals in this zone should be accompanied by a FRA
Flood Zone 1	Low	All uses of land are appropriate in this zone. Other sources of flooding should be reviewed. FRAs are required for sites over 1ha and Drainage Impact Assessments are required for sites over 0.25 ha (See Section 5.1)

Guidance for zones 3b, 3a, 2 and 1 based on Table D.1 in Appendix D.

Other sources of Flooding

5.2.8 When considering the Sequential Test, the potential extent of surface water flow routes and ponding areas (Figures A4a-d, Appendix A) should be reviewed. If there are two otherwise equally suitable sites for development in Flood Zone 1, with one site identified as being potentially at risk of surface water flooding and the other site outside the potential zone of surface water flood risk, then the site outside the potential surface water flooding risk zone should be preferentially selected for development.

5.2.9 Figures A4a-d (in Appendix A) can also be used to inform site specific FRAs as to where there may be a risk posed by surface water.

Implications for the Borough of Brentwood

5.2.10 Figures C1-3 show the sites included in Brentwood's Housing and Economic Land Availability Assessment (currently being updated), against the EA Flood Zones, Risk of Flooding from Surface Water and Critical Drainage Areas. The vast majority of sites lie outside of Flood Zones 2 and 3 meaning that all development is suitable at these locations with regard to fluvial flood risk.

5.2.11 Some of the sites identified through the HELAA, such as those on Greenfield land to the south-east of Brentwood urban area, lie partly within Flood Zones 2 and 3 associated with Haveringsgrove Brook[9]. These sites have the majority of land area in Flood Zone 1. In the event that these sites are taken forward, site selection and design should prioritise Zone 1 development over development in Zones 2 and 3.

5.2.12 With most of Flood Zone 3 being classified as functional floodplain this imposes limitations on the types of development which are appropriate in this zone. All development proposed in Zone 3 will need to undergo a Flood Risk Assessment which will delineate Flood Zones 3a and 3b and determine what proportion of the site falls within each one. Where a single development site spans multiple Flood Zones then a sequential approach should be sought within the site whereby development is allocated firstly to areas of lower risk. This is covered in further detail in Section 6.3.

5.3 Exception Test

5.3.1 The Exception Test recognises that there will be some exceptional circumstances when development within higher risk zones is unavoidable, although this is unlikely to be the case in Brentwood. The allocation of necessary development must still follow the sequential approach and where exceptions are proposed, the Exception Test must be satisfied.

5.3.2 Instances where FRAs are required to support the planning applications are discussed in Section 8. Flood mitigation measures should be considered as early as possible in the design development process to reduce and manage the flood risks associated with development. Section 6 describes how flood risk can be managed through development design.

5.3.3 If the Sequential Test shows that it isn't possible to use an alternative site, the Exception Test is required if the development is classified as:

- highly vulnerable and in flood zone 2;
- essential infrastructure in flood zone 3a or 3b; and
- more vulnerable in flood zone 3a.

Passing the Exception Test

5.3.4 NPPF states that the Exception Test should be undertaken but only after the Sequential Test has been applied. The Sequential Test successively applied must demonstrate that there are no other reasonably alternative sites available in zones of lower flood risk. This is an essential evidence base and should be considered a prerequisite for any development proposed in a zone of flood risk. Once the Sequential Test has been applied and passed, NPPF requires the Exception Test to then demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risks. Where development is essential in a flood risk zone, NPPF preferentially directs development to be on previously developed land, if this is not possible it must be demonstrated that there are no reasonable alternative sites on developable previously developed

[9] Haveringsgrove Brook is currently being scoped as part of a new model for the River Wid and River Blackwater Tributaries

land. The final requirement of the Exception Test states that the development must be safe, without increasing the flood risk elsewhere and where possible reduce overall flood risk.

5.3.5 To pass the Exception Test, the following criteria must be met:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- 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.

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

Flood Risk Assessment requirement of the Exception Test

5.3.7 The Exception Test requires a FRA, demonstrating that the proposed development will be safe, without increasing the flood risk elsewhere. To achieve this, NPPF identifies a number of factors which need to be considered:

- Safe access and egress;
- Operation and maintenance;
- Design of development to manage and reduce flood risk wherever possible;
- Resident awareness;
- Flood warning; and
- Evacuation procedures and funding arrangements.

5.3.8 These key aspects are expanded in Section 6, where flood risk management is discussed in terms of design and emergency responses.

6. Flood risk management through design

6.1 Introduction

6.1.1 This section only applies to development within Flood Zones 2 and 3. As outlined in Section 4.4 most of Flood Zone 3 is designated 'Functional Floodplain', with the exception of areas for which the EA hold detailed models (Rivers Wid and Mardyke). This designation should be observed as part of any development proposal. Any development within Flood Zone 3 must be supported with hydraulic modelling which assesses the flood hazard, depths and velocities associated with a range of return periods up to and including the 1 in 1000 year plus climate change return period. The hydraulic modelling should define the extent of Flood Zone 3b. The requirements of the modelling should be agreed with the Local Planning Authority (LPA) and the Environment Agency in advance.

6.1.2 Only when the flood risks are fully understood and where the principal of avoidance has been first applied, should flood risk management be attempted through design. This section of the SFRA presents flood risk management measures appropriate in Flood Zones 2 and 3. This is supplementary guidance to that provided in NPPF and NPPG. In all instances where development is proposed in areas of flood risk, it is recommended that the LPA and the Environment Agency are consulted early in the process to establish any site specific issues and requirements. Guidance on the scope of FRAs and useful sources of additional information are provided in Section 8 of this SFRA.

6.2 Approach

6.2.1 Flood risk management by design should only be considered after the sequential approach has been applied to development proposals. The sequential approach is applicable both in terms of site allocation and site layout. Only when it has been established that there are no suitable alternative options in lower risk areas, should building design solutions be considered to facilitate development in flood risk areas.

6.2.2 The sequential approach to land use planning on sites can mitigate some of the flood risks. However, there will be instances where a level of risk remains. In these circumstances, flood risk management through design is required. This would need to be addressed as part of site-specific FRA. The following sections provide some over-arching guidance when considering planning applications.

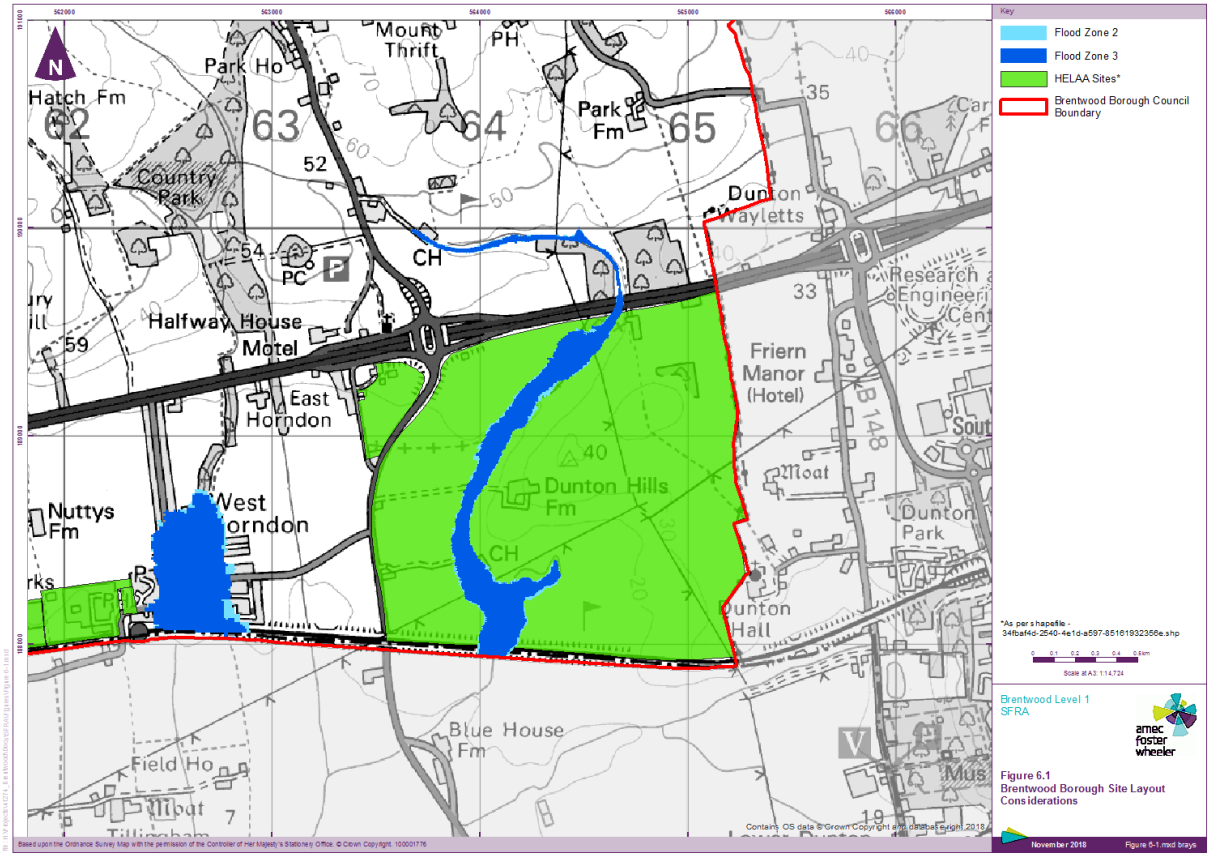
6.3 Site layout

6.3.1 Following the full application of the Sequential Test, a site may be proposed for development within a medium to high flood risk zone. The sequential approach to the spatial distribution of land uses on site should be deployed ahead of building design solutions.

6.3.2 In the instance that a site lies partially within Flood Zones 2 and 3, the sequential approach to site design can be applied to minimise flood risk. Detailed modelling undertaken as part of a site specific Flood Risk Assessment would allow refinement of predicted flood extents, potentially shifting some areas into zones of lower risk. Land use planning should reflect the differing degrees of flood risk in the vulnerability classifications of proposed land uses (see Table D.2. in Appendix D). Based on the existing flood zoning, water compatible uses could be placed in areas in Flood Zone 3, with less vulnerable uses occupying Flood Zone 2, and any more or highly vulnerable uses being placed in the area of lowest flood risk. Water compatible uses may include public open space and recreational or outdoor sport areas.

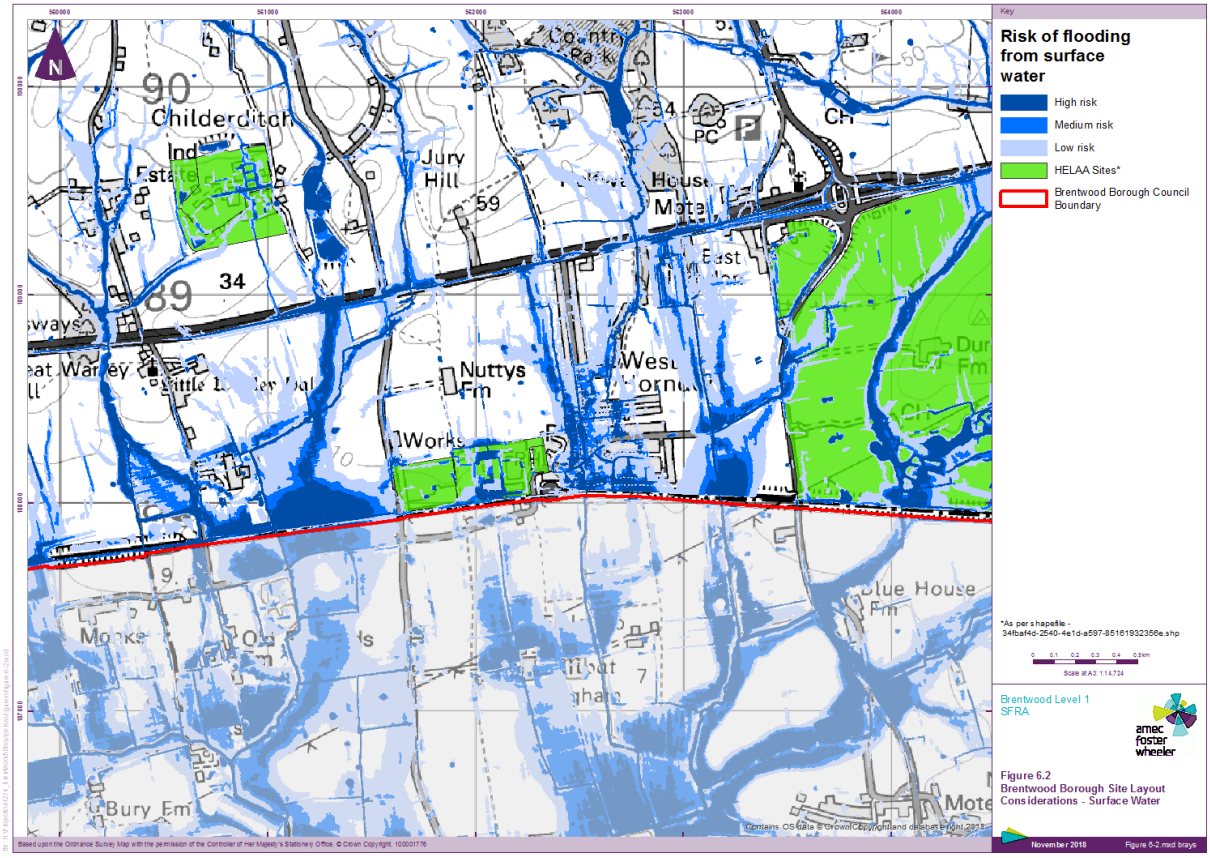
6.3.3 An example of where this approach would be applicable includes the Site seen in the south-east corner of the Borough, named "Entire land east of A218", and shown in Figure 6.1.

Figure 6.1 Site layout considerations



6.3.4 Figure 6.2 below provides an example of a site proposed in the HELAA which contains a surface water flow route. As with the above example, land use planning should reflect the variation in flood risk across the site area, locating development of higher vulnerability away from areas of surface water risk where possible.

Figure 6.2 Surface water flow route through potential development site



6.4 Development controls

6.4.1 Under exceptional circumstances, following the application of the Sequential Test, where development is proposed in areas of flood risk, it will be necessary for the design to incorporate certain flood risk management elements. The following paragraphs describe some of these control measures.

Development in fluvial flood risk areas

6.4.2 Figure A1 (in Appendix A), illustrates the extent of the Environment Agency's main rivers. To ensure that flood risk is considered as part of a development along the banks of any of these watercourses, a buffer zone along both banks has been implemented by the Environment Agency. The Environment Agency's policy is that any proposed development within 8 metres of the bank of a main river, or 8metres from the landward toe of any fluvial flood defence or culvert requires Environment Agency consultation. All development proposals within this zone should involve consultation with the Environment Agency.

6.4.3 Development within a fluvial flood risk area will be subject to Development Controls, including:

- The provision of safe access and egress - The FD2320/TR1 Report[10] (DEFRA, 2005) Section 7.5.3 states that 'new developments are required to provide safe access and exit during a flood'. Measures by which this will be achieved should be clear in the site-specific FRA. Safe access and exit is required to enable the evacuation of people from the development, provide the emergency services with access to the development during a flood and enable flood defence authorities to carry out necessary duties during the period of flood.

[10] https://www.thenbs.com/PublicationIndex/documents/details?Pub=DEFRA&DocID=275716

A safe access or exit route is a route that is safe for use by occupiers without the intervention of the emergency services. FD2320/TR1 emphasises that a route can only be completely safe in flood risk terms if it is dry at all times. However it is recognised that this is not always practicable, necessitating more detailed analysis.

- The specification of finished floor levels - Finished floor levels of more vulnerable uses should be above the predicted 1 in 100 annual probability water levels plus climate change and inclusive of a freeboard allowance. The freeboard allowance used may be site specific and will depend on developers' discussions with the LPA and the Environment Agency. Typically freeboard is 300mm if the site is behind hard defences and 600mm if not. Ideally less vulnerable land uses should also have floor levels that do not flood and this arrangement should be sought wherever possible.
- No increase in building footprint - The footprint of buildings should not be increased post re-development without mitigation to compensate for lost floodplain storage space. Such schemes should be discussed in detail with the LPA and the Environment Agency.
- Provision of compensatory storage - Compensatory storage will be required if the proposed development increases the built footprint in the floodplain. The resulting loss of floodplain storage will require compensation, through the lowering of land levels elsewhere within the site. Compensation should be provided for flood events less than and including the 1 in 100 annual probability plus climate change event. Storage should be provided on a level for level and volume for volume basis, so that the behaviour of the floodplain during a flood event remains unchanged. All proposals requiring compensatory storage should be discussed with the LPA and the Environment Agency.

Development in areas designated as functional floodplain (Zone 3B)

6.4.4 Development in the functional floodplain should be avoided in line with the Sequential Approach presented in NPPF. Only water compatible uses will be permitted providing there is no reduction on flood conveyance or flood storage. Less vulnerable, more vulnerable and highly vulnerable uses are not permitted in Zone 3b. Essential infrastructure may be permitted providing the Exception Test is satisfied.

Development in surface water flood risk areas

6.4.5 In accordance with NPPF, any new development proposed in Flood Zones 2 or 3, or in Flood Zone 1 if the site is greater than 1 hectare, must include a site-specific FRA, which will be reviewed by the Environment Agency. It is recommended that the site threshold for triggering a Drainage Impact Assessment as part of a Planning Application is 0.25 hectares. These Drainage Impact Assessments should be inclusive of a consideration of surface water drainage and measures to mitigate against any potential increase in run off. In addition to this, Figures A4 a-d should be reviewed to assess whether the site is within a zone of potential surface water flood risk. As part of these assessments, the respective water company (Anglian Water or Thames Water) should be contacted to discuss the proposed method of managing surface water;

6.4.6 Site specific FRAs should consider the local drainage infrastructure in detail. When preparing site specific FRAs the impact of blocked drains and the likely consequences should be established. If necessary it might be appropriate to slightly raise ground floor levels to reduce potential damages. This is not a requirement of NPPF, it is just a means of reducing the impact of a potential risk. Such mitigation should be supported by evidence to demonstrate that surface water flow routes are not altered to the extent that the risk of flooding is made worse elsewhere;

6.4.7 An area identified at risk from surface water flooding – either from flood mapping or from historical records – should not be excluded from development solely on that basis. Surface water flooding can often be carefully managed and good site design may not only reduce the risk of flooding on site but could also help alleviate flooding problems downstream from the development. Such opportunities for a strategic drainage approach are identified in the Brentwood SWMP; and

6.4.8 The management of runoff during the construction period is an important consideration, particularly for large sites and details of measures to mitigate for this phase of development are required as part of an FRA. The Water Framework Directive (WFD) places specific requirements on the management of non-point source pollution such as that from construction site silts. Methods to reduce the volume of solids (and runoff) leaving the site include:

- Phased removal of surface vegetation at the appropriate construction phase;
- Provision of a grass buffer strip around the construction site and along watercourses;
- The covering of stored materials;
- Ensuring exposed soil is re-vegetated as soon as feasibly possible;
- Protection of storm water drain inlets; and
- Silt fences, siltation ponds and wheel washes.

Consideration of climate change

6.4.9 Managing climate change and the associated heightened flood risks are key components of NPPF. Site specific FRAs should take into account climate change, for at least the next 100 years, unless it can be demonstrated that the development will have lifespan of less than 100 years in which case a shorter horizon would be considered acceptable, upon agreement with the LPA and the Environment Agency.

6.4.10 The potential impacts of climate change on river flows in Brentwood have been strategically assessed as part of this Level 1 SFRA. Further detail is provided in Section 4.7.

Basements

6.4.11 It is recommended that habitable rooms in basements should not be permitted in Flood Zones 2 or 3. Adaptation of existing properties, to include a basement for habitable rooms should be discouraged in Flood Zones 2 and 3. It is however recognised that the implementation of this may be challenging, as basement development is sometimes classified as Permitted Development when within the bounds of the existing building.

6.4.12 Basements for less vulnerable uses or non-habitable rooms must be designed with safe internal escape. Each application should be discussed with the LPA and the Environment Agency. Site specific analysis should accompany any proposal, to demonstrate that a proposed basement would not impede the flow of groundwater in such a way that the risk of groundwater flooding elsewhere is increased.

6.5 Building design

6.5.1 The final step in the flood risk management hierarchy is to mitigate through building design. NPPF considers this as the least preferred option and should not be used in place of the sequential approach to land use planning on a site.

6.5.2 The Department for Communities and Local Government[11] has published guidance on improving the flood performance of new buildings. The guide identifies a hierarchy of building design which fits within step 5 of the flood risk management hierarchy of NPPF (assess, avoid, substitute, control and mitigate). This is set out below:

- Flood avoidance:

Constructing a building and its surrounds (at site level) to avoid it being flooded (e.g. by raising it above the flood level).

[11] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7730/flood_performance.pdf

- Flood resistance:

Constructing a building in such a way to prevent flood water entering the building and damaging its fabric.

- Flood resilience:

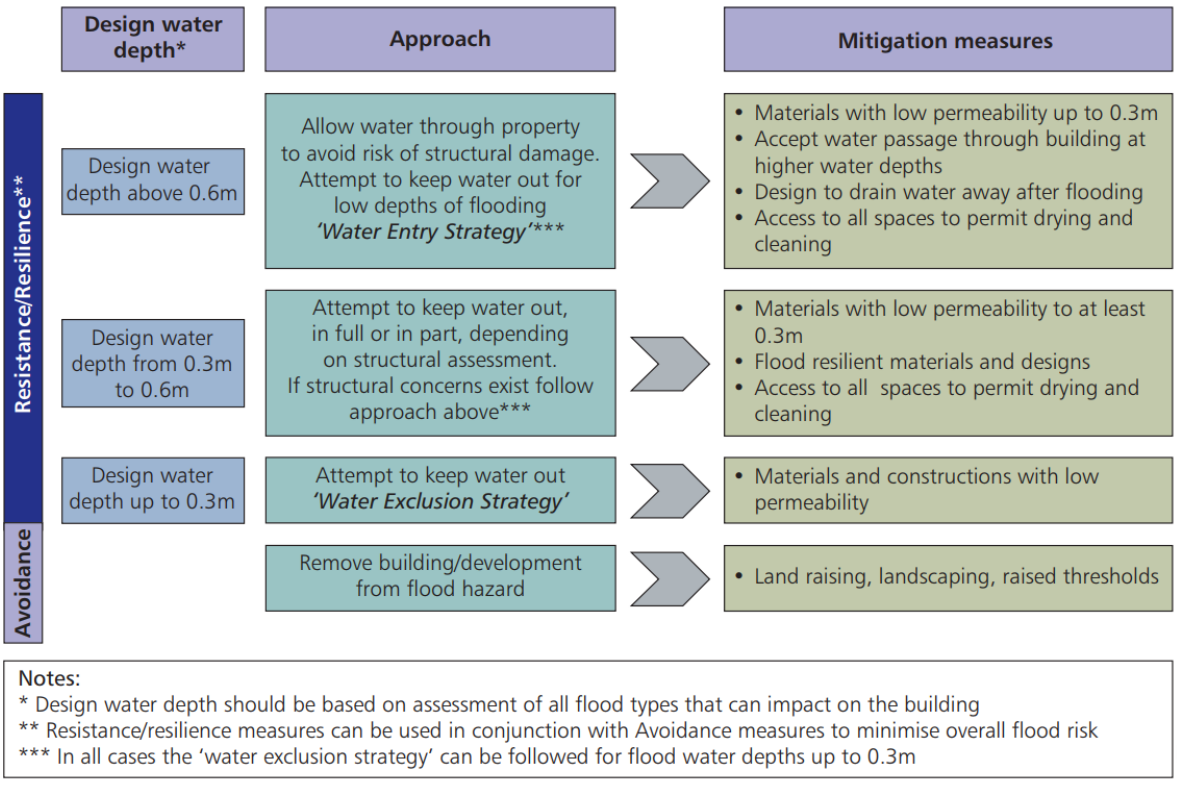
Constructing a building in such a way that although flood water may enter the building its impact is reduced (i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated).

- Flood reparable:

Constructing a building in such a way that although flood water enters a building, elements that are damaged by flood water can be easily repaired or replaced.

6.5.3 The Flood Resilient Construction Report (Defra, 2007), sets out to help the designer determine the best option or design strategy for flood management at the building site level, based on knowledge of basic flood parameters (e.g. depth, duration and frequency), these factors would normally be determined by the site specific FRA during the planning application process. Depending on these parameters (in particular depth) and after utilising options for flood avoidance at site level, designers may opt for a water exclusion strategy or a water entry strategy, as illustrated in Figure 6.3.

Figure 6.3 Flexible and risk averse approaches to flood risk management and save development – from 'Improving the Flood Performance of New Buildings – Flood Resilient Construction', Communities and Local Government (2007)



6.5.4 In a Water Exclusion Strategy, emphasis is placed on minimising water entry whilst maintaining structural integrity, and using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (up to a possible maximum of 0.6m).

6.5.5 In a Water Entry Strategy, emphasis is placed on allowing water into the building facilitating draining and consequent drying. Standard masonry buildings are at significant risk of structural damage if there is a water lever difference between outside and inside the building of about 0.6m or more. This strategy is therefore favoured when high flood water depths are involved.

6.6 Evacuation routes

6.6.1 In exceptional circumstances, pending successful application of the Sequential Test, development may be proposed in areas of flood risk. In such an event, safe escape routes to outside the flood risk zone should be incorporated into site designs to facilitate safe evacuation of the site. Additional detailed modelling of watercourses may be required to provide the necessary flood levels and speeds of onset and flood hazard classifications needed to inform safe evacuation routes. Safe routes should be identified both inside and beyond the site boundary of the new development. Even where a new development is above the floodplain and is considered to be acceptable with regard to its impact on flood flows and flood storage, it should be demonstrated that the routes to and from the development are also safe to use. Safe escape routes should be intuitively designed, so that they remain logical routes of escape during a flood event. In many cases, the adaptation of the normal access an egress routes so that they remain safe is the preferable option, rather than the engineering of routes specifically for use in flood events. Where possible, new development should aim to provide dry escape for the lifetime of the development and an emergency flood plan should be submitted as part of the FRA.

7. Sustainable surface water management

7.1 Surface water management and SuDS in Brentwood

7.1.1 Sustainable Drainage Systems (SuDS) are an approach to managing surface water that replicates natural drainage. The key objective are to manage the flow rate and volume of runoff at the source, to reduce risk of flooding and improve water quality. From 6 April 2015, the Planning Practice Guidance for Flood Risk and Coastal Change (PPG) was amended to provide a stronger emphasis on the usage of SuDS. LPAs are required to ensure that SuDS are incorporated in all major development plans where appropriate, and make sure that there are arrangements in place for ongoing maintenance over a development's lifetime.

7.1.2 LLFAs are statutory consultees for surface water drainage, and are required take account of new "non-statutory" national SuDS standards that have been introduced[12] as part of the update to NPPG.

7.1.3 Sites greater than 1 hectare in size in Flood Zone 1, and all development within Flood Zones 2 and 3 are covered by the legislation presented in NPPF, which dictates a FRA must accompany a planning application. This SFRA also recommends that planning applications for sites over 0.25 hectares in Flood Zone 1 are supported by drainage impact assessments. From a drainage perspective, these FRAs and Drainage Impact Assessments needs to detail how surface water is currently managed on site and how it is proposed to be managed post development. The discharge route (e.g. surface water drains or an open watercourse) should be detailed and it is important that there is evidence of either water company or Environment Agency consultation which includes approval of the discharge. These assessments should describe how current run off rates and volumes are managed, for brownfield site development this should include details of how rates and volumes will be reduced. If a reduction in runoff rates and volumes is not proposed the assessment must provide evidence to explain why this cannot be achieved.

7.1.4 Essex County Council are the Lead Local Flood Authority and in this role they will be required to act as SuDS approval body. The mechanism for this approval process should be established between Brentwood Borough Council and Essex County Council.

Runoff rates

7.1.5 A minimum requirement of NPPF is that post development rates of runoff must not exceed pre-development runoff rates. Furthermore, the Environment Agency and the Borough should seek to reduce runoff rates wherever possible.

7.2 Selecting appropriate SuDS

7.2.1 The applicability of SuDS techniques for use on potential development sites should be based on an assessment of the following key influences, put forward by CIRIA (2015)[13]:

- Land use characteristics favour different SuDS techniques. For example, industrial sites where pollution could be an issue are best managed with attenuation SuDS over infiltration SuDS, with multiple treatment stages;
- Catchment characteristics may have a bearing of the choice of SuDS, as particular catchments may be regulated for a sensitivity to flooding or pollution and may potentially be aggravated by one SuDS technique compared to another; and

[12] https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards - Non-statutory technical standards for sustainable drainage systems
[13] https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

- Quantity and quality performance would guide the choice of a particular SuDS technique and is dependent upon the requirements.

7.2.2 The SuDS Manual[14] 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:

- Infiltration;
- Detention/attenuation;
- Conveyance; and
- Water harvesting.

7.2.3 Proposed and existing land-uses are thought to be a significant factor in deciding appropriate SuDS techniques, as these influence the volume of water required to be attenuated. Existing or historic land uses have the potential to influence the choice of SuDS techniques by informing the likelihood of pollution and potential contamination issues. Indications of the most suitable techniques for individual sites cannot be made at a strategic level, however, since these will be governed by site specific characteristics and other considerations. Therefore, site specific FRAs will provide the required recommendations. The applicability of SuDS techniques can only be assessed in the SFRA through the consideration of regional characteristics relating to the underlying geology.

7.2.4 The selection of the appropriate technique(s) is/are dependent on various factors. These include the following:

- Soils – soil permeability has a significant bearing on the choice of infiltration SuDS techniques;
- Groundwater – infiltration techniques require several metres of soil depth between the base of the device and the maximum expected groundwater level;
- Area draining to single SuDS component – vegetative or filtering SuDS can attenuate smaller volumes of runoff than ponds which can handle larger volumes generated from a bigger area;
- Slope of drainage area – steeper slopes reduce the suitability of some SuDS techniques, such as infiltration, which require longer residence times; and
- Head – SuDS that require gravity to operate will require a positive head between inflow and outflow.

7.2.5 Table B1 (in Appendix B) CIRIA (2015) provides a summary of influential site characteristics which should be assessed at the site specific level.

Source Protection Zones

7.2.6 The Environment Agency has defined Source Protection Zones (SPZs) for 2,000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. SPZs are further subdivided into the following categories:

- SPZ1 (Inner SPZ – 50 day travel time or 50 metres): designed to protect against the effects of human activity which might have an immediate effect upon the source. SPZ1 was originally based on the need to protect against biological contaminants;
- SPZ2 (Outer SPZ – 400 day travel time or at least 25% of the recharge catchment area): designed to provide protection against slowly degrading pollutants; and
- SPZ3 (Catchment SPZ): covers the complete catchment area of the groundwater source.

[14] https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

7.2.7 In the Borough of Brentwood there are no SPZs and so there is no associated constraint on use of infiltration SuDS.

Groundwater vulnerability

7.2.8 Groundwater Vulnerability is a dataset held by the Environment Agency which maps the presence of aquifers and assesses the overlying soil type to determine infiltration potential. Aquifer categories are split into 'principal' and 'secondary', indicating productivity.

7.2.9 Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

7.2.10 Secondary Aquifers include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage.

7.2.11 Figure A7 outlines Groundwater Vulnerability classifications in Brentwood Borough. This dataset indicates that there are no areas underlain by principal (major) aquifers with secondary (minor) aquifers covering the majority of the area of Brentwood Borough. Soil classes, derived from the Hydrology of Soil Types database, indicate that there is a high potential for leachate infiltration for much of the urban area of Brentwood and for smaller areas along the north western border of the Borough. The majority of the Borough has medium to low infiltration potential or does not contain aquifers.

7.2.12 The groundwater vulnerability classification has been used as a surrogate for identifying land where infiltration potential is likely to be high and therefore where infiltration SuDS may be appropriate. The resulting map is shown in Figure A8 (Appendix A). Areas identified as being of 'high' suitability correspond to areas containing more permeable soil types which have the potential to receive more infiltration. Areas identified as being of 'low' suitability are likely to contain clayey soils or soils of a shallow nature which may reduce the volume and/or rate at which water can be infiltrated. The areas of 'no data' are characterised by London Clay, according to the 1:50,000 scale BGS Geology mapping. London Clay typically has low infiltration rates.

Restrictions and controls on the use of SuDS

7.2.13 In locations where infiltration techniques are not appropriate, solutions that attenuate runoff and discharge to surface water (the fluvial water bodies or surface water sewers) are likely to be the most appropriate. Such schemes will require consultation with the sewage undertaker (Anglian Water or Thames Water) to determine discharge rates and with the Environment Agency if it is proposed to discharge into a fluvial water body.

7.3 Using the SFRA to inform SuDS suitability

7.3.1 Infiltration/discharge to groundwater SuDS techniques are considered amongst the most sustainable solutions as maintenance requirements are comparatively low and the systems do not discharge to watercourses or the sewage undertakers piped drainage network.

7.3.2 Figures A7 and A8 indicate Groundwater Vulnerability and Infiltration Potential respectively. These maps are based on the British Geological Society aquifer types and Hydrology of Soil Types database. Areas of high groundwater vulnerability are likely to coincide with areas of high infiltration potential.

7.3.3 The SFRA mapping does not preclude the need to undertake site specific investigations and consultation with the Environment Agency. Issues of ground contamination, ground water pollution and technical feasibility will all have to be addressed at the site specific level.

7.4 Choice of SuDS

7.4.1 Appendix B outlines the range of possible SuDS options available, each offering different benefits. In selecting the most appropriate SuDS scheme for a new development consideration should be given to:

- The long term sustainability of the design;
- How water quality can be improved; and
- How biodiversity can be enhanced.

7.4.2 Oversized pipes and underground storage cells should be considered only when all other, more beneficial solutions, have been exhausted.

8. Flood Risk Assessments and windfall sites

8.1 Site specific Flood Risk Assessments

8.1.1 NPPF dictates that a Flood Risk Assessment (FRA) is required for 'proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding'.".

8.1.2 Table 8.1 provides a clear instruction to developers and Planning Officers as to where a Flood Risk Assessment (FRA) is required in Brentwood. Should any one of the criteria listed in Table 8.1 apply to the site in question then, a FRA needs to be prepared to accompany a planning application. NPPF should then be referred to establish the scope of the FRA and the Environment Agency should also be consulted.

8.1.3 Figures A3a-d (in Appendix A) should be reviewed in consultation with Table 8.1, as it defines the zones of flood risk that are referred to.

Table 8.1 FRA requirements for developers

Criteria Requiring a FRA	FRA Required (Yes/No)	Scope of the FRA
In Flood Zone 3b[1]	Yes	Follow the requirements of NPPF
In Flood Zone 3a	Yes	Follow the requirements of NPPF
In Flood Zone 2	Yes	Follow the requirements of NPPF
Greater than 1 hectare in Flood Zone 1	Yes	Follow the requirements of NPPF.

[1] Zone 3b has not been delineated as part of this study. Assume all Flood Zone 3 is 3b until proved otherwise.

8.1.4 In all cases, the FRA or Drainage Assessment must follow the SuDS hierarchy in the selection of an appropriate SuDS technique. A piped solution will only be acceptable if it can be demonstrated that more sustainable SuDS techniques are not feasible.

8.2 Windfall sites

8.2.1 It is highly likely that there will always be windfall development, and these sites will need to be assessed. Brentwood's emerging local development plan will identify the target areas for growth and redevelopment. The appropriateness for sites outside these areas will need to be addressed on a site by site basis. Proposed windfall development should pass the Sequential Test and Exception Test if required. Additionally, the sequential approach to flood risk management will be required within the development site, and this will need to be addressed within the development proposals and accompanying FRAs.

8.2.2 For windfall sites, and sites not included in the SFRA assessment, the Environment Agency Flood Zones should be used in conjunction with Table 5.1.

9. Recommendations for the Local Development Plan

9.1.1 The Level 1 SFRA has assessed flood risks from all sources and advocated a sequential risk based approach to managing flood risk, which is in line with the guiding principles presented in NPPF. The primary objective of which is to steer new development towards areas of least flood risk. This section summarises the recommendations for consideration in the spatial planning process and in the management of flood risks, it also identifies situations/events which might trigger the need to either update the SFRA or undertake additional flood risk assessment work.

9.2 Recommendations

9.2.1 Throughout the SFRA there are a number of recommendations relating to the management of flood risk within the Borough of Brentwood. These key recommendations, for inclusion in the Local Development Plan, are summarised below:

- Aim to reserve land in Flood Zone 1 for essential infrastructure and where possible highly vulnerable and more vulnerable land uses;
- Should the Council wish to allocate sites with an identified flood risk, then the policy should either be to avoid the areas of flood risk or to assess the risk in more detail through either Level 2 SFRA work or on a site specific level. This more detailed review should include identification of Flood Zone 3b and it should assess flood hazard and depth for return periods up to and including the 1 in 1000 annual probability plus climate change event;
- In the absence of a Level 2 Assessment, windfall sites in Flood Zones 2 and 3 should not be accepted unless they include a detailed review of potential flood risks. This will need to include detailed hydraulic modelling;
- Sites around unmodelled main river and ordinary watercourses should use the surface water flood risk maps as a proxy for fluvial flood risk. The development of such sites should only be permitted following a hydraulic assessment of the likely flood risks from these currently unmodelled main river and ordinary watercourses;
- Manage flood risk through avoidance of risk where possible;
- Follow the Sequential approach advocated in NPPF and Section 5.2 of the SFRA;
- Site design in fluvial floodplains should facilitate safe escape;
- An emergency evacuation procedure should be implemented for those sites which can feasibly be designed to allow for evacuation out of the flood risk zone. Evacuation procedures should be reviewed and approved by the LPA prior to the issue of planning consent;
- All new development should attempt to reduce surface water run-off by sustainably managing run-off on site. Flood risk must not increase post development; and
- All new development greater than 1 hectare in size and all new development in Flood Zones 2 and 3 are required to undertake a Flood Risk Assessment considering all sources of flood risk. Development in Flood Zone 1 greater than 0.25 hectares will be required to undertake a Drainage Impact Assessment. These assessments should include an assessment of climate change.

9.3 Triggers for updating the SFRA

9.3.1 The list below identifies key events which could trigger the need for an SFRA update or additional flood risk assessment. This list is not exhaustive and it is recommended that the Council undertakes regular consultation with the Environment Agency so as to ensure that an up to date evidence base is maintained. The following ought to be considered:

- An update of the National Flood Zones in the Borough of Brentwood;
- A significant revision or replacement of NPPF;
- A revision or replacement to the set of HELAA sites assessed in this SFRA; and
- A shift away from the policy of 'avoidance' resulting in development being planned for areas of flood risk, or if development is planned in the areas adjacent to unmodelled watercourses.

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