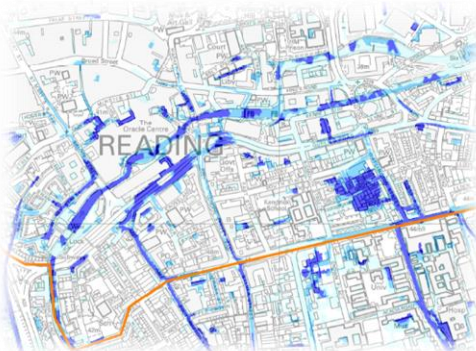


Reading Borough Council

Level 2 Strategic Flood Risk Assessment



On behalf of:






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Revision	Date	Description	Prepared	Reviewed	Approved

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1 Level 2 Strategic Flood Risk Assessment

1.1 Scope of Report

- 1.1.1 Peter Brett Associates LLP (PBA) was commissioned by Reading Borough Council (RBC) to undertake a 'Level 2 Strategic Flood Risk Assessment' ('L2 SFRA'), to consider the flood risk to 15 sites throughout the Borough.
- 1.1.2 The administrative area of RBC is significantly impacted by fluvial flooding due to the presence of a number of main rivers within the area, including the River Thames, River Kennet, Foudry Brook and Holy Brook. The results of the Level 1 (L1) SFRA indicated that it is not possible to accommodate all necessary development outside of areas at flood risk, therefore consideration of the sites located within areas identified to be at risk of flooding should be completed.
- 1.1.3 The L2 SFRA is intended to provide an evidence base, to allow RBC to undertake the (flood risk) Sequential Test to the submitted sites, which are proposed for allocation as part of the Local Plan, and are identified within Flood Zone 2 'Medium Probability' or Flood Zone 3 'High Probability'.
- 1.1.4 The results will assist the Council in understanding the flood risk posed to new development sites and will inform RBC's assessment of site suitability for inclusion in the RBC new Local Plan.
- 1.1.5 This assessment incorporates information from the new L1 SFRA released 2017, and is in accordance with the updated local and national legislation.
- 1.1.6 This L2 SFRA provides a more detailed assessment of flood risk at sites identified in Flood Zones 2 and 3, as well as those affected by climate change scenarios. Different sources of flooding are considered, and information on historic flooding provided where applicable and possible.
- 1.1.7 The National Planning Policy Framework (NPPF) provides the following detailed definitions of Flood Zones, which were also provided within the L1 SFRA:
- **Flood Zone 1 'Low Probability'** – less than 1 in 1000 (0.1%) annual probability of river flooding;
 - **Flood Zone 2 'Medium Probability'** – between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of river flooding, or between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of sea flooding;
 - **Flood Zone 3a 'High Probability'** – greater than 1 in 100 (1%) annual probability of river flooding, or 1 in 200 (0.5%) of sea flooding; and
 - **Flood Zone 3b 'Functional Floodplain'** – land where water has to flow or be stored in times of flood. The starting point for identifying this is land which floods with an annual probability of 1 in 20 (5%) or greater.
- 1.1.8 The extent of Flood Zone 3b 'Functional Floodplain' identified in the L1 SFRA was utilised within this assessment.

1.2 L2 SFRA Requirements

1.2.1 The L2 SFRA has been prepared in accordance with the NPPF and associated Planning Policy Guidance (PPG) on Flood Risk and Coastal Change, and in accordance with the latest EA guidance on climate change (February 2016).

1.2.2 In considering flood risk to the sites, it is necessary to fully consider the potential impacts of climate change for the lifetime of the development. Details of the latest EA climate change guidance on the application of climate change allowances in flood risk assessments is provided via the following link:

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>.

1.2.3 This guidance provides contingency allowances for potential increases in peak river flow in Table 1, and for potential increases in rainfall intensity in Table 2. **Table 1-1** outlines the allowances relevant for the Thames River Basin District.

Table 1-1: Climate Change - Peak River Flow Allowances

River Basin District	Allowance Category	Total Potential Change Anticipated for '2020s'	Total Potential Change Anticipated for '2050s'	Total Potential Change Anticipated for '2080s'
Thames	Upper End	25%	35%	70%
	Higher Central	15%	25%	35%
	Central	10%	15%	25%

1.2.4 These allowances should be applied to reflect the proposed design life of buildings, and the 2080s horizon is the typical standard for most forms of new residential/commercial development unless there are specific justification for a shorter lifespan.

1.2.5 The specific range of allowances to be considered in the new development under consideration within this L2 SFRA – i.e. either 'More Vulnerable' residential or 'Less Vulnerable' commercial/industrial development – is detailed in the **Table 1-2** below:

Table 1-2: Applicable Peak River Flow Climate Change Allowance Ranges

Flood Zone	More Vulnerable Development	Less Vulnerable Development
1	n/a	n/a
2	25%-35%	25%
3a	35%-70%	25%-35%
3b	<i>Development should not be permitted</i>	

1.2.6 The L2 SFRA should provide sufficient information to inform the application of the Exception Test, where appropriate through considering:

- Flood probability;
- Flood depth;
- Flood velocity;
- Rate of onset of flooding; and
- Duration of flooding.

1.2.7 The Exception Test is detailed within paragraph 102 of the NPPF, and is a method used to demonstrate that flood risk to people and property will be managed satisfactorily, while allowing necessary development to be permitted in situations where suitable sites at lower risk of flooding are not available. The NPPF states:

“...For the Exception Test to be passed:

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.”

2 Baseline Flood Risk Information

2.1 Sites under Consideration

- 2.1.1 This L2 SFRA has been prepared to determine the risk of flooding from a number of sources (fluvial, surface water, sewer and artificial sources) at specified proposed development sites, as advised by RBC.
- 2.1.2 The site details and reference numbers correspond to those identified within the 'Housing and Economic Land Availability Assessment' (May 2017), and further detailed in the RBC 'Sequential and Exception Test' (November 2017).
- 2.1.3 The sites assessed and a location plan in relation to the administrative area of Reading Borough and the main rivers are provided in **Appendix A**.
- 2.1.4 Where a site has been identified in the Local Plan, the relevant reference number has also been provided.
- 2.1.5 The sources of information used to inform the site-specific assessments is as detailed below, with the relevant location (or Map prefix) provided for cross-reference to the L1 SFRA.

2.2 Historic Flooding

L1 SFRA Map F2 (EA Historic Records) and F3 (RBC Records)

- 2.2.1 Historic records of flooding were provided by the EA in the form of their Recorded Flood Outlines (RFO) for the Borough. This shows the "*extents of known flooding from rivers, the sea and groundwater*" over the study area. The below events were previously provided for the L1 SFRA:
- March 1947;
 - June 1971 (River Kennet only);
 - November 1974;
 - August 1977;
 - September 1992;
 - October 1993;
 - December 2000;
 - January 2003;
 - July 2007; and
 - Winter 2013/14.
- 2.2.2 Flood records were provided by RBC for the L1 SFRA and were also utilised within this study.

2.3 Fluvial Flooding

L1 SFRA Map F5 (Modelled Flood Extents) and F5CC (Modelled Flood Extents with Climate Change Allowances)

- 2.3.1 The probability of fluvial flooding was assessed using the available detailed hydraulic modelling.
- 2.3.2 The detailed hydraulic models completed as part of the River Thames (Reading Complex Change) Flood Alleviation Study (June 2011) and the River Kennet Flood Study (2007) were utilised within this assessment.
- 2.3.3 As part of the L1 SFRA, PBA have re-run the EA River Thames and River Kennet models to assess the flooding impacts based on the EA climate change allowances guidance, as discussed in **Section 1.2**. This work has provided modelled flood extents for the 1 in 100 annual probability +25%, +35% and +70% allowance for climate change scenarios and the appropriate allowances – subject to proposed use and Flood Zone – have been considered when assessing the sites.
- 2.3.4 It is noted that the EA have confirmed that they are in the process of updating the hydraulic models through the Reading area, with outputs currently anticipated towards the end of 2018.

2.4 Surface Water Flooding

L1 SFRA Map F6

- 2.4.1 The risk of flooding from surface water was determined using the EA's updated 'Flood Map for Surface Water' ('uFMfSW') released in 2013 as their third iteration of a national scale surface water modelling exercise.

2.5 Reservoir Flooding

L1 SFRA Map F7

- 2.5.1 The Reservoir Flood Map shows the potential extent of flooding in the event of a breach from large reservoirs (over 25,000 cubic metres of water).
- 2.5.2 This mapping study assumes a worst-case scenario; i.e. that a breach occurs for the full height and width of the impounding structure when the water level is near the crest.

2.6 Groundwater Flooding

L1 SFRA Map F8

- 2.6.1 The EA 'Areas Susceptible to Groundwater Flooding' (AStGWF) dataset is a strategic scale map showing groundwater flooding probability areas on a 1km square grid. The data is annotated to show what percentage of the 1km area could be susceptible to groundwater flooding, thus providing an indication of the degree of probability of groundwater flooding that is present within a broad area.
- 2.6.2 The accompanying guidance specifies that *"these data show likelihood of groundwater flooding occurring and is therefore a hazard not risk-based dataset"*.

2.7 Sewer Flooding

L1 SFRA Map F9

- 2.7.1 The risk of sewer flooding at each site was determined using the postcode DG5 register incident count (provided by Thames Water Utilities Ltd for the L1 SFRA), which counts the number of internal and external sewer incidents which have occurred within the postcode area of the site.

3 Requirements for Mitigation

3.1 Overview of Mitigation Requirements

- 3.1.1 The following sub-sections provide an overview of the mitigation requirements for new development, which are detailed further in the L1 SFRA and have been applied in the recommendations when undertaking the site-specific reviews in **Appendix B**.

3.2 Ground Floor Levels

L1 SFRA Section 12.3

- 3.2.1 In accordance with the requirements of the relevant British Standards and EA guidance, it is recommended that floor levels of new development are set a minimum of 300mm above the modelled 1 in 100 annual probability plus appropriate allowance for climate change fluvial flood level.
- 3.2.2 Where a range of climate change allowances are applicable, the generally accepted approach is to use the lower end of the specified range of climate change allowances as a baseline for mitigation requirements.
- 3.2.3 The higher end is considered as a sensitivity test to consider residual risk and inform additional freeboard requirements – i.e. if floor levels should ideally be above this level, otherwise flood resistant/resilient measures should be incorporated to protect development under such conditions.

3.3 Floodplain Storage

L1 SFRA Section 12.5

- 3.3.1 Any new development located in the vicinity of a watercourse should be constructed such that it does not reduce the available floodplain storage capacity over a site, which could potentially cause an increase in flood levels on-site or elsewhere.
- 3.3.2 The impacts require consideration over the proposed lifetime of the development and should therefore be considered up to the 1 in 100 annual probability plus appropriate allowance for climate change flood level.
- 3.3.3 In assessing the proposed sites for allocation, a high level assessment has been provided in terms of the impact of development on the site to the floodplain storage capacity, with consideration of the availability of compensatory flood storage in the form of higher ground or the removal of (non-floodable) existing building footprint.

3.4 Safe Access and Flood Risk Management

L1 SFRA Section 12.7

- 3.4.1 It is necessary to consider safe access arrangements as part of the mitigation for any new development and the policy recommendations for safe access and flood risk management are outlined within Section 12.7 of the L1 SFRA.
- 3.4.2 For proposed 'Less Vulnerable' uses – i.e. commercial or office use where sleeping accommodation is not provided – safe access can typically be addressed through the incorporation of management systems including, in the event of widespread flooding, closure

of the site in advance of flooding affecting the area and re-opening after the flooding has receded.

- 3.4.3 For 'More Vulnerable' uses, the provision of safe access is a more sensitive issue, particularly in areas affected by flooding from the River Thames (where flooding characteristics are typically of significant lead-in time but also of long duration when flooding does occur).
- 3.4.4 Section 12.7 of the L1 SFRA set out the issues relating to new development and safe access. Following further discussions with RBC as part of the L2 SFRA it was considered that, based on the flooding characteristics of the area, a more pragmatic approach is required in assessing safe access for new residential development.
- 3.4.5 This is a particular concern in areas such as Lower Caversham, where a 'physical' safe route at the peak of the 1 in 100 annual probability plus appropriate allowance for climate change flood level is not feasible, and the agreed approach below facilitates regeneration of areas susceptible in severe flood events whilst ensuring that development is not intensified in the areas most at risk of frequent flooding.
- 3.4.6 The following hierarchy should therefore be applied when considering the provision of safe access to new development in RBC:

More Vulnerable Development:

a) The preference is to have a continuous dry route at the 1 in 100 annual probability plus appropriate allowance for climate change event;

b) If (a) is not achievable, then developer should assess if safe access is available at the current 1 in 100 annual probability flood event (in accordance with Defra flood hazard guidance);

If (b) is achievable, then it is considered safe access in more extreme events could be addressed through provision of a site 'Flood Management and Evacuation Plan', subject to a detailed analysis of the flood hazard along the route and RBC emergency planning department approval;

If (b) is not achievable, it is recommended that the site is not suitable for new (or intensification of) permanent residential development and other uses should be considered (i.e. 'Less Vulnerable' commercial/office development).

- 3.4.7 The above approach is intended specifically in relation to residential dwellings. Certain other forms of 'More Vulnerable' development, such as hotels, operate as managed facilities and are therefore better placed to introduce suitable operating procedures in the event of an anticipated flood, including Flood Management and Evacuation Plans, to ensure occupants/users take appropriate action and, if necessary, vacate the site in advance of the area being impacted. As such, it is important to discuss the arrangements for safe access with RBC at the earliest opportunity.

3.5 Surface Water Drainage

L1 SFRA Section 13

- 3.5.1 Any new development needs to ensure that proposed surface water drainage arrangements are appropriately designed to ensure no increase – and preferably a decrease – in flood risk with priority given to the use of Sustainable Drainage Systems (SuDS) to replicate, as closely as possible, the natural (pre-development) drainage regime of a site.
- 3.5.2 Different forms of SuDS contribute to the key pillars of water quantity, water quality, amenity and biodiversity and measures which provide an enhancement of these elements should be actively encouraged.
- 3.5.3 As of April 2015, the Lead Local Flood Authority (LLFA) has become the statutory consultee for surface water management on planning applications for ‘major development’. As the LLFA, RBC are therefore responsible for the approval of surface water drainage systems within such development. Major development consists of any of the following:
- The provision of dwelling houses where residential development of 10 or more units; or where the development is to be carried out on a site having an area of 0.5 hectares or more and the number of units is not known;
 - The provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or,
 - Development carried out on a site having an area of 1 hectare or more.
- 3.5.4 The L1 SFRA should be reviewed to provide guidance on design criteria and level of detail for surface water drainage submissions.

4 Conclusion

- 4.1.1 This Level 2 Strategic Flood Risk Assessment (L2 SFRA) considered 15 potential development sites based in Flood Zones 2 'Medium Probability' and Flood Zone 3 'High Probability'.
- 4.1.2 Of these sites, it was considered that, provided appropriate flood risk mitigation techniques are incorporated into the development design, that development would be feasible in accordance with the requirements of the NPPF. All of the sites would be subject to a site-specific detailed FRA, and a number of them would benefit from further analysis of the safe access arrangements.

Appendix A List of Sites and Location Plan

L2 SFRA Reference	Site Name	Local Plan Reference
AB004	North of the Station	CR11e
AB005	Riverside	CR11g
AB006	Napier Road Junction	CR11h
AB007	Napier Court	CR11i
AB073	28-30 Richfield Avenue	WR3c
AB075	115-117 Caversham Road	CR11f - part
AB081	Subgard Self-Storage, 75-77 Caversham Road	CR11f - part
AB096	Great Brigham's Mead	Not Identified
BA003	Part of former Battle Hospital, Portman Road	WR3i
CA002	72 George Street	Not Identified
CA004	383 Gosbrook Road	Not Identified
CA006	Reading University Boat Club, Promenade Road	CA1a
CA007	Cantay House, Ardler Road	Not Identified
CA009	4-6 Send Road	Not Identified
CA011	Former Caversham Nursery, 82 Gosbrook Road	Not Identified

PBA Drawing ref: 27560/4009/001 – Location of Sites Overlaid on EA Flood Zone Map

Appendix B Site-Specific Reviews

The references used are from the Council's Housing and Economic Land Availability Assessment (November 2017):

- AB004 – North of the Station
- AB005 – Riverside
- AB006 – Napier Road Junction
- AB007 – Napier Court
- AB073 – 28-30 Richfield Avenue
- AB075 – 115-117 Caversham Road
- AB081 – Subgard Self-Storage, 75-77 Caversham Road
- AB096 – Great Bringham's Mead
- BA003 – Part of former Battle Hospital, Portman Road
- CA002 – 72 George Street
- CA004 – 383 Gosbrook Road
- CA006 – Reading University Boat Club, Promenade Road
- CA007 – Cantay House, Ardler Road
- CA009 – 4-6 Send Road
- CA011 – Former Caversham Nursery, 82 Gosbrook Road