West Berkshire
Strategic Flood Risk Assessment (SFRA)
Level 1

May 2008 (Final)

West Berkshire Council
Market Street
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EXECUTIVE SUMMARY

The West Berkshire (Level 1) SFRA

1. Planning Policy Statement (PPS) 25: Development and Flood Risk requires that local planning authorities prepare a Strategic Flood Risk Assessment (SFRA) in consultation with the Environment Agency. The primary purpose of the SFRA is to determine the variation in flood risk across the district of West Berkshire. Robust information on flood risk is essential to inform and support the Council's revised flooding policies in its emerging Local Development Framework (LDF).

2. Jacobs was commissioned to develop the West Berkshire Strategic Flood Risk Assessment (SFRA) in June 2007. West Berkshire is currently reviewing its planning framework, and this SFRA intends to supplement the evidence base that will inform this review process. The SFRA is a technical document that will be submitted to the Secretary of State with the submission of the Core Strategy. This SFRA will be developed, refined and updated over time and will feed into the Council's emerging Core Strategy and site allocations.

3. This report (and the supporting mapping) represents the Level 1 SFRA[1], and should be used by the Council to inform the application of the Sequential Test. Following the application of the Sequential Test, it may be necessary to develop a Level 2 SFRA should it be shown that proposed allocations fall within a flood affected area of the District. The Level 2 SFRA should consider the risk of flooding in greater detail within a local context to ensure that the site can be developed in a safe and sustainable manner

The SFRA Findings

4. The risk of flooding within West Berkshire is widespread, arising not only from rivers, particularly to the towns of Hungerford, Newbury and Thatcham, but also from surface water and groundwater flooding. The recent events of the summer of 2007 were a timely reminder of the impacts that flooding can have upon the local community. The susceptibility of communities throughout the District to flooding is discussed in Sections 5 and 6 of this report.

5. A relatively large number of homes and businesses within West Berkshire are at risk of flooding, arising from a number of sources including river flooding, localised runoff, groundwater flooding and sewer flooding. The West Berkshire (Level 1) SFRA has delivered the following key findings and outcomes:

   - The District has been delineated into zones of **'low', 'medium' and 'high' probability of fluvial flooding** in accordance with PPS25 (Appendix D). These maps should be by the Council used to inform the application of the Sequential Test.

   - Detailed modelling of the **impacts of climate change** has not been carried out within the District, however in accordance with current best practice, it is reasonable to assume that Zone 2 Medium Probability is a reasonable, albeit somewhat conservative, approximation of the 1% (100 year) flood extent in the year 2108 (i.e. in 100 years). This would suggest that the extent of flooding in future years will not alter dramatically, however properties that are currently at risk will be subject to more frequent and more severe flooding.

[1] Refer paragraphs 2.32 to 2.35 of the Living Draft of the Practice Guide Companion to PPS25 (February 2007)

- The risk of **groundwater and surface water flooding** in West Berkshire is relatively high, affecting homes and businesses throughout the District. It is not possible to categorise flooding from other (non fluvial) sources in terms of the PPS25 flood zones, however it is essential that these potential risks are not overlooked. For this reason, a series of 'Critical Drainage Areas' (CDAs) have been identified to inform the planning process (Appendix F).

The Recommended Way Forward

6. A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test. Specific planning recommendations have been provided for all urban areas within West Berkshire (Section 6.4).

7. It is important that strategic planning decisions should consider the risks from groundwater and/or surface water flooding. Areas affected by these sources of flooding have been identified as Critical Drainage Areas (CDA). **Any development which is located in a CDA should be accompanied by a detailed FRA**.

8. Where, following the application of the Sequential Tests, other planning considerations require further consideration of sites that are at risk of flooding, specific recommendations have been provided to assist the Council and the developer to apply the Exception Test[2]. These should be applied as development control recommendations for all future development (Section 6.4.4).

9. Council policy should be robust enough to ensure that the recommended development control measures within this SFRA can be imposed consistently at the planning application stage. It is the responsibility of the Council to establish these policies. This is essential to achieve future sustainability within West Berkshire with respect to flood risk management.

10. Emergency planning is essential to minimise the risk to life posed by flooding within the district. It is recommended that West Berkshire Council review their adopted emergency response plan in light of the findings and recommendations of the SFRA.

11. The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the District. A rolling programme of detailed flood risk mapping within the South East region is underway. This, in addition to observed flooding that may occur throughout a year, will improve the current knowledge of flood risk within the District and may marginally alter predicted flood extents within West Berkshire. Furthermore, Communities and Local Government (CLG) are working to provide further detailed advice with respect to the application of PPS25, and future amendments to the PPS25 Practice Guide are anticipated. It is recommended that the West Berkshire SFRA is reviewed on a regular basis. A series of key questions should be addressed as part of the SFRA review process, and these are provided in Appendix K.

[2] It is highlighted that the development control recommendations will assist the developer to meet *only* point (3) of the Exception Test (i.e. "*a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall").*

Table of Contents

Appendices

Glossary

AEP	Annual Exceedance Probability, or the probability of flooding in any one year, for example: ➢ 5% (20 years) i.e. 5% chance of occurring in any year ➢ 3.33% (30 years) ➢ 1% (100 years) ➢ 0.1% (1000 years)
CLG	Communities and Local Government. CLG sets UK policy on local government, housing, urban regeneration, planning and fire and rescue. It has responsibility for building regulations, fire safety and some housing issues in England and Wales.
Core Strategy	The Development Plan Document within the Council's Local Development Framework, which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.
Critical Drainage Area (CDA)	Area that has been affected by localised flooding issues
Defra	Department of Environment, Food and Rural Affairs. Defra has overall policy responsibility for flood and coastal erosion risk in England. Defra funds most of the Environment Agency's flood management activities in England and provides grant aid on a project by project basis to the other flood and coastal defence operating authorities (local authorities and internal drainage boards).
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
Development Plan Document (DPD)	A spatial planning document within the Council's Local Development Framework, which set out policies for development and the use of land. Together with the Regional Spatial Strategy, they form the development plan for the area. They are subject to independent examination.
De Facto Flood Defence	A structure that provides a flood defence function, however has not been built and/or maintained for this purpose (e.g. boundary wall)
DTM	Digital Terrain Model, depicting the topography of the District
Flood Zone Map	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency
Fluvial Flooding	Flooding arising from rivers or streams
Formal Flood Defence	A structure built and maintained specifically for flood defence purposes
GEM	Groundwater Emergence Maps, depicting areas that may be susceptible to groundwater flooding
Habitable Room	A room used as living accommodation within a dwelling but excludes bathrooms, toilets, halls, landings or rooms that are only capable of being used for storage. All other rooms, such as kitchens, living rooms, bedrooms, utility rooms and studies are counted
LiDAR	Light Detection and Ranging (LIDAR) is an airborne mapping technique which uses a laser to measure the distance between the aircraft and the ground. This technique results in the production of a terrain map

Local Development Framework (LDF)	Consists of a number of development plan documents which together form the spatial strategy for development and the use of land
Localised Flooding Issue	Flooding from non fluvial and non coastal sources .i.e. surface water runoff, sewer flooding or groundwater flooding
Main River	A river that falls under the jurisdiction of the Environment Agency
Non Main River (or Ordinary Watercourse)	A river that falls under the jurisdiction of the Local Planning Authority
Planning Policy Guidance (PPG)	A series of notes issued by the Government, setting out policy guidance on different aspects of planning. They will be replaced by Planning Policy Statements
Planning Policy Statement (PPS)	A series of statements issues by the Government, setting out policy guidance on different aspects of planning. They replace Planning Policy Guidance Notes
Pluvial Flooding	Flooding arising from surface water runoff and/or the failure of the stormwater (or sewer) drainage system
PPS1	Planning Policy Statement 1: Delivering Sustainable Development
PPS25	Planning Policy Statement 25: Development and Flood Risk Department of Community & Local Government, 2006
Previously Developed (Brownfield) Land	Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example, a house and its garden would be considered to be previously developed land.
Residual Risk	A measure of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the review process
SEA	Strategic Environmental Assessment. Authorities which prepare and/or adopt a plan or programme which is likely to have significant effects on the environment must prepare a SEA. The SEA will assess the environmental effects of the plan or programme, and consult environmental authorities and the public. The SEA will take the results of the consultation into account during the preparation process and before the plan or programme is adopted.
SUDS	Sustainable Drainage Systems aim to decrease the amount of surface runoff, decrease the velocity of surface runoff, or divert it for other useful purposes, thereby reducing the contribution it makes to sewer discharge and flooding.
Supplementary Planning Document (SPD)	Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.
Sustainability Appraisal (SA)	Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987).
Flood Zone 3b Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Defined as areas at risk of flooding in the 5% AEP (1 in 20 chance) design event
Flood Zone 3a High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Flood Zone 2 Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Flood Zone 1 Low Probability	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

1 Introduction

1.1 Overview

1. West Berkshire's principal urban areas are Newbury, Thatcham, Hungerford and the areas of Tilehurst, Purley and Calcot to the west of Reading. The district covers an area of approximately 272 square miles (70,000 hectares) and has a population of approximately 144,000 (source: 2001 Census) with an estimated 60,000 households.

2. A number of watercourses, recognised as 'main rivers' by the Environment Agency, flow through West Berkshire. The most prominent rivers are the River Kennet, River Lambourn, River Pang and the Foudry Brook. The River Thames flows on the north-eastern boundary of West Berkshire.

3. The topography of West Berkshire can be contrasted between the higher downlands in the north-west of the district and the low-lying floodplains of the rivers (principally the Kennet and the Pang). The Kennet's floodplain, which dominates much of the south of West Berkshire, is limited on either side by steep slopes, rising to the county boundary with Hampshire to the south and up to the Berkshire Downs to the north.

4. Land use in West Berkshire is characterised by green space (which includes gardens and bodies of open water) and this accounts for 95% of land coverage within the district. Transport, buildings and other, non-specified, land uses account for the remaining 5%.

5. Planning Policy Statement (PPS) 25: Development and Flood Risk requires that local planning authorities prepare a Strategic Flood Risk Assessment (SFRA) in consultation with the Environment Agency. The primary purpose of the SFRA is to determine the variation in flood risk across the district of West Berkshire. Robust information on flood risk is essential to inform and support the Council's revised flooding policies in its emerging Local Development Framework (LDF).

6. Jacobs was commissioned to develop the West Berkshire Strategic Flood Risk Assessment (SFRA) in June 2007. West Berkshire is currently reviewing its planning framework, and this SFRA intends to supplement the evidence base that will inform this review process. The SFRA is a technical document that will be submitted to the Secretary of State with the submission of the Core Strategy. This SFRA will be developed, refined and updated over time and will feed into the Council's emerging Core Strategy and site allocations.

7. **This report (and the supporting mapping) represents the Level 1 SFRA[3], and should be used by the Council to inform the application of the Sequential Test**. Following the application of the Sequential Test, it may be necessary to develop a Level 2 SFRA[4] should it be shown that proposed allocations fall within a flood affected area of the District. The Level 2 SFRA should consider the risk of flooding in greater detail within a local context to ensure that the site can be developed in a safe and sustainable manner

1.2 Policy Context

8. The West Berkshire SFRA has been developed in accordance with Planning Policy Statement (PPS) 25: Development and Flood Risk. The SFRA will inform the West Berkshire Local Development Framework (LDF), which in turn will be established within a framework of national, regional and local planning policy. This policy underpins decision making within the District, guiding the distribution, density and type of development that will be permitted in the future.

9. A broad understanding of the policy within which both the SFRA and the LDF have been developed is important, and for this reason an overview of the planning policy framework

[3] Refer paragraphs 2.32 to 2.35 of the Living Draft of the Practice Guide Companion to PPS25 (February 2007)
[4] Refer paragraphs 2.36 to 2.42 of the Living Draft of the Practice Guide Companion to PPS25(February 2007)

has been provided in Appendix J.

1.3 Pitt Review (December 2007)

10. The widespread flooding that took place throughout England during the summer of 2007 highlighted the damage and disruption that can be caused by flooding. The Environment Agency has invested heavily in recent years to establish a robust understanding of the risks associated with fluvial and coastal flooding. The responsibility for *surface water management* is very uncertain however, with various agencies managing different elements of the drainage system, providing little (if any) integration. The result is an apparent lack of understanding and appreciation of the susceptibility to, and impact of, surface water flooding.

11. An independent review of the events of 2007 is being carried out by Sir Michael Pitt. The Pitt Review Interim Report was released in December 2007, providing 15 key recommendations for action by national, regional and local government. These relate primarily to establishing a robust understanding of the risk posed by flooding from 'other' sources, raising awareness, and the critical importance of preparedness in a flooding emergency.

12. The implementation of these recommendations will require clear leadership at a regional level, and cooperation from all tiers of government. It is hoped that the West Berkshire SFRA will provide an initial step in the gathering of knowledge that will inform the implementation of the Pitt Review outcomes. The identification of Critical Drainage Areas in this West Berkshire SFRA is the first step in understanding the risk posed by flooding from 'other' sources.

2 SFRA Approach

13. The primary objective of the West Berkshire SFRA is to inform the revision of flooding policies, including the allocation of land for future development, within the emerging Local Development Framework (LDF). The SFRA also has a broader purpose and, in providing a robust depiction of flood risk across West Berkshire, it can:

    - Inform the development of the policy that will underpin decision making within West Berkshire, particularly within areas that are affected by (and/or may adversely impact upon) flooding;
    - Assist the development control process by providing a more informed response to development proposals affected by flooding, influencing the design of future development within West Berkshire;
    - Help to identify and implement strategic solutions to flood risk, providing the basis for possible future flood attenuation works;
    - Support and inform West Berkshire Council's emergency planning response to flooding.

14. The Government provides no specific methodology for the SFRA process. Therefore, to meet these broader objectives, this SFRA has been developed in a pragmatic manner in close consultation with West Berkshire Council and the Environment Agency.

15. A considerable amount of knowledge exists with respect to flood risk within West Berkshire, including information relating both to historical flooding and the predicted extent of flooding under extreme weather conditions (i.e. as an outcome of detailed flood risk modelling carried out by the Environment Agency). The West Berkshire SFRA has built upon this existing knowledge, delineating the district into zones of 'high', 'medium' and 'low' probability of flooding, in accordance with PPS25. These zones have then been used to provide a robust and transparent evidence base for the development of flooding related policy, as well as the allocation of sites for future housing and employment uses.

16. A summary of the adopted SFRA process is provided in Figure 1, below, outlining the specific tasks undertaken.

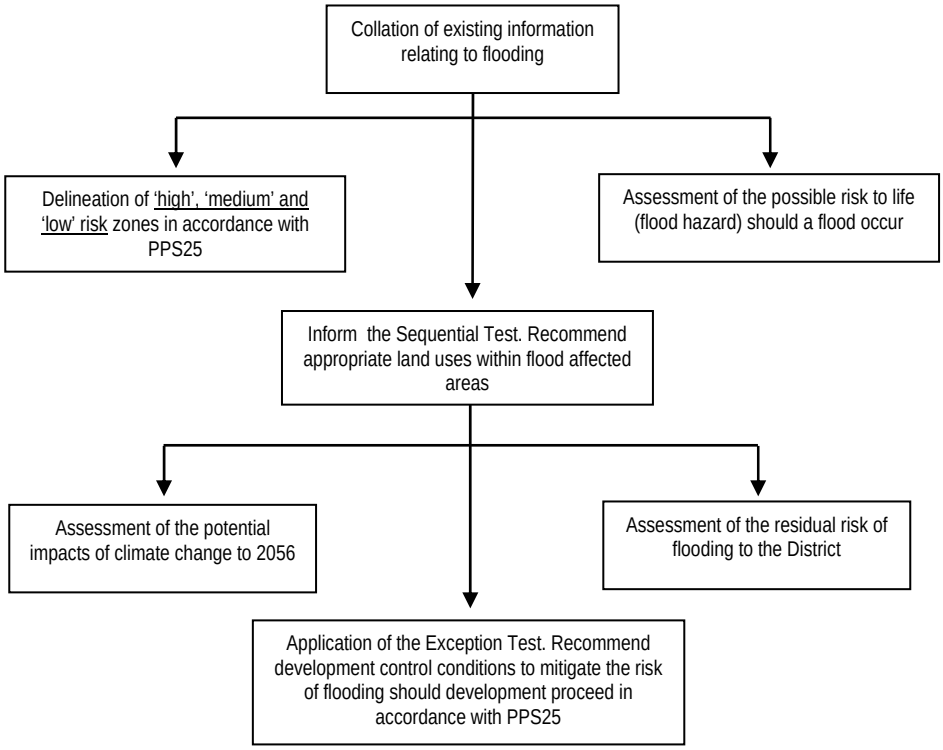

Figure 1: Overview of the SFRA Process

17. It is important to recognise that planning boundaries do not necessarily coincide with river catchment boundaries. There are areas at risk of flooding downstream of West Berkshire and future development within the District could influence the risk of flooding posed to neighbouring areas if it is not carefully managed. It is essential that all local authorities clearly understand the core issues that flood risk raises within their respective areas and that they adapt their decision making accordingly. They must be aware of the impact that inappropriate planning may have, not only locally, but upon adjoining areas.

18. Local Authorities across the Home Counties and within Greater London are beginning to carry out similar strategic flood risk investigations. These will help provide the evidence base for the Core Strategies and Site Specific development allocations that will form part of the Local Development Frameworks that all local planning authorities must now produce.

19. Whilst the delivery teams and programmes underpinning these studies vary from one district to the next, all should be developed in liaison with the Environment Agency. Consistency in the adopted approach and decision making with respect to the effective management of flood risk throughout the sub region is essential. Regular discussions with the Environment Agency have been carried out throughout the SFRA process to this end, seeking clarity and consistency where needed.

3 Data Collection

3.1 Overview

20. A considerable amount of knowledge exists with respect to flood risk within West Berkshire, including (but not limited to):

- Historical river flooding information;
- Information relating to localised flooding issues (surface water, groundwater, sewer related and/or pluvial flooding), which was collated in consultation with the Council and the Environment Agency;
- Detailed flood risk mapping;
- Environment Agency Flood Zone Maps (April 2008);
- Topography (LiDAR).

21. This data has been sourced from key stakeholders, as highlighted below. The interpretation of this data to inform the delineation of zones of 'high', 'medium' and 'low' probability of flooding in accordance with PPS25 is explained in Section 4, and the findings of this interpretation is outlined in Section 5. The formulation of planning and development control recommendations is provided in Section 6.

3.2 Consultation

22. Consultation has formed a key part of the data collation phase for the West Berkshire SFRA. The following key stakeholders have been comprehensively consulted to inform the current investigation:

West Berkshire Council

- *Planning:* Consulted to identify areas under pressure from development and/or regeneration
- *Land Drainage & Highways:* Consulted to identify areas potentially at risk from river flooding, groundwater flooding and surface water problems
- *Emergency Planning:* Consulted to discuss the West Berkshire Council's existing emergency response to flooding.

Environment Agency

The Environment Agency has been consulted to source specific flood risk information to inform the development of the SFRA. In addition, the Environment Agency is a statutory consultee under PPS25 and therefore must be satisfied with the findings and recommendations for sustainable flood risk management into the future. For this reason, the Environment Agency has been consulted during the development of the SFRA to discuss potential flood risk mitigation measures and planning recommendations.

Thames Water

Thames Water is responsible for the management of urban drainage (surface water) and sewerage within West Berkshire. Thames Water was consulted to discuss the risk of localised flooding associated with the existing drainage/sewer system.

British Waterways

British Waterways was consulted, but had no information regarding flooding on the Kennet and Avon canal to pass on.

3.3 Environment Agency Flood Zone Maps

23. The Environment Agency's Flood Map[5] shows the natural floodplain, ignoring the presence of defences, and therefore areas potentially at risk of flooding from rivers or the sea. The Flood Map shows the area that is susceptible to a 1 in 100 (1% annual exceedance probability (AEP)) chance of flooding from rivers, and a 1 in 200 (0.5% AEP) chance of tidal flooding[6], in any one year. It also indicates the area that has a 1 in 1000 (0.1% AEP) chance of flooding from rivers and/or the sea in any given year. This is also known as the Extreme Flood Outline.

24. The Flood Map outlines have been produced from a combination of a national generalised computer model, more detailed local modelling (if available), and some historic flood event outlines. The Environment Agency's Flood Map provides a consistent picture of flood risk for England and Wales.

25. The Environment Agency's knowledge of the floodplain is continuously being improved by a variety of studies, detailed models, data from river flow and level monitoring stations, and actual flooding information. They have an ongoing programme of improvement, and updates to the Flood Zone Maps are made on a quarterly basis where more accurate information is available.

3.4 Historical Flooding

26. Discussions have been held with the Council and the Environment Agency to identify those areas within West Berkshire that are known to have been exposed to flooding in recent years, and these have been highlighted in the Historical Flood Incidence Map (Appendix A) and are summarised in Section 5.2 below.

27. It is important to recognise that the incidents listed are events in which areas have been affected not only by flooding from rivers, but also from surcharging of the underground sewer system, blockage of culverts and gullies, and/or surface water runoff or groundwater. Often the *cause* of observed flooding is difficult to ascertain, particularly after the floodwaters have passed.

28. It is worth noting that, whilst prescriptive information relating to the precise location and depth of flooding is not always available, anecdotal information highlights the importance of careful and informed decision making when locating future development within the District.

3.5 Detailed Hydraulic Modelling

29. A number of detailed modelling investigations have been carried out by the Environment Agency, and the outputs made available for the purposes of this SFRA. These studies encompass the lower reaches of the River Kennet, the mid reaches of the River Kennet, Foudry Brook, River Dun, River Lambourn, River Thames and the River Pang. These detailed studies produce flood extents for a range of flood event magnitudes, and consider effect of formal defences which exist in the catchment (identified in Section 3.6 below).

30. It should be noted that the detailed hydraulic models developed on behalf of the Environment Agency assume 'typical' conditions within the river systems that are being analysed. The predicted water levels may change if the operating regimes of the rivers involved are altered (e.g. engineering works which may be implemented in the future), if culverts become blocked, or if the condition of the river channel is allowed to deteriorate.

[5] April 2008 version used as part of the West Berkshire (Level 1) SFRA
[6] It is highlighted that there is no risk of tidal flooding within West Berkshire

3.6 Flood Defences

31. Flood defences are typically raised structures that alter natural flow patterns and prevent floodwater from entering property in times of flooding. They are generally categorised as either 'formal' or 'de facto' defences. A 'formal' flood defence is a structure that was built specifically for the purpose of flood defence, and is maintained by its respective owner, which could be the Environment Agency, Local Authority, or an individual. A 'de facto' flood defence is a structure that has not been specifically built to retain floodwater, and is not maintained for this specific purpose, but may afford some protection against flooding. These can include boundary walls, industrial buildings, railway embankments and road embankments situated immediately adjacent to rivers.

32. Flood defences within West Berkshire have been identified in consultation with the Environment Agency, and these are indicated in Appendix B. A single *formal* flood defence has been identified, providing protection[7] to properties in Stratford Mortimer against flooding from Foundry Brook. A small number of *de facto* flood defence structures have also been highlighted, providing a degree of protection against flooding from the River Kennet in Newbury (i.e. Bone Mill Sluices). The area of Newbury that benefits from the presence of these de facto flood defences is highlighted in Appendix B.

33. The railway line at Purley-on-Thames provides a degree of protection against flooding from the River Thames to properties to the south of the line. No obvious additional de facto *raised* flood defences providing protection from flooding have been identified in West Berkshire as part of the SFRA process. It is important to recognise however that local roads and/or rail lines that have been constructed on raised embankments may alter overland flow routes, and as such may have a localised effect upon the risk of flooding. This should be carefully reviewed in a local context as part of the detailed site based Flood Risk Assessment.

34. It is worth noting that a number of feasibility studies have been carried out in recent years by the Environment Agency to consider the economic, environmental and technical viability of potential flood defence schemes within West Berkshire. These studies are outlined in Section 6.3.4 below.

3.7 Topography & Geology

35. Detailed topographic information has been provided by the Environment Agency (2007) for a large proportion of the District in the form of LiDAR. LiDAR enables a detailed Digital Elevation Model (DEM) to be developed that, in simple terms, provides a three dimensional representation of West Berkshire.

36. Geological information has been retrieved from the British Geological Society (BGS), providing an overview of soils and substrate.

[7] It is understood that the Stratfield Mortimer scheme provides a standard of protection of approximately 1 in 60 years

4 Data Interpretation

37. The data captured from key sources to inform the development of the West Berkshire SFRA is outlined in Section 3 above. This section provides an overview of how this data was interpreted to meet the requirements of PPS25. The findings of these analyses are presented in Section 5 below.

4.1 Delineation of the PPS25 Flood Zones (Fluvial Flooding)

38. To inform the planning process, it is necessary to review flood risk across the District, categorising the area in terms of the likelihood (or probability) that flooding will occur.

39. The national policy (PPS25) definitions of these flood zones are provided below.

Flood Zone 3b The Functional Floodplain

Areas of the region susceptible to flooding within which "*water has to flow or be stored in times of flood*" (PPS25), defined as areas at risk of flooding in the 5% AEP (1 in 20 chance) design event.

Flood Zone 3a High Probability

Land assessed as having a 1 in 100 or greater annual probability of flooding in any year (i.e. 1% AEP) from rivers or a 1 in 200 or greater annual probability of flooding in any year (i.e. 0.5% AEP) from the sea[8].

Flood Zone 2 Medium Probability

Land assessed as having between a 1 in 100 (i.e. 1% AEP) and 1 in 1000 (i.e. 0.1% AEP) annual probability of river flooding in any year, or between a 1 in 200 (i.e. 0.5% AEP) and 1 in 1000 (i.e. 0.1% AEP) annual probability of flooding from the sea in any year.

Flood Zone 1 Low Probability

Land assessed as having a less than 1 in 1000 annual probability of river flooding in any year (i.e. 0.1% AEP).

4.1.1 Delineation of Flood Zone 3b Functional Floodplain

40. Flood Zone 3b Functional Floodplain is defined as those areas in which "water has to flow or be stored in times of flood". The definition of functional floodplain remains somewhat open to subjective interpretation. PPS25 states that "SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes)." For the purposes of the West Berkshire SFRA, Zone 3b has been defined in the following manner.

- land where the flow of flood water is not prevented by flood defences or by permanent buildings or other solid barriers from inundation during times of flood;
- land which provides a function of flood conveyance (i.e. free flow) or flood storage, either through natural processes, or by design (e.g. washlands and flood storage areas);
- land subject to flooding in the 5% AEP (20 year) flood event (i.e. relatively frequent inundation expected, on average once every 20 years).

41. Detailed modelled flood extents for the River Kennet, River Pang, River Dun, River

[8] Once again, it is important to reiterate that West Berkshire is not at risk from tidal flooding

Lambourn, River Thames and Foundry Brook (Section 3.5) were adopted for the basis of Flood Zone 3b Functional Floodplain delineation.

Existing Development within Flood Zone 3b Functional Floodplain

42. The PPS25 Practice Companion Guide highlights the importance of considering existing land use when delineating areas that are to be treated as 'functional floodplain' for planning purposes. Discussions with the Environment Agency have confirmed that, due to the obstructions to overland flow paths posed by existing development within flood affected areas, existing buildings that are impermeable to flooding should not be considered as falling within the functional floodplain. Notwithstanding this however, the land surrounding existing buildings within this zone is indeed Zone 3b Functional Floodplain, and planning decisions should be taken accordingly.

43. It is important to recognise that these areas are subject to relatively frequent flooding. There are clear safety, sustainability and insurance implications associated with future development within these areas, and informed planning decisions must be taken with extreme caution.

4.1.2 Delineation of Flood Zone 3a High Probability

44. Flood Zone 3a High Probability is defined as those areas of the District that are situated within the 1% AEP (100 year) fluvial flood extent. With West Berkshire detailed modelled flood extents for the River Kennet, River Pang, River Dun, River Lambourn, River Thames and Foundry Brook (Section 3.5) were adopted for the basis of Zone 3a High Probability delineation.

45. A small number of watercourses in rural areas of the District have not been modelled explicitly by the Environment Agency, and in these instances the Environment Agency's Flood Zone Maps have been adopted to inform the SFRA process. At these locations, two thorough checks have been carried out to ensure that the adopted flood map provides an accurate depiction of Zone 3a High Probability:

- The Environment Agency Flood Zone Map assumes that the 50% (1 in 2 chance) design flood is carried within the river channel, and all remaining flow (i.e. up to the 1% [1 in 100 chance]) is assumed to be conveyed overland. The flood extents within the floodplain are estimated accordingly. A check of this assumption has been made.
- Detailed topography has been used to carry out a 'sensibility or reality check' of the Flood Zone maps. This check has sought to ensure that the predicted floodplain extents are realistic in light of surrounding ground levels (e.g. the peak design water level is equivalent on the left and right banks).

46. No amendments have been made to the Environment Agency flood zone maps in this instance as an outcome of these cursory checks.

4.1.3 Delineation of Flood Zone 2 Medium Probability

47. Flood Zone 2 Medium Probability is defined as those areas of the District have between a 1 in 100 (i.e. 1% AEP) and 1 in 1000 (i.e. 0.1% AEP) annual probability of river flooding in any year. In this instance, Zone 2 Medium Probability is defined in accordance with the Environment Agency Flood Zone Map.

4.1.4 Delineation of Flood Zone 1 Low Probability

48. Flood Zone 1 Low Probability is defined as those areas of the District that are situated above (or outside of) the 0.1% AEP (1000 year) flood extent. For SFRA purposes, this incorporates all land that is outside of the shaded Zone 2 and Zone 3 flood risk areas (as

defined above).

4.2 Assessment of Risk (Flood Hazard)

49. The assessment of flooding carried out as part of the SFRA process focuses very much the *likelihood* of flooding within the District, defined by the PPS25 flood zones. Of equal importance however is the *impact (or consequence)* that will occur within the District should a flood occur. For example, will the flooding result simply in shallow ponding for a short period of time, causing a temporary disruption to traffic? Or will deep fast flowing floodwaters inundate areas of West Berkshire without warning, posing an immediate and very real risk to life?

50. Substantial research has been carried out internationally into the risk posed to pedestrians during flash flooding. This research has concluded that the likelihood of a person being knocked over by floodwaters is related directly to the depth of flow, and the speed with which the water is flowing. This is referred to as 'Flood Hazard'.

51. For example, if a flood flow is relatively deep but is low energy (i.e. slow moving), then an average adult will be able to remain standing. Similarly, if the flow of water is moving rapidly but is very shallow, then once again an average adult should not be put off balance. If however the flow is both relatively deep and fast flowing, then a person will be washed off their feet, placing them at considerable risk. The risk to health and safety as a result of submerged hazards during flooding conditions (given the often murky nature of floodwaters) is also a consideration.

52. The risk to life and property as a result of flooding from *rivers* (i.e. when they break their banks and flow overland) can really only be sensibly considered on a more 'local' scale. The wide geographical area under consideration at the current time makes the assessment of flood hazard somewhat difficult to portray. This assessment must be captured as part of the subsequent Level 2 SFRA (Section 1) which will consider emerging allocations on a site-by-site basis to ensure that development can be designed to mitigate the risk of flooding in a safe and sustainable manner.

53. In the interim however, it is important to consider the risk to life posed by flooding from *'artificial' water bodies*. This includes, for example, water storage facilities (ponds and reservoirs) and water conduits (i.e. the Kennet & Avon Canal). Should these assets overtop or collapse, this could result in sudden and uncontrolled flooding. Whilst the likelihood of this occurring is very small, it is important to ensure at the very least some broad awareness of these potential risks. This is examined further in Section 5.4 below.

4.3 Local Drainage Issues

54. The risk of flooding from other (non river related) sources is an important consideration. The recent flooding that affected England, and particularly the South East, in the summer of 2007 highlighted the potential risk that groundwater, surface water runoff and sewer flooding can have upon an area. Newbury, Thatcham, Pangbourne and Lambourn were all affected by flooding from surface water runoff and/or failure of the drainage systems. Elsewhere in the country, Sheffield and Hull both suffered severe flooding from other (non river related) sources.

55. Information has been provided by the Council relating to anecdotal observations of localised flood risk problems that have occurred within the District. These are generally as a result of blocked culverts and gullies, surface water runoff, and failures of the underground sewer system during particularly intense rainfall. Some very general information has also been provided by Thames Water, providing a simple overview (per post code area) of the number of properties that have been affected by sewer flooding over the past decade.

56. Of course, this information only relates to localised problems *once they have occurred*. PPS25 strongly advocates the prediction (where possible) of potential flood risk, seeking an avoidance strategy that guides development away from these areas wherever possible. It is

very difficult to predict the potential risk of localised flooding. Detailed modelling techniques are available for sewered systems only, and rely heavily upon comprehensive survey information relating to the existing drainage system which is often not readily available. Definitive modelling packages to assess the risk of surface water (or flash) flooding are not available, and localised problems (including, for example, the blockage of gullies) can clearly not be predicted.

Identification of Critical Drainage Areas (CDAs)

57. Given the perceived scale of the potential 'local flood risk' within the District, a broad risk assessment has been developed in an endeavour to map those areas that may be most at risk from groundwater and/or surface water flooding. These have been defined as **Critical Drainage Areas**. The risk assessment has been developed on the basis of District geology and topography, mapping steep sided valleys, overland flow routes, and areas overlaying chalk aquifers.

58. A review of these areas of local flood risk indicates a strong correlation with observed flooding incidents as identified by the Environment Agency and the Council. It should be highlighted however that the overland flow path modelling cannot take into account local factors, such as the layout of roads, buildings, walls and fences. The SFRA mapping is intended to provide simply a strategic overview of areas that may be at risk, however it is essential that a more detailed (site based) review is carried out by the developer as part of the planning application and design process (i.e. detailed Flood Risk Assessment).

4.4 Potential Impacts of Climate Change upon Flood Risk

59. A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime. PPS25 (Appendix B) states that a 10% increase in the 1% AEP (100 year) river flow can be expected within the next 20 years, increasing to 20% within the next 50 to 100 years.

60. It is essential that developers consider the possible change in flood risk over *the lifetime of the development* as a result of climate change. The likely increase in flow (and hence flood level) over the lifetime of the development should be assessed proportionally to government guidance as outlined above. For design purposes, the Environment Agency recommend that the 'lifetime of development' is adopted as 60 years and 100 years for commercial and residential development respectively.

61. It is important to remember however that the potential impacts of climate change will affect not only the risk of flooding posed to property as a result of river flooding, but it will also potentially increase the frequency and intensity of localised storms over the District. This may exacerbate localised drainage problems, and it is essential therefore that the detailed FRA considers the potential impacts of climate change upon localised flood risks, aswell as the risks of river related flooding. PPS25 Appendix B (Table B2) provides guidance as to the anticipated increase in rainfall intensity that should be considered for design purposes. Designers should assume a 10% increase in rainfall intensity over the next 20 years, increasing to 20% in 50 years, and 30% in 100 years.

5 Flood Risk in West Berkshire

5.1 Overview

Fluvial (River) Flood Risk

62. Within West Berkshire, the principal watercourses that pose a potential risk of fluvial flooding to properties include the River Kennet, the River Lambourn, the River Pang and the River Thames. Other smaller watercourses, some of which are tributaries of the above, will also contribute to the risk of flooding however. Minor watercourses include the Rivers Shalbourne and Dun, which meet the Kennet near Hungerford, and Sulham Brook, which contributes to the flooding problems associated with the River Pang in Pangbourne. An overview of fluvial flood risk from rivers within West Berkshire is provided below.

Localised Flood Risk

63. A potential risk of flooding from other (non river related) sources exists throughout the District, including:

- *Surface Water Flooding* occurs when the amount of rainfall exceeds the rate of infiltration into the ground. This typically happens where the ground surface is impermeable, such as urban districts which have roads and paved areas. It also occurs where there are impermeable soils, such as clay. However, following periods of prolonged and/or heavy rainfall, many types of soil can also become impermeable. The risk from surface water runoff is greater in locations which are situated adjacent to sloping land, within natural valleys and/or are within local depressions.
- *Sewer Flooding* arises as a result of the failure of artificial drainage systems. Artificial drainage systems are put in place to manage runoff and effluents from a developed area, and typically include infrastructure such as pipes, land drains, sewers, drainage ditches, urban watercourses and culverts. Flooding from these systems can be as a result of several different problems. Common causes of flooding are:
  - blockages through debris accumulation;
  - insufficient flow capacity (usually as a result of lower design requirements during the time when they were built, as explained below);
  - structural failure (collapse).

  It is important to recognise that surface water networks are typically designed to cater for events up to a 3.33% (1 in 30 chance). Events that exceed this return period will overload the sewer system, resulting in flooding on the surface.

64. With changing climate patterns, it is expected that intense storms of this nature will become increasingly common. It is vitally important therefore that planning decisions recognise the potential risk that increased runoff poses to property and plan development accordingly so that future sustainability can be assured.

65. The potential sources of flood risk within the District are explained more fully below.

5.2 Historical Flooding

66. Flooding from the River Kennet has been recorded as far back as the 19th century. Particularly severe flooding occurred in 1947, an event that caused widespread damage throughout the lower reaches of the River Thames catchment. Flooding within the lower reaches of the River Kennet, affected properties in Newbury and Thatcham (and surrounding areas) also occurred in 1971, 1990, 2000 and 2003.

67. The most recent flooding event to affect West Berkshire was in July 2007. The July 2007

floods have been directly attributable to a period of short, but very intense, rainfall, which, according to early estimates, will only occur once every several hundred years. The rainfall caused severe surface water flooding in parts of the District.

68. Discussions with West Berkshire Council have been carried out to identify those areas within the District that are known to have experienced flooding in recent years. The Environment Agency has also made available the detailed River Kennet study which involved researching historical flooding incidences on the River Kennet. Historical flood data was collated and mapped, with some information stretching as far back as the early 20th Century. Known historical flooding incidents have been highlighted in the adjoining historical flood incidence map (see Appendix A).

69. It is important to emphasise that not all observed incidents captured in the adjoining relate to flooding from rivers, and reports of groundwater and surface water flooding within the District are relatively widespread, as discussed in Section 5.5. In some cases the cause of the flooding is somewhat uncertain, providing a timely reminder that planning decisions must not focus solely upon the risk of fluvial (river) flooding, but must also consider the potential risks posed by flooding from other sources.

5.3 Fluvial Flood Risk

River Kennet

70. The River Kennet flows west-east across West Berkshire, flowing through the towns of Hungerford and then Newbury, before flowing to the south of Thatcham, via Theale towards the Borough of Reading. The majority of the River Kennet's floodplain, according to the flood modelling, largely lies within rural areas and green space. However, parts of Kintbury, Newbury and Woolhampton have development shown to be within Flood Zone 3.

71. The modelled flood outline in Newbury is much reduced when compared to its extent to the east and west of the town. However, due to the density of development in the town centre, any fluvial flooding here could affect a significant number of properties, businesses and infrastructure. As the historical flood map shows, there have been a number of reports of flooding in Newbury along the course of the River Kennet.

72. A number of isolated properties along the length of the Kennet river valley, such as farm buildings and mills, are also shown to be within Zone 3.

River Dun

73. The River Dun is a tributary of the River Kennet and the confluence of these two rivers is on the eastern edge of Hungerford. Both rivers flow through the town and any fluvial flood risk here would be attributed to both watercourses. Indeed, historical flooding in Hungerford is focused in the area of the confluence and where the watercourses are channelled through the town, under bridges and through control structures. The Dun also has a confluence with the River Shalbourne just west of Hungerford, but historical flood data, like the flood modelling, does not indicate that flooding issues are common here.

River Lambourn

74. The flood modelling of the River Lambourn shows that, apart from some isolated locations, most peak river flows would be largely contained by the river channel. Localised spots of Zone 3 are present in Welford, Boxford, Woodspeen/Bagnor and Donnington, which are just north of Newbury, prior to the Lambourn's confluence with the River Kennet. Historical flood mapping shows that the River Lambourn has caused flooding in Newbury. This is because the B4009 road crosses the River Lambourn and the capacities of the structures in this location are not great enough to pass peak flows, thus causing the watercourse to come out of bank. The Lambourn's major tributaries, the Winterbourne and, to the west, the Great Shefford, show no Zone 3a and 3b areas of flood risk.

River Pang

75. The flood modelling on the upper River Pang is not detailed like it is for the other West Berkshire watercourses and it can be seen that the Flood Zones do not accurately follow the river. Therefore, accurate conclusions are difficult to draw in this case. It can be seen that the high risk Flood Zones are largely confined to the river corridor. Very few urban areas are intersected by the River Pang in its upper reaches, except for the villages of Compton, Hampstead Norreys and Bradfield.

76. Flooding has been witnessed in Compton (2000/2001) and Hampstead Norreys. The flooding in Compton has been attributed to rising groundwater, which activates a winterbourne (seasonal) watercourse that flows into the River Pang. The Pang is unable to accommodate the increased volume of water and flooding occurs. The diversion, landscaping and culverting of the watercourse has also exacerbated flooding problems in Compton. The flooding in Hampstead Norreys is caused by similar mechanisms.

77. The lower reaches of the River Pang, towards its confluence with the Thames, are where the greatest amounts of flooding are predicted. However, like many other parts of West Berkshire, the areas of flood risk are outside the urban area and only cover green space and rural land. This flooding, which is modelled to flood to the south of Pangbourne, is also a mechanism of the Sulham Brook, which flows parallel to the River Pang just prior to its confluence with the Thames.

River Thames

78. Although the River Thames does not actually flow through West Berkshire, it is the source of some of the most severe flooding in West Berkshire in recent times. The course of the River Thames delineates part of West Berkshire's north-eastern boundary and the settlement of Purley-on-Thames is bounded by the river. In January 2003, following prolonged and heavy rainfall, properties to the north of the railway lane were inundated by a sudden advance of flood water from the River Thames and over 200 properties were affected. The railway line forms a de facto flood defence and properties to the south are consequently afforded a level of flood protection.

Foudry Brook

79. The Foudry Brook flows from Hampshire into and across the very south-eastern corner of West Berkshire. This watercourse has undergone detailed flood risk modelling. The modelling shows that Zone 3 covers largely green space and rural land, with Stratfield Mortimer lying just outside the modelled Flood Zones.

80. There also exists a considerable amount of localised and incidental flood risk within West Berkshire. This is predominantly caused by localised surface water flooding following heavy rainfall and groundwater. Flooding from these mechanisms is discussed in subsequent sections.

River Enborne

81. The River Enborne flows in an easterly direction along the southern boundary of West Berkshire, affecting village communities within both West Berkshire and the neighbouring District of Basingstoke and Deane. The River Enborne is a tributary of the River Kennet, its confluence situated immediately to the north of Aldermaston.

82. The Environment Agency issue flood warnings to properties in West Woodhay, Enborne Row and Brimpton, highlighting the potential risk posed to these areas of flooding from the River Enborne.

5.4 Water Infrastructure (Pond & Canal) Failure

83. A number of water infrastructure facilities are evident within the District when viewing the OS basemap of West Berkshire (see figures provided in Appendix D). There are no large reservoirs within (or near) the District boundaries that will pose a potential risk to local residents as a result of failure. Other facilities are discussed briefly below.

Local Ponds

84. A number of local ponds are evident throughout West Berkshire, including (for example) a cluster of water bodies immediately to the south of Thatcham, i.e. the Nature Discovery Centre.

85. The risk of potential overtopping and/or failure of these facilities should be considered where future development is planned in close proximity. No specific risk 'envelope' is available for the water storage facilities, and the potential risk of flooding as a result of structural failure and/or overtopping is certainly anticipated to generally be much less than the indicative scenarios set out within PPS25 (i.e. 1% likelihood of occurring in any one year).

86. Notwithstanding this, this should be considered as a local residual risk within the context of a detailed Flood Risk Assessment.

Kennet & Avon Canal

87. The Kennet & Avon Canal is a key feature of the District, and as a raised conduit in some locations, this may pose a potential risk of flooding should a breach (structural) failure of the structure occur. The geometry of the canal along its length is unknown, and therefore a holistic assessment of the potential impact of structural failure is not feasible within the context of the SFRA. Discussions with British Waterways have proven inconclusive, however a rigorous monitoring and maintenance regime is in place that should ensure that the risk of catastrophic failure is extremely low. Consequently this should not unduly influence spatial planning decisions, however any potential future development within close proximity of the structure should consider the residual risk of failure in a local context (i.e. within the detailed Flood Risk Assessment).

88. Discussions with the Council have identified a potential risk of overtopping from the canal during particular wet weather, as outlined below. The detailed modelling of the canal system is heavily reliant upon complex operating regimes, and is outside the scope of this strategic investigation. It is essential however that the detailed FRA for any proposed future development within close proximity of the canal considers the potential risk of overtopping in liaison with the Environment Agency and BW.

5.5 Localised Risk of Flooding

5.5.1 Local Drainage Issues (Observed Flooding Incidents)

89. As discussed earlier, consultation has been carried out with a number of stakeholders to identify known and/or perceived problem areas. These problems are generally attributed to inundation resulting from (for example) culvert blockages and/or surface water flooding. Properties and infrastructure within the District have been subject to flooding in the recent past, as indicated in Appendix A.

90. Many of these problems are largely attributable to groundwater issues, which have been addressed separately below. However, several recurrent local flooding issues were identified, including:

- An unclassified watercourse that flows through Hermitage has been culverted, diverted and built over as the community developed. When rainfall becomes sustained and/or heavy, water from surrounding land enters the watercourse, which then restores its original course and floods properties;
- The area of the gravel pits near Aldermaston has been known to result in localised flooding. There are small lakes near the gravel pits that are used to wash the extracted gravel. In times of heavy rain, these fill and the excess water has flooded the Butt Pub in Aldermaston;
- The Kennet and Avon canal is reported to overflow during times of very heavy rainfall and the floodwater has inundated the Cunning Man pub, Reading Road, Burghfield;
- The A329 near Basildon and Purley Rise often floods due to inadequate highway drainage. In most cases, no pumping takes place and water levels are given time to recede naturally;
- A single report of groundwater flooding within Newbury (in an area overlying gravels) has been identified, however the precise locality and nature of the problem could not be confirmed;
- Properties in Newbury, Thatcham, Pangbourne and Lambourn were affected by surface water flooding in July 2007 following prolonged intense rainfall, many (if not all) of which were situated *outside* of the delineated PPS25 flood zones 2 and 3.

91. Given the heavily urbanised character of key town centres within West Berkshire, it is inevitable that localised flooding problems arising from under capacity drainage and/or sewer systems will occur, particularly given the mounting pressure placed upon ageing systems as a result of climate change. Furthermore, sewer systems are generally designed (in accordance with current Government guidance) to cater for the 3.33% (1 in 30) storm, and highway soakaways are generally designed for only 10% (1 in 10) storms. Storms over and above these design events will exceed the drainage system, resulting in overland flow, often in an uncontrolled manner (resulting in localised flooding). Input has been sought from Thames Water to pinpoint known and/or perceived problem areas relating to the sewer system. However, the information provided is very general.

Planning Response within Critical Drainage Areas

92. As highlighted earlier, given the perceived risk of localised flooding within West Berkshire, 'Critical Drainage Areas' have been identified for planning purposes. The guidance in PPS25 aims to steer development away from areas of flood risk, but this guidance is largely focussed upon areas of fluvial flood risk (as defined by the PPS25 flood zones). A suite of dedicated development control recommendations have therefore been provided in Section 6.4.4 specifically for these areas.

5.5.2 Groundwater Flooding

93. Many of the reports of groundwater flooding in West Berkshire have arisen from communities in the Berkshire Downs. The permeable beds of cretaceous chalk within the Downs are aquifers and are capable of storing and transporting groundwater flow. In such areas not only can normally dry areas of land flood due to locally high water tables, but intermittent streams called 'bournes' (or 'winterbournes') can be reactivated, causing flooding in locations remote from the perennial head of the stream. Flooding from both of these groundwater sources were experienced in 2000/2001 when sustained periods of heavy rainfall were experienced.

94. Groundwater flooding is normally difficult to predict and challenging to mitigate. However, following the 2000/2001 event a groundwater monitoring network was set up by the Environment Agency to predict groundwater flooding from chalk aquifers (see Appendix G). When groundwater levels in the boreholes reach a given height, warnings are triggered, which are issued to authorities and other external parties. The Environment Agency can use these levels calculate how many days it will take before the known flood level is reached. Furthermore, groundwater abstraction infrastructure was used successfully in 2003 and 2007 to lower groundwater tables at key locations to alleviate problems in Lambourn, Great Shefford, East Ilsley and Compton.

Planning Response to Groundwater Flooding

95. Despite a groundwater flood warning and management procedure being place for locations with a known risk, uncertainty still surrounds the long-term effectiveness and standards of protection offered across West Berkshire. Consequently, strategic planning and development control decisions should still consider the risks from groundwater flooding.

96. From a planning perspective, the risk of groundwater flooding is highly variable and heavily dependent upon local conditions at any particular time, and therefore it is not possible to sensibly develop a strategic map of 'groundwater risk' as part of the SFRA process. It is important to recognise however that historical flooding is *not* necessarily a robust measure of the risk of flooding in future years, and indeed the absence of observed flooding in the past should not be taken as any guarantee that flooding will not occur at some point in time.

97. Due to the high degree of variability when considering groundwater flooding, it is important to ensure that the potential risk of groundwater flooding to a property is considered within a local context. This is most appropriate at the development application stage (i.e. as part of the detailed Flood Risk Assessment). The FRA should incorporate a site based assessment of the potential risk of groundwater flooding to the site, confirming (or otherwise) the likelihood and/or severity of this source of flood risk.

98. Where a potential risk of groundwater is identified, it may be appropriate to (for example) incorporate flood proofing measures and/or the raising of entry thresholds to mitigate possible damages. It should also be noted that raising thresholds alone will not prevent flooding of basements or other underground structures, as groundwater will move up vertically through the floor. The adopted design of below-ground structures will need to ensure that it does not obstruct groundwater flow, or result in any worsening to the risk posed to adjoining, or nearby properties.

99. Another consideration with respect to groundwater is the effectiveness (or otherwise) of SUDS. The design of proposed developments should carefully consider the impact that raised groundwater levels may have upon the operation of SUDS during periods of heavy rainfall. The Environment Agency will object to soakaways in areas prone to groundwater flooding or where the maximum seasonal water table is less than 2m from the bottom of the soakaway, in the interests of groundwater quality protection.

5.6 Topography & Geology

5.6.1 Topography

100. The topography of West Berkshire is characterised by its river valleys, flowing in relatively well defined valleys from west to east (towards the River Thames). The natural floodplain of the River Kennet is a primary feature of the District, within which the risk of flooding to lower lying areas adjoining the river corridor is evident.

101. Elsewhere, ground levels are relatively undulating. In some areas, steep sided slopes (particularly in more rural areas) respond quickly to intense rainfall, allowing runoff to drain quickly and unhindered towards villages situated at their base, resulting in a risk of localised flooding[9].

102. A map of the topography of West Berkshire is provided in Appendix E.

5.6.2 Geology

103. The bedrock geology of West Berkshire is characterised predominantly by chalk to the north and west of the District, and clay to the south (i.e. south east of Thatcham). This geology will heavily influence both the susceptibility of areas to groundwater flooding (Section 5.5.2), and the the functionality of Sustainable Drainage (SUDS) techniques. The geology should therefore be carefully considered as part of the design process.

104. In simple terms, some infiltration techniques including for example soakaways are unlikely to operate efficiently in areas overlaying impermeable soils (i.e. clay). Areas of shallow groundwater may also hinder the performance of SUDS during wet weather, and once again infiltration techniques may not be suitable in areas where the maximum seasonal water table is situated within 2m of the surface.

105. An overview map of the geology of the West Berkshire is provided in Appendix E.

5.7 Impacts of Climate Change upon Flood Risk

106. No detailed modelling has been carried out within the District of West Berkshire relating to the potential impacts of climate change. For planning purposes therefore, **Zone 2 Medium Probability is considered a reasonable approximation of the likely extent of the High Probability flood zone in 100 years as a result of climate change**. This is a 'best practice' approach adopted throughout England in areas where more detailed information is not readily available.

Planning Response to Climate Change

107. **It is clear that climate change will not markedly increase the extent of river flooding within most areas of the District.** Consequently, few areas that are currently situated outside of Zone 3 High Probability will be at substantial risk of flooding in the forseeable future. This is an important conclusion from a spatial planning perspective.

108. It is important to recognise however that **those properties (and areas) that are currently at risk of flooding may be susceptible to more frequent, more severe flooding in future years**. It is essential therefore that the development control process (influencing the design of future development within West Berkshire) carefully mitigates against the potential impact that climate change may have upon the risk of flooding to the property.

109. For this reason, all of the development control recommendations set out below require all floor levels, access routes, drainage systems, infrastructure and flood mitigation measures to be designed *with an allowance for climate change*[10]. This provides a robust and sustainable approach to the potential impacts that climate change may have upon the District over the next 100 years, ensuring that future development is considered in light of the possible increases in flood risk over time.

[9] Overland flow paths are identified in Appendix E

[10] All elements of design must account for the potential impact of climate change in predicted peak design water levels, as highlighted in Section 6.4.4. The impacts of climate change should be assessed over the lifetime of the proposed development, and calculated in accordance with Appendix B of PPS25 (or as otherwise advised by the Environment Agency).

Climate Change Impacts upon Localised Flooding

110. It is important to remember however that the potential impacts of climate change will affect not only the risk of flooding posed to property as a result of river and/or tidal flooding, but it will also potentially increase the frequency and intensity of localised storms over the District. This may exacerbate localised drainage problems, and it is essential therefore that the detailed FRA considers the potential impacts of climate change upon localised flood risks, aswell as the risks of river related flooding.

111. PPS25 Appendix B (Table B2) provides guidance as to the anticipated increase in rainfall intensity that should be considered for design purposes. Designers should assume a 10% increase in rainfall intensity over the next 20 years, increasing to 20% in 50 years, and 30% in 100 years.

5.8 Residual Risk of Flooding

112. It is essential that the risk of flooding is minimised over the lifetime of the development in all instances. It is important to recognise however that flood risk can never be fully mitigated, and there will always be a residual risk of flooding. This residual risk is associated with a number of potential risk factors including (but not limited to):

- a flooding event that exceeds that for which the local drainage system has been designed;
- the residual danger posed to property and life as a result of flood defence failure;
- general uncertainties inherent in the prediction of flooding.

113. The modelling of flood flows and flood levels is not an exact science, therefore there are inherent uncertainties in the prediction of flood levels used in the assessment of flood risk. The adopted flood zones underpinning the West Berkshire SFRA are largely based upon detailed river modelling within the area. Whilst these provide a robust depiction of flood risk from a strategic perspective, all detailed modelling requires the making of core assumptions and the use of empirical estimations.

114. Taking a conservative approach for planning purposes therefore, the Environment Agency advises that finished floor levels are raised to 300mm above the 0.5% (200 year) peak design flood level (including climate change) when advising developers.

6 Sustainable Management of Flood Risk

6.1 Overview

115. An ability to demonstrate 'sustainability' is a primary government objective for future development within the UK. The definition of 'sustainability' encompasses a number of important issues ranging broadly from the environment (i.e. minimising the impact upon the natural environment) to energy consumption (i.e. seeking alternative sources of energy to avoid the depletion of natural resources). Of particular importance however is sustainable development within flood affected areas.

116. Recent history has shown the devastating impacts that flooding can have on lives, homes and businesses. A considerable number of people live and work within areas that are susceptible to flooding, and ideally development should be moved away from these areas over time. It is recognised however that this is often not a practicable solution. For this reason, careful consideration must be taken of the measures that can be put into place to minimise the risk to property and life posed by flooding. These should address the flood risk not only in the short term, but throughout the lifetime of the proposed development. This is a requirement of PPS25.

117. The primary purpose of the SFRA is to inform decision making as part of the planning and development control process, taking due consideration of the scale and nature of flood risk affecting the District. Responsibility for flood risk management resides with all tiers of government, and indeed individual landowners, as outlined below.

6.2 Responsibility for Flood Risk Management

118. There is no statutory requirement for the Government to protect property against the risk of flooding. Notwithstanding this however, the Government recognise the importance of safeguarding the wider community, and in doing so the economic and social well being of the nation. An overview of key responsibilities with respect to flood risk management is provided below.

119. The South East England Regional Assembly (SEERA) should consider flood risk when reviewing strategic planning decisions including (for example) the provision of future housing and transport infrastructure. SEERA is responsible for developing a Regional Flood Risk Assessment (RFRA) to inform the development (and distribution) of housing targets for Boroughs throughout the South East of England.

120. The Environment Agency has a statutory responsibility for flood management and defence in England and Wales. It assists the planning and development control process through the provision of information and advice regarding flood risk and flooding related issues.

121. The Local Planning Authority is responsible for carrying out a Strategic Flood Risk Assessment. The SFRA should consider the risk of flooding throughout the District and should inform the allocation of land for future development, development control policies and sustainability appraisals. Local Planning Authorities have a responsibility to consult with the Environment Agency when making planning decisions.

122. Landowners & Developers[11] have the primary responsibility for protecting their land against the risk of flooding. They are also responsible for managing the drainage of their land such that they do not adversely impact upon adjoining properties.

[11] Referred to also as 'landowners' within PPS25

123. The Environment Agency has developed a guide entitled "Living on the Edge" that provides specific advice regarding the rights and responsibilities of property owners, the Environment Agency and other bodies. The guide is targeted at owners of land situated alongside rivers or other watercourses, and is a useful reference point outlining who is responsible for flood defence, and what this means in practical terms. It also discusses how stakeholders can work collaboratively to protect and enhance the natural environment of our rivers and streams. This guide can be found on the Environment Agency's website at *www.environment-agency.gov.uk*

6.3 Strategic Flood Risk Management - The Environment Agency

6.3.1 Overview

124. With the progressive development of urban areas along river corridors, particularly during the industrial era, a reactive approach to flood risk management evolved. As flooding occurred, walls or embankments were built to prevent inundation to developing areas, often without consideration as to the effect that such limiters had on the ability of the watercourse to redistribute the risk of flooding elsewhere.

125. The Environment Agency (EA) in more recent years has taken a strategic approach to flood risk management. The assessment and management of flood risk is carried out on a 'whole of catchment' basis. This enables the Environment Agency to review the impact that proposed defence works at a particular location may have upon flooding at other locations throughout the catchment.

126. A number of flood risk management strategies are underway within the region, encompassing the large river systems that influence flood risk within West Berkshire. A brief overview of these investigations is provided below.

6.3.2 Thames Catchment Flood Management Plan (CFMP)

127. "*One of the Environment Agency 's main goals is to reduce flood risk from rivers and the sea to people, property and the natural environment by supporting and implementing government policies*.

128. *Flooding is a natural process – we can never stop it happening altogether. So tackling flooding is more than just defending against floods. It means understanding the complex causes of flooding and taking co-ordinated action on every front in partnership with others to reduce flood risk by*:

- *Understanding current and future flood risk;*
- *Planning for the likely impacts of climate change;*
- *Preventing inappropriate development in flood risk areas;*
- *Delivering more sustainable measures to reduce flood risk;*
- *Exploring the wider opportunities to reduce the sources of flood risk, including changes in land use and land management practices and the use of sustainable drainage systems.*

129. *Catchment Flood Management Plans (CFMPs) are a planning tool through which the Agency aims to work in partnership with other key decision-makers within a river catchment to explore and define long term sustainable policies for flood risk management. CFMPs are a learning process to support an integrated approach to land use planning and management, and also River Basin Management Plans under the Water Framework Directive*."[12]

[12] Catchment Flood Management Plans – Volume 1 (Guidance), Version 1.0, July 2004

130. A CFMP is being developed for the River Thames catchment and West Berkshire falls within this. A consultation summary document has recently been provided outlining the main messages from the CFMP (January 2007[13]).

131. The Environment Agency has summarised the CFMP into four main messages, which will form the basis for their approach to managing the risk of flooding in a sustainable way. The four messages are:

- Flood defences cannot be built to protect everything;
- Climate change will be the major cause of increased flood risk in the future;
- The floodplain is the most important asset in managing flood risk;
- Development and urban regeneration provide a crucial opportunity to manage the risk.

132. Specific messages have been produced in the Thames CFMP that apply to individual catchment types. The catchment types that apply to West Berkshire are: undeveloped natural floodplain; developed floodplain with built defences; and narrow floodplains and mixed land use. The main messages for these types of catchments are:

Undeveloped natural floodplain

- The floodplain is the most important asset in managing flood risk;
- Maximising the capacity of the floodplain to retain water in these areas can have many advantages for people and the natural environment;
- Managed flooding of some areas of the natural floodplain will reduce the risk to some communities;
- The Environment Agency will do all it can to prevent development that compromises the capacity of the floodplain to retain water. Future maintenance work on river channels should aim to increase the capacity of the floodplain.

Developed floodplain with built defences

- At present it is still possible and effective to maintain these flood defences;
- Climate change will mean that these defences will become less effective in the future. Therefore, the Environment Agency need to make sure that:
  - Any redevelopment reduces the residual flood risk in the areas benefiting from these flood defences using measures set out in PPS25;
  - The natural floodplain is used upstream and downstream of these areas to accommodate additional floodwater.

Narrow floodplains and mixed land use

- PPS25 provides the policy framework to make sure that flood risk is considered in new developments;
- There does not need to be a radical change in the way the Environment Agency manages the risk in these areas. The Environment Agency will continue to maintain watercourses, increase flood awareness and provide appropriate flood warnings.

[13] Thames Region Catchment Flood Management Plan, Summary Document for Consultation, January 2007

133. The Thames CFMP provides guidance and advice on how the SFRA process should address the following:

- Risk Reduction;
- Riverside Developments;
- Drainage;
- Flood Alleviation Schemes;
- Emergency Planning;
- Long Term Planning.

134. Finally, messages have been provided in the Thames CFMP that apply specifically to the River Kennet. Further detail can be obtained from the Environment Agency, however of particular relevance is the importance that is placed upon the Strategic Flood Risk Assessment (SFRA) process to inform spatial planning and flood resilience responses in Newbury. Specific outcomes that are sought include:

- Long-term master-planning for Newbury to establish an urban corridor that is more accommodating of flooding and its location in a floodplain. The outcomes here will be long-term and need to relate to the action below on improving conveyance;
- Using the sequential approach and applying the exception test if necessary.
- Establishing a Functional Floodplain (to be discussed and agreed locally).
- All redevelopment to be flood resilient (i.e. raised floor levels). Establish priorities for retro-fitting of vulnerable assets.
- Safeguarding natural floodplain from future development through the appropriate application of the sequential test.

135. In summary, the CFMP seeks a sustainable, planning-led solution to flood risk management within the Thames Region. The CFMP encourages local authorities (and indeed developers) to aim for a positive reduction in flood risk through future development and regeneration. This process strives to ensure that decisions taken not only avoid the creation of a future legacy of new development at risk of flooding, but also progressively reduce the risk of flooding to existing development. This is a key objective of PPS25.

6.3.3 Kennet Strategy

136. The Kennet Strategy (July 2005) was developed in advance of the Thames CFMP (refer above), however was designed to ensure compatibility with the emerging CFMP program. The strategic aim for the Strategy was "*to increase knowledge and improve understanding of flooding in the Kennet catchment in order to reduce risks to people and the development and natural environment, providing all institutions with a framework for sustainable flood risk management for the next 100 years.*"

137. The Strategy has considered the River Kennet catchment as a whole, extending from the adjoining District of Wiltshire, through West Berkshire, and into the Borough of Reading. Three flooding 'hotspots' were identified by the Strategy, providing the focus for future possible flood alleviation schemes, and these included Marlborough (Wiltshire), Hungerford and Newbury (West Berkshire) and Reading. Collectively it was estimated that approximately 1150 homes within the catchment are at risk of flooding from the River Kennet in the 1% (100 year) design event.

138. A number of potential flood alleviation options were broadly considered to assess the

benefits that they will provide (in terms of reduced flood risk to property), the environmental impacts and/or opportunities that they may introduce, and the costs that would be incurred. The following key conclusions have been drawn:

- *Land-use management is promoted as a non-structural measure that will have benefits at a local level in terms of both low-order flood alleviation and water quality improvement;*
- *In the case of upstream storage, it neither provides a single strategic flood alleviation solution for this catchment nor is it a practicable one, as the typically long duration flooding cannot be attenuated easily without very large storage facilities;*
- *Local storage options are proposed, integrated with other structural options, as they not only contribute to flood attenuation and compensation storage, but also provide the opportunity for wetland creation and other environmental enhancement;*
- *The preferred structural solutions are schemes for Newbury and Hungerford in the Middle Kennet and Marlborough in the Upper Kennet, and these have been put forward for further consideration;*
- *Other structural options were identified and reviewed throughout the catchment as part of this strategy but could not be justified as part of the preferred option.*

6.3.4 Flood Alleviation Schemes Being Investigated

139. A number of potential opportunities for flood alleviation are (or have been recently) under investigation by the Environment Agency, as summarised below. It is highlighted that all schemes are, it is understood, under consideration.

Refurbishment of Bone Mill Sluices, Newbury (2007)

140. It is understood that the existing sluice gates at Bone Mill Sluices are in a dilapidated condition, and an investigation is underway to examine options for their refurbishment. These investigations have focussed heavily upon the impact that the proposed refurbishment may have upon water levels through Newbury, seeking to optimise the benefit provided to the local community (in terms of reduced flood risk).

Proposed Extension to Existing Flood Defences, Stratfield Mortimer (2005)

141. The Environment Agency has provided drawings of a possible extension to the existing bund that provides protection to properties in Stratfield Mortimer against flooding from Foudry Brook.

Possible Flood Alleviation Scheme, Lambourn (2005)

142. The feasibility of potential flood alleviation scheme has been investigated for the town of Lambourn, within which it was estimated that approximately 95 homes are at risk of flooding from the River Lambourn in the 1% (100 year) flood event. Flood storage was deemed to be the only practical option available for the town, however the cost of construction was found to be prohibitive when compared to the economic benefits achieved. For this reason, no further consideration of the scheme has been proposed.

Possible Flood Alleviation Works, Winterbourne (2001)

143. Properties in the village of Winterbourne were affected by flooding from Winterbourne Stream in 2000. Following the floods, the Council carried out some maintenance works to the stream, removing accumulated silt upstream and downstream of the village. The

Environment Agency subsequently reviewed the need for, and feasibility of, a possible flood alleviation scheme for the village, however this was considered unwarranted. Rather a recommendation was made to consider a programme of future maintenance of Winterbourne Stream to reduce the build up of silt.

Possible Flood Alleviation Scheme, Burghfield (2003)

144. The feasibility of potential flood alleviation scheme has been investigated for the town of Burghfield, within which it was estimated that approximately 54 homes are at risk of flooding from the River Kennet in the 1% (100 year) flood event. A number of potential improvement options have been considered, the most favourable being the introduction of a bund to provide a 4% (1 in 25 chance) standard of protection to four of the worst affected properties.

6.3.5 Flooding in West Berkshire, Action Plan for 2001/02

145. Following the floods in West Berkshire during 2000, a joint task force was established to review the cause of flooding, and outlining specific actions to be undertaken to mitigate risk. This Action Plan was developed accordingly by West Berkshire Council, Thames Water and the Environment Agency.

146. The Action Plan has been prepared to provide the general public with a clear explanation of the causes of flooding during the winter of 2000, and highlighting roles and responsibilities (including contact details) should further problems be experienced. A number of key actions were raised, relating to specific problem areas throughout the District that suffered flooding in 2000. These have been largely taken forward through the commissioning of the local investigations outlined in the sections above.

6.4 Planning & Development Control – West Berkshire

6.4.1 Planning Solutions to Flood Risk Management

147. The risk of flooding is most effectively addressed through *avoidance*, which in very simple terms equates to guiding future development (and regeneration) away from areas at risk. Development that is sustainable for future generations is imperative, and it is widely recognised that the risk of flooding cannot be considered in isolation. There are many tests and measures of 'sustainability' that must be weighed in the balance when locating and designing future development.

148. PPS25 endeavours to guide Local Planning Authorities in this decision making process, and the Sequential and Exception tests underpin the method by which flood risk should be taken into consideration as part of the planning process. The application of these tests within West Berkshire (by the Council) is outlined below.

The Sequential Test

149. Historically urbanisation has evolved along river corridors, the rivers providing a critical source of water, food and energy. This leaves many areas of England with a legacy of key urban centres that, due largely to their close proximity to rivers, are at risk of flooding.

150. The ideal solution to effective and sustainable flood risk management is a planning led one, i.e. steer urban development away from areas that are susceptible to flooding. PPS25 advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites). In simple terms, this requires planners to seek to allocate sites for future development within areas of lowest flood risk in the initial instance. Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites (i.e. within areas that may potentially be at risk of flooding) be contemplated. This sequential approach is referred to as **The Sequential Test**, and is summarised in Figure 3.1 of the

PPS25 Practice Companion Guide (A Living Draft, February 2007).

It is absolutely imperative to highlight that the SFRA does not attempt, and indeed cannot, fully address the requirements of the PPS25 Sequential Test. As highlighted in this section and Figure 3.1 of the Practice Guide, it is necessary for the Council to demonstrate that sites for future development have been sought within the lowest flood risk zone (i.e. Zone 1 Low Probability). Only if it can be shown that suitable sites are not available within this zone can alternative sites be considered within the areas that are at greater risk of possible flooding (i.e. Zone 2, and finally Zone 3).

151. As indicated by the bottom right hand corner of Figure 3.1 of the Practice Guide, PPS25 stipulates permissible development types. This considers both the degree of flood risk posed to the site, and the likely vulnerability of the proposed development to damage (and indeed the risk to the lives of the site tenants) should a flood occur.

152. Wherever possible, the Council should restrict development to the permissible land uses summarised in PPS25 Appendix D (Table D2). These are replicated in Appendix E of this report for ease of reference. This may involve seeking opportunities to 'swap' more vulnerable allocations at risk of flooding with areas of lesser vulnerability that are situated on higher ground.

153. It is important to recognise that the principles of the sequential approach are applicable throughout the planning cycle, and refer equally to the forward planning process (delivered by Council as part of the LDF) as they do to the assessment of windfall sites. Where windfall sites come forward for consideration, it is essential that the developer to consider the planning 'need' for the proposed site (adopting a sequential approach in accordance with PPS25). The Council will assist where possible with supporting information. The detailed FRA will be required to demonstrate the careful and measured consideration of whether indeed there is an alternative site available within an area of lesser flood risk, in accordance with the PPS25 Sequential Test.

The Exception Test

154. A proportion of West Berkshire is situated within PPS25 Zone 3. This is a particularly important growth area within the south of England and future investment is paramount, and consequently there are clearly other non-flooding related planning 'needs' that warrant further consideration of these areas. Given that this is the case, following the application of the Sequential Test, the Council and potential future developers are required to work through the **Exception Test** (PPS25 Appendix D) where applicable. 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 SFRA where one has been prepared. If the DPD has reached the 'submission' stage, the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;*
- *the development should be on developable, previously development land or if it is not on previously developed land, that there are no reasonable alternative sites on previously development land; and*

155. The first two points set out in the Exception Test are planning considerations that must be adequately addressed. A planning solution to removing flood risk must be sought at each specific location in the initial instance, seeking to relocate the proposed allocation to an area of lower flood risk (i.e. Zone 1 Low Probability or Zone 2 Medium Probability) wherever feasible.

156. The West Berkshire SFRA has been developed to inform the Sequential Test. It will be the responsibility of the Council to carry out the Sequential Test on the basis of this information, allocating potential sites for future development accordingly. Furthermore, the developer will

be required to demonstrate within the detailed Flood Risk Assessment that the Sequential Test has been applied, and (where appropriate) that the risk of flooding has been adequately addressed in accordance with PPS25.

- *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall."*

157. The management of flood risk throughout the District must be assured should development be permitted to proceed, addressing the third critical element of the Exception Test. The SFRA has provided specific recommendations that ultimately should be adopted as design features, with evidence provided of how they will be fulfilled prior to permission being granted for all future development. It is the responsibility of the prospective developer to build upon these recommendations as part of a detailed Flood Risk Assessment to ensure that the specific requirements of PPS25 can be met.

158. An overview of flood risk throughout the District has been provided in Section 5 and the adjoining flood risk maps (Appendix D).

Future planning decisions should consider the spatial variation in flood risk across the District, as defined by the delineated flood zone that applies at the specified site location, and apply the recommendations provided below accordingly

159. It is reiterated that PPS25 applies equally to both allocated sites identified within the emerging LDF and future windfall sites.

6.4.2 A Proactive Approach – Positive Reduction of Flood Risk through Development

160. It is crucial to reiterate that PPS25 considers not only the risk of flooding posed to new development. It also seeks to positively reduce the risk of flooding posed to existing properties within the District. It is strongly recommended that this principle be adopted as the underlying 'goal' for developers and Council development control teams within the District.

161. Developers should be encouraged to demonstrate that their proposal will deliver a positive reduction in flood risk to the District, whether that be by reducing the frequency or severity of flooding (for example, through the introduction of SUDS), or by reducing the impact that flooding may have on the community (for example, through a reduction in the number of people within the site that may be at risk). This should not be seen as an onerous requirement, and indeed if integrated into the design at the conceptual stage, will place no added demands upon the development and/or planning application process.

- Possible risk reduction measures for consideration may include the following:
- The integration of SUDS to reduce the runoff rate from the site;
- Where redeveloping an existing site, a change in land use to reduce the vulnerability of the proposed development;
- A reduction in the building platform area;
- The raising of internal floor levels and flood proofing (within existing buildings) to reduce potential flood damage;
- The rearrangement of buildings within the site to remove obstructions to overland flow paths;
- The placement of buildings to higher areas within the site to limit the risk of flood damage;
- The integration of landscaping for flood storage and flood resilience

162. It is recommended that a clear statement is requested within each and every detailed FRA that concisely summarises how a reduction in flood risk has been achieved within the proposed (re)development. This may be specified as (for example) a reduction in flow from the site, a reduction in water levels within (or adjacent to) the site, or a reduction in the consequences of flooding.

6.4.3 Localised Flood Risk within the Planning Process

163. The PPS25 Practice Guide advocates the application of a sequential approach when allocating land, taking into consideration *all* sources of flooding. The local drainage related problems identified within West Berkshire are considered a primary risk, and consequently areas that may be at risk of groundwater and/or surface water flooding have been identified as Critical Drainage Areas for planning purposes.

164. It is important to recognise that there is a high degree of uncertainty in the risk of localised flooding from other sources, relating both to how frequently (if at all) flooding can be expected to occur, and the damage that this may cause. From a spatial planning perspective therefore, it is considered unreasonable to restrict future development within areas that may have suffered a localised flooding incident in years past. It is essential however not to overlook the potential risk of localised flooding during the design process. A proactive approach to risk reduction through design can mitigate the potential for damage, both to the development itself and elsewhere. Specific development control recommendations have been provided accordingly.

6.4.4 Spatial Planning & Development Control Recommendations

PPS25 Requirement	PPS25 Flood Zone					
	Zone 3b Functional Floodplain		Zone 3a High Probability	Zone 2 Medium Probability	Critical Drainage Areas	Zone 1 Low Probability
	Developed Areas	Undeveloped Areas				
SPATIAL PLANNING RECOMMENDATIONS						
Important Considerations	It is important to recognise that, within Zone 3b Functional Floodplain, *'previously developed land'* relates solely to existing buildings that are impermeable to flood water. The land surrounding these buildings are important flow paths and/or flood storage areas that must be retained.		Future development within Zone 3a High Probability can only be considered following application of the Sequential Test	Future development within Zone 2 Medium Probability can only be considered following application of the Sequential Test	Critical Drainage Areas (CDAs) have been identified as areas that may be susceptible to groundwater and/or surface water flooding. Localised flooding must be considered as an integral part of the design process for all development within CDAs.	It is important to recognise that sites within Zone 1 may be susceptible to flooding from other sources. Development may contribute to an increase in flood risk elsewhere if not carefully mitigated
	It should be recognised that property situated within Zone 3b Functional Floodplain will be subject to frequent flooding, on average, no less than once in every 20 years. There are clear sustainability implications to be considered in this regard, and it is highly questionable whether insurance against flooding related damages will be available in the longer term.				As part of the Environment Agency's Making Space for Water programme, the methods for monitoring and recording these sources of flooding are being investigated. Further advice on CDAs may emerge as a result.	
Land Use (refer Table D2 of PPS25)	Proactively seek a reduction in risk by reducing the vulnerability of the existing land use	Water Compatible Development	Land use should be restricted to Water Compatible or Less Vulnerable development. More Vulnerable development may only be considered if Exception Test can be passed	Land use should be restricted to Water Compatible, Less Vulnerable or More Vulnerable development. Highly Vulnerable development may only be considered if Exception Test can be passed	No restrictions upon land use	No restrictions upon land use
DEVELOPMENT CONTROL RECOMMENDATIONS						
Detailed Flood Risk Assessment (FRA)	Required	Required	Required	Required	Required	Required for all sites greater than 1ha in area. Recommend that all sites carry out an assessment of localised flood risks (including surface water (flash) flooding)
Extensions, Outbuildings, Permitted Development & Property Subdivision	There should be a presumption against all building extensions (including out-buildings). Property subdivision may increase the popultation at risk, and should not be permitted		Building extensions (including out-buildings) should be discouraged to avoid raising flood levels elsewhere. Property subdivision may increase the intensity of development, and the population at risk, and should be discouraged	N/A	Building extensions and outbuildings may obstruct overland flow paths and should be designed carefully to avoid raising the potential risk of flooding to adjoining properties	N/A
Floor Level	To be situated a minimum of 300mm above the 1 in 100 year river flood level, including climate change (refer Section 6.6.2)				No minimum level stipulated by PPS25	
Site Access & Egress	For residential property, dry access is to be provided in the 1 in 100 year design event. For commercial property, access must be 'safe' in accordance with Defra "Flood Risk to People" (FD2320 & FD2321)	Residential and/or commercial property is not appropriate within Zone 3b Functional Floodplain (undeveloped). Emergency evacuation procedures should be considered as an integral part of the design process.	For residential property, dry access is to be provided in the 1 in 100 year design event. For commercial property, access must be 'safe' in accordance with Defra "Flood Risk to People" (FD2320 & FD2321)		Localised flooding will typically be short duration, however groundwater flooding may occur over longer periods. The detailed FRA should consider the vulnerability of the proposed development, and if the anticipated duration of flooding is extended, then a safe route of egress should be provided	No minimum level stipulated by PPS25
Basements	Not permitted	N/A	No sleeping accomodation permitted at basement level. All basements must have an access point that is above the 1 in 100 year river flood level, including climate change (refer Section 6.6.2)	No restrictions	No sleeping accomodation permitted at basement level. All basements must have an access point that is above the anticipated localised flood level	No restrictions
Site Runoff	Implement SuDS to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SuDS design must take due account of groundwater and geological conditions (refer Section 6.6.3)					
Buffer Zone	A minimum 8m buffer zone must be provided to 'top of bank' within sites immediately adjoining a river corridor. This relates to both open waterways and culverted waterway corridors. Reference should be made to the Environment Agency's "Living on the Edge" guide (www.environment-agency.gov.uk) that discusses any development situated in, over, under or adjacent to rivers and/or streams					
Other	Ensure that the proposed development does not result in an increase in maximum flood levels within adjoining properties. This may be achieved by ensuring (for example) that the existing building footprint is not increased, that overland flow routes are not truncated by buildings and/or infrastructure, or hydraulically linked compensatory flood storage is provided within the site (or upstream)					
	As an integral part of the government's "Making Space for Water" agenda, the Environment Agency is actively seeking the renaturalisation of culverted watercourses as part of any future development. Realistic opportunities to reinstate the natural open waterway within existing culverted reaches of the river(s) should be promoted					

6.5 SFRA Interpretation

6.5.1 Use of the SFRA

165. The spatial variation in flood risk across the District is depicted in the adjoining maps (Appendix D), and described in the sections below. The West Berkshire SFRA (Level 1) should be used by both the Council and prospective developers to meet their obligations under PPS25 throughout the planning cycle. Instructions for use are provided below:

West Berkshire Council (Forward Planning)

166. Appendix D provides an overview of the spatial variation in fluvial flood risk throughout the District. It is necessary to adopt a sequential approach when considering where land should be allocated for future development, and this is described in Section 6.4. This figure should be used to inform this sequential approach. Further more detailed descriptions of flood risk in a more localised context (including historical flooding) are provided in Appendix A. Furthermore, PPS25 provides clear guidance on permissible land use within areas potentially at risk from flooding, and this too is discussed in Section 6.4.

167. Whilst there is no particular constraint placed upon land use within areas of Zone 1 Low Probability within the District, it is strongly recommended that the Council takes due consideration of flooding from other sources (i.e. non fluvial). Areas considered particularly at potential risk of groundwater and/or surface water flooding have been delineated as Critical Drainage Areas (CDA) accordingly.

168. Areas at risk from localised and non fluvial sources are depicted in Appendices C and F. Many of these localised sources of flooding within West Berkshire can be effectively managed through the design process, however it is recommended that advice is taken from the Environment Agency to ensure that the severity of the local issue that may affect (or be exacerbated by) the proposed allocation is fully appreciated.

West Berkshire Council (Development Control) & Developers

169. It is important that the potential risk of flooding is considered as an integral part of all proposed development within the District. Appendix D provides a measure of the severity of flooding within the proposed development site. Further more detailed descriptions of flood risk in a more localised context (including historical incidents) are provided in Appendix A. These should be used to trigger a more detailed assessment of flood risk related issues within the site, as described in Section 6.4 and 6.6.

170. The assessment of localised flooding related issues is imperative for all proposed development, irrespective of its location and/or scale within the District, and the SFRA provides some helpful tools to assist in this regard:

171. Appendix A provides an indication of areas that have been susceptible to localised flooding historically. This is not a comprehensive record of flooding, and relies upon community reports of flooding made to the Council(s). It is a good indication of areas that may be susceptible however, and reiterates the importance of considering flood risk related issues in areas that are outside of the designated PPS25 flood zones.

172. The figures provided in Appendix E provide an overview of the topography and geology of the District. The detailed FRA should use this information to assess (in a site based context) the potential risk of localised ponding, flash flooding and/or inundation from groundwater.

6.5.2 Overview of Flood Risk - Key Areas

173. Flood risk within West Berkshire has been considered on the basis of areas of development pressure and character. Although no specific sites have been put forward for development at this stage in the LDF preparation process, the emerging Core Strategy proposes that new development is focussed within the main urban areas and their surroundings. Therefore, the

locations chosen for discussion are:

- Newbury
- Thatcham
- Hungerford
- Purley, Calcot, Tilehurst, Theale
- The Kennet Valley (south of Reading)
- The Berkshire Downs

174. The discussions of flood risk should be cross-referenced with the Flood Zone maps in Appendix D. This approach has not been done specifically for each area in the following section in order to avoid the discussion of each area of flood risk becoming cumbersome and repetitive. However, they indicate which of the key principals of PPS25 are particularly relevant to that area.

6.5.3 Newbury (Figure D-2)

Fluvial Flooding – River Kennet
Newbury is West Berkshire's largest urban area and it sits on the confluence of two of the districts principal watercourses; the River Kennet and the River Lambourn. The areas that are currently affected by **Zone 3a High Probability** in Newbury are as follows: To the west of the town (west of the A34 road), there are wide tracts of Flood Zone 3a, showing that the topography would allow the 1% annual probability flood event to flood much of the land here. Just east of the A34, Zone 3a continues to cover a wide tract of land, including the Speen Moor Plantations, where the river meanders alongside the Kennet and Avon canal, as well as a number of other bypass and drainage channels. The extent of Flood Zone 3a temporarily narrows as the River Kennet bypasses the dismantled railway line. As the river enters Northcroft Park, Flood Zone 3a broadens again to cover most of the park, as well as the recreation centre, Northcroft lane, Cleveland Grove, Crawford Place, West Street and the properties thereabouts. East of West Street, Flood Zone 3a narrows and is entirely restricted to the river channel between Northbrook Street and Park Way. Downstream of Park Way Flood Zone 3a extends into Victoria Park and covers much of the land between Mill Lane/Bone Lane and the River Lambourn. Flood Zone 3a narrows slightly in the area of the confluence of the River Kennet and River Lambourn but still covers the area of the Marina and Ham Marsh. Downstream of the Ham Bridge and the B3421, Flood Zone 3a covers the wetland area and the Nature Discovery Area, with the only buildings at risk being those between the Kennet and Avon canal and the railway line in the vicinity of Brookway, Express Way and Cyril Vokins Road. In west Newbury, **Zone 3b Functional Floodplain** covers the north-eastern part of the West Fields part of town and, in particular, West Mills, Kennet Road, Craven Road and Berkley Road are shown to be at risk. There are documented incidences of flooding in West Mills. The area west of the A339 and south of London Road is also shown to have a large tract of Zone 3b, which extends outwards from the areas shown to be within Zone 3a as discussed above. Park Way, Charlton Place, Mary's Road and Victoria Gardens are within Zone 3b Functional Floodplain. To the east of the A339, **Flood Zone 3b Functional Floodplain** is, again, more widespread. Faraday Road is within Zone 3b, as is the area to the south of the River Kennet, which includes the industrial areas of Mill Lane, Arnhem Road, and Bone Lane. Beyond this, as the River Kennet flows east, **Flood Zone 3b Functional Floodplain** becomes more restricted. Flood Zone 2 follows very similar patterns to those of Flood Zone 3a. However, Flood Zone 2 is a little more extensive in the area between Northbrook Street and Park Way and the area around the Marina, including the industrial estates in that part of town. Needless to say, even if the extent of Flood Zone 2 is the same as that of Flood Zone 3a, the depth of flooding in the 0.1% annual probability event will be greater, meaning that the level of Flood Hazard is also greater.

Fluvial Flooding – River Lambourn
The River Lambourn enters Newbury on the north side of town towards Donnington. The river valley here is in open, green space and **Zone 3a High Probability** is shown to cover these areas The same is true of the land between the A339 and Shaw Bridge, which passes the Lambourn under Shaw Road. It is not until the River Lambourn flows east, past Shaw Road, that properties encroach upon the river channel. In this area, as described above, Flood Zone 3a stretches between the River Lambourn and the River Kennet, covering most of the land between the river channel and the A4 London Road. **Zone 3b Functional Floodplain** on the River Lambourn follows similar patterns, and extents as, Zone 3a High Probability. The same is true of Flood Zone 2, except that there is more coverage in the area between the River Lambourn and the A4.
Localised Flooding
In terms of surface water problems, Newbury does not have any significant historical records of flooding. Even during the July 2007 event, there were relatively few reported incidences of flooding from surface water. Where surface water flooding was reported in Newbury, it was focused around Shaw Road, Cromwell Road, Wellington Close and Walton Way. Flooding was also evident at the railway station, with flooding of the railway lines to a depth of approximately 0.5m (between the platforms) as a result of overflowing drains within the proximity of the station.

6.5.4 Thatcham (Figure D-2 and Appendix F)

Fluvial Flooding – River Kennet
The River Kennet flows to the south of Thatcham and the flood modelling shows that the extensive areas of **Zone 3a, 3b and 2** are entirely restricted to the undeveloped areas that is south of town. Only the very south-eastern corner of Thatcham, in the area of the station and the industrial estate, is shown to be within Zone 3.
Localised Flooding
Thatcham's greatest flood risk comes from surface water flooding. Some 1625 reported incidences of flooding were received in July 2007. This event caused flooding in two distinct areas of the town, including the housing estates enclosed by the A4, Pipers Way and Station Road (south east of Thatcham), and the area to the north of Bath Road, between Northfield Road and Henwick Lane/Gordon Road (north west of Thatcham). A number of flood reports also came from the area south of Bath Road by Bourne Road and Paynedown Road (over 130 properties were flooded in this road alone).

6.5.5 Hungerford (Figure D-3)

Fluvial Flooding – River Kennet
Hungerford is in the south-west of West Berkshire and lies between the confluences of the River Kennet and River Dun to the east and the River Dun and River Shalbourne to the west. The principal watercourse in Hungerford, therefore, is the River Kennet, yet flood modelling shows that it imposes little flood risk upon the town. Upstream of Hungerford, the areas of **Zone 3a High Probability** and **Zone 3b Functional Floodplain** are largely restricted to undeveloped land either side of the river corridor. Only where the A4 Bath Road crosses the River Kennet by Eddington Bridge does Zone 3a and 3b encroach upon development. Historical flood data does show that flooding has occurred here, no doubt when debris build-up reduces the conveyance capacity of the bridge, thus causing the River Kennet to flood over the A4 Bath Road and rejoin the channel downstream. To the east of Eddington Bridge, Zone 3a and 3b reach across a greater width of the floodplain, with Zone 3a being as extensive as Zone 3b in many places. No development associated with Hungerford is at risk here, but individual farm buildings and a trout farm do fall within Zone 3a.
Localised Flooding
The potential risk of localised flooding from surface water runoff and/or groundwater appears very low in Hungerford, supported by the relatively small number of reported incidents.

6.5.6 Purley, Calcot, Tilehurst and Theale (Figure D-4 and D-5)

Fluvial Flooding – River Kennet
The River Kennet (and its tributary Holy Brook) flows to the south of Calcot and Theale and, although the modelled areas of flood risk, including **Zone 3a High Probability** and **Zone 3b Functional Floodplain**, cover a wide area, no property is shown to be at risk (except for individual farm buildings and mills). In this area, Zone 3b is extensive and covers much of the floodplain. Zone 3a extends further still and is shown to put the areas to the north of the River Kennet, toward the railway line, at risk from the 1% AEP event. Only when **Zone 2 Medium Probability** is considered does development get shown as being at risk. The Zone 2 outline encloses the Industrial Estate/Business Park off Waterside Drive in Theale and Hawkesbury Drive and Mackay Close in Calcot.

Fluvial Flooding – River Thames
In Purley-on-Thames, flood risk arises from the River Thames. **Zone 3a High Probability** extends from the River Thames to Mapledurham Drive, Colyton Way, Wintringham Way, Brading Way and Chestnut Grove. Flood Zone 2, encompasses all of Purley-on-Thames that lies to the north of the railway line. This area of Purley-on-Thames has experienced severe flooding in recent times. In January 2003, following prolonged and heavy rainfall, properties to the north of the railway lane were inundated by a sudden advance of flood water from the River Thames and over 200 properties were affected. Groundwater was thought to have compounded flooding here as saturated land allowed groundwater levels to rise to a level where flooding occurred. No modelling detailing Flood Zone 3b is available for this area of West Berkshire. As stated previously in this report, the railway line forms a de facto flood defence and properties to the south are afforded flood protection from fluvial flooding from the River Thames. In Pangbourne, the areas of flood risk are largely to the south and south-east of the village, in the shared floodplains of the River Pang and the Sulham Brook. Coverage of Flood Zone 3a to the south of Pangbourne is patchy and does not put any wide areas of development at risk. Only a small finger of Zone 3a encroaches onto the eastern corner of Pangbourne, in the area of Briars close. The widest distribution of Zone 3a exists to the east Tidmarsh, which is to the South of Pangbourne. 26 properties in Briars Close are now protected to a 1.33% (1 in 75 chance) standard of protection following the implementation on the River Pang and Sulham Brook Flood Alleviation Scheme, by the Environment Agency. **Zone 2 Medium Probability** is much more extensive in Pangbourne and its surrounds. The shared floodplains of the River Pang and Sulham Brook to the south of Pangbourne are covered by Zone 2. Development on the eastern fringe of Pangbourne is also shown to be within Zone 2, which includes Bourne Road, Wilder Avenue, Bucknell Avenue and Purley Way. An area of Zone 2 also extends into west Pangbourne in the region of the A340 Tidmarsh Road, to the north of Green Lane. Development either side of the A340 in this area would be at risk in the 0.1% AEP flood event
Localised Flooding
The potential risk of localised flooding from surface water runoff appears relatively low in this area. The risk associated with potential groundwater flooding is discussed in relation to the ‘River Thames’ above.

6.5.7 The Berkshire Downs (Figure D-1)

Fluvial Flooding – River Thames
The Berkshire Downs, in terms of main rivers, are intersected only by the River Lambourn and the River Pang. Detailed flood modelling of these rivers show that they have little flood risk associated with them. On the Lambourn, only small areas of **Zone 3a High Probability** exist in the small settlements of Boxford and Woodspeen. **Zone 2 Medium Probability** does not extend further than the Zone 3a High Probability flood outline. This is due to the steep sided valley of the River Lambourn. Very few historical reports of fluvial flooding have been recorded for the River Lambourn.
Localised Flooding
A few localised incidences of flooding in Lambourn itself have been highlighted, which lies near the source of the river. Many of these localised incidents have been attributed to groundwater flooding, or high river levels exacerbated by inputs from groundwater springs. As with many other areas in the Berkshire Downs, Lambourn, Great Shefford, East and West Ilsley, Hampstead Norreys, Compton, Burghfield and Hermitage, are all affected from time to time by groundwater or groundwater-influenced flooding.

6.6 Detailed Flood Risk Assessment (FRA) – The Developer

6.6.1 Scope of the Detailed Flood Risk Assessment

175. As highlighted above, the SFRA is a strategic document that provides an overview of flood risk throughout the area. It is imperative that a site-based Flood Risk Assessment (FRA) is carried out by the developer for all proposed developments, and this should be submitted as an integral part of the planning application.

176. The FRA should be commensurate with the risk of flooding to the proposed development. For example, where the risk of flooding to the site is negligible (e.g. Zone 1 Low Probability), there is little benefit to be gained in assessing the potential risk to life and/or property as a result of flooding. Rather, emphasis should be placed on ensuring that runoff from the site does not exacerbate flooding lower in the catchment. The particular requirements for FRAs within each delineated flood zone are outlined below.

Proposed Development within Zone 3a High Probability & Zone 3b Functional Floodplain (existing developed areas)

177. All FRAs supporting proposed development within Zone 3b Functional Floodplain (existing developed areas only) and Zone 3a High Probability should include an assessment of the following:

178. The vulnerability of the development to flooding from other sources (e.g. surface water drainage, groundwater) as well as from river flooding. This will involve discussion with the Council and the Environment Agency to confirm whether a localised risk of flooding exists at the proposed site.

- The vulnerability of the development to flooding over the lifetime of the development (including the potential impacts of climate change) **for all sources of flooding**, i.e. maximum water levels, flow paths and flood extents within the property and surrounding area. The Environment Agency may have carried out detailed flood risk mapping (with respect to fluvial flooding) within localised areas that could be used to underpin this assessment. Where available, this will be provided at a cost to the developer. Where detailed modelling is not available, hydraulic modelling by suitably qualified engineers will be required to determine the risk of flooding to the site. The propensity of culverted systems to block, increasing the risk of flooding, should be considered.

179. The potential of the development to increase flood risk elsewhere through the addition of hard surfaces, the effect of the new development on surface water runoff, the obstruction of groundwater flow paths, and the effect of the new development on depth and speed of flooding to adjacent and surrounding property. This will require a detailed assessment, to be carried out by a suitably qualified engineer. It is emphasised that the detailed assessment of potential impacts elsewhere should not be limited (in a geographical sense) to the District of West Berkshire. Future development within the District may adversely affect sites within adjoining Boroughs, and it is essential that this is mitigated.

180. A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood resistant and resilient design, escape/evacuation, effective flood warning and emergency planning. Within defended areas, the structural integrity of the existing flood defences should be considered. It will be necessary to demonstrate that the structural conditions of the defences can be assured over the lifetime of the development.

181. Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum.

182. Details of proposed sustainable drainage systems (SUDS) that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SUDS design must take due account of groundwater and geological conditions.

183. The developer must provide a clear and concise statement summarising how the proposed (re)development has contributed to a positive reduction in flood risk within the District.

184. Any sites situated within close proximity of the Kennet Avon Canal must include an assessment of the local risk implications of the possible overtopping and/or failure of the canal (Section 5.4)

Proposed Development within Zone 2 Medium Probability

185. For all sites within Zone 2 Medium Probability, a high level FRA commensurate with the level of risk posed to the site should be prepared based upon readily available existing flooding information, sourced from the EA. It will be necessary to demonstrate that the residual risk of flooding to the property is effectively managed through, for example, the provision of raised floor levels (Section 6.6.2) and the provision of a planned evacuation route and/or safe haven.

186. The risk of alternative sources of flooding (e.g. urban drainage and/or groundwater) must be considered, and sustainable drainage techniques must be employed to ensure no worsening to existing flooding problems elsewhere within the area. Once again, it is reiterated that future development within the District may adversely affect sites within adjoining Boroughs, and it is essential that this is mitigated.

187. As part of the high level FRA, the developer must provide a clear and concise statement summarising how the proposed (re)development has contributed to a positive reduction in flood risk within the District.

188. Details of proposed sustainable drainage systems (SUDS) that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SUDS design must take due account of groundwater and geological conditions (Section 6.6.3);

189. Any sites situated within close proximity of the Kennet Avon Canal must include an assessment of the local risk implications of the possible overtopping and/or failure of the canal (Section 5.4).

Proposed Development within Zone 1 Low Probability and Critical Drainage Areas (CDA)

190. For all sites within Zone 1 and Critical Drainage Areas (CDA), a simple Flood Risk Assessment is recommended. The risk of alternative sources of flooding (e.g. urban drainage and/or groundwater) must be considered. Details of proposed sustainable drainage systems (SUDS) that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SUDS design must take due account of groundwater and geological conditions (Section 6.6.3).

Liaison with the Environment Agency

191. To assist local planning authorities, the Environment Agency has produced standing advice to inform on their requirements regarding the consultation process for planning applications on flood risk matters. Full details of their Flood Risk Standing Advice can be found on the website: www.pipernetworking.com.

192. The Environment Agency is an excellent source of information to inform the development of the detailed FRA. The external relations team should be contacted as early as possible to source information relating to (for example) historical flooding, hydraulic modelling and topography (LiDAR). It is emphasised that the information provided within the SFRA is the best available at the time of writing. More up to date information may be available, and contact should always be made with the Environment Agency at an early stage to ensure that the detailed site based FRA is using the most current datasets, avoiding unnecessary re-work.

193. It is strongly recommended that a draft of the detailed FRA is provided to the Environment Agency for review and comment before submitted with the Planning Application, thereby reducing potentially costly delays to the planning process.

6.6.2 Raised Floor Levels (Freeboard) & Basements

194. The raising of floor levels above the 1% AEP (100 year) fluvial flood level will ensure that the damage to property is minimised. Given the anticipated increase in flood levels due to climate change, the adopted floor level should be raised above the 1% AEP (100 year) predicted flood level assuming a 20% increase in flow over the next 100 years, plus an allowance for freeboard (see below).

195. Floor levels should be situated a minimum of 300mm above the 1% AEP (100 year) plus climate change flood level, determined as an outcome of the site based FRA. A minimum of 600mm above the 1% AEP (100 year) flood level should be adopted if no climate change data is available. The height that the floor level is raised above flood level is referred to as the 'freeboard', and is determined as a measure of the residual risks. Within areas of Critical Drainage Areas (CDA) that may be at risk from non-fluvial sources of flooding, the entry thresholds should be situated no less than 600mm above ground level (with floodproofing to that height – as explained in Section 6.7).

196. The use of basements within flood affected areas should be discouraged. Where basement uses are permitted however, it is necessary to ensure that the basement access points are situated 300mm above the 1% AEP (100 year) flood level plus climate change. The basement must be of a waterproof construction to avoid seepage during flooding conditions. Habitable uses of basements within flood affected areas should not be permitted. It must be demonstrated that any below ground construction does not adversely increase the risk of groundwater flooding to adjoining properties.

6.6.3 Sustainable Drainage Systems (SUDS)

197. SUDS is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment. The management of rainfall (surface water) is considered an essential element of reducing future flood risk to both the site and its surroundings. Indeed reducing the rate of discharge from urban sites to greenfield runoff rates is one of the most effective ways of reducing and managing flood risk within the District. The integration of sustainable drainage systems into a site design can also provide broader benefits, including an improvement in the quality of runoff discharged from the site, the capture and re-use of site runoff for irrigation and/or non potable uses, and the provision of greenspace areas offering recreation and/or aesthetic benefits. If planned properly at the outset, SUDS need not cost any more than 'conventional' drainage scheme.

198. SUDS may improve the sustainable management of water for a site by[14]:

- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- reducing volumes and the frequency of water flowing directly to watercourses or sewers from developed sites;
- improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- reducing potable water demand through rainwater harvesting;
- improving amenity through the provision of public open space and wildlife habitat;
- replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained;
- designs should, wherever possible, include landscaping for flood storage and flood resilience.

199. In catchment terms, any reduction in the amount of water that originates from any given site is likely to be small. But if applied across the catchment in a consistent way, the cumulative affect of a number of sites could be significant.

200. There are numerous different ways that SUDS can be incorporated into a development and the most commonly found components of a SUDS system are described in the following table[15]. The appropriate application of a SUDS scheme to a specific development is heavily dependent upon the topography and geology of the site (and its surrounds). Careful consideration of the site characteristics must be assured to ensure the future sustainability of the adopted drainage system.

Pervious surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil.
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
Filter drain	Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water; they may also permit infiltration.
Filter strips	Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
Swales	Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
Basins, Ponds and Wetlands	Areas that may be utilised for surface runoff storage.

[14] Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004
[15] Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004

Infiltration Devices	Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
Bioretention areas	Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground

201. For more guidance on SUDS, the following documents and websites are recommended as a starting point:

- Quality Design – West Berkshire Supplementary Planning Document Series (June 2006)
- Sustainable River Catchments in the South East (SuRCaSE)[16] - http://www.liv.ac.uk/swimmer/surcase/themes_actions/sustainable_drainage.html
- Interim Code of Practice for Sustainable Drainage Systems, National SUDS Working Group, 2004
- Planning Policy Statement 25, Annex F, CLG (2006)
- www.ciria.org.uk/SUDS/

202. Furthermore, the Environment Agency (Thames Region) has issued best practice guidance for Sustainable Drainage Systems (October 2006), available from the Environment Agency development control teams. This provides a clear hierarchy for SUDS, reflecting the degree of sustainability offered by the SUDS application as captured in the table below.

	SUDS technique	Flood Reduction	Water Quality Improvement	Landscape & Wildlife Benefit
Most Sustainable ↓	Living roofs	✔	✔	✔
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✔	✔	✔
	Filter strips and swales	✔	✔	✔
	Infiltration devices - soakaways - infiltration trenches and basins	✔	✔	✔
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paving	✔	✔	
Least Sustainable	Tanked systems - over-sized pipes/tanks - storms cells	✔		

6.7 Local Community Actions to Reduce Flood Damage

203. There will always be a residual risk of flooding, whether that be (for example) from an event that is more extreme than that considered, or whether as a result of a flood defence system that fails unexpectedly. Flood resistance and flood resilience may need to be incorporated into the design of buildings for this reason.

[16] "*Sustainable River Catchments for the South East (SuRCaSE) is a three-year demonstration project funded by the European Union's Life Environment Programme. It is designed to demonstrate the value and practical means of applying the Ecosystem Approach to achieve sustainable management of water resources in South East England.*" Refer www.liv.ac.uk/swimmer/surcase for further information.

204. In all areas at risk of flooding, a basic level of flood resistance and resilience will be achieved by following good building practice and complying with the requirements of the Building Regulations 2000[17]. The difference between 'resilience' and 'resistance' is explained below:

- *Flood resistance,* or 'dry proofing', where flood water is prevented from entering the building. For example using flood barriers across doorways and airbricks, or raising floor levels.
- *Flood resilience,* or 'wet proofing', accepts that flood water will enter the building and allows for this situation through careful internal design for example raising electrical sockets and fitting tiled floors. The finishes and services are such that the building can quickly be returned to use after the flood.

205. Examples of both flood-resistant and flood resilient design are given in Improving the Flood Performance of New Buildings (Flood Resilient Construction), CLG (2007).

206. It is clear that numerous homes within the District are at risk of flooding. It is essential therefore to ensure a broad awareness with respect to flood risk, providing the community with the knowledge (and tools) that will enable them to help themselves should a flood event occur.

207. The following 'community based measures' are cost effective solutions that local communities may introduce to minimise the damage sustained to their own homes in the case of flooding. Further guidance is provided by the EA, Defra and CLG[18] (refer the National Flood Forum [*www. floodforum.gov.uk*]).

6.7.1 Flood Proofing

208. The 'flood proofing' of a property may take a variety of forms:

For <u>new homes</u> and/or <u>during redevelopment</u>

Raising of floor levels

The raising of floor levels above the anticipated maximum flood level ensures that the interior of the property is not directly affected by flooding, avoiding damage to furnishings, wiring and interior walls. It is highlighted that plumbing may still be impacted as a result of mains sewer failure.

Raising of electrical wiring

The raising of electrical wiring and sockets within flood affected buildings reduces the risks to health and safety, and reduces the time required after a flood to rectify the damage.

For <u>existing homes</u>

Flood boards

The placement of a temporary watertight seal across doors, windows and air bricks to avoid inundation of the building interior. This may be suitable for relatively short periods of flooding, however the porosity of brickwork may result in damage being sustained should water levels remain elevated for an extended period of time. This may lessen the effectiveness of flood proofing to existing properties affected by flooding from larger river systems such as the Thames.

[17] Office of Deputy Prime Minister (ODPM) – now Communities & Local Government (CLG)
[18] Improving the Flood Performance of New Buildings – Flood Resiliant Construction (May 2007)

6.8 Civil Contingency

209. This SFRA provides a concise summary of the possible sources of flooding within the District. The Civil Contingency team will use this assessment along with other related documentation to inform the contents of the Councils Major Incident planning process.

6.9 Insurance

210. Many people and business rely on insurance as the ultimate safeguard from flooding. The financial assistance helps them to overcome the consequences of flooding.

211. Following large scale flood events, such as those that occurred during 2000 and 2007, the insurance industry reviews the provision of insurance to people and business in flood risk areas. At present, the insurance industry continues to provide cover to the majority of people in flood risk areas. However, its provision is not guaranteed over the long-term.

212. If the insurance industry collectively decides not to provide cover, or that cover can not be provided without substantially increasing insurance premiums, this could have serious consequences in flood risk areas, across the country, including those in West Berkshire. Increased premiums could affect the viability of business and reduce house prices. For those denied insurance, severe financial impacts could be felt from the damages caused by flooding.

213. It is important to ensure that spatial planning decisions do not place property within areas at risk of flooding, as the long term viability of those properties could be significantly affected by potential changes within the insurance industry

7 Conclusion & Recommendations

214. Many properties within West Berkshire are at risk of flooding, arising from a number of sources including river flooding, localised runoff, groundwater flooding and sewer flooding. The West Berkshire (Level 1) SFRA has delivered the following key findings and outcomes:

- The District has been delineated into zones of **'low', 'medium' and 'high' probability of fluvial flooding** in accordance with PPS25 (Appendix D). These maps should be used by the Council used to inform the application of the Sequential Test.
- Detailed modelling of the **impacts of climate change** has not been carried out within the District, however in accordance with current best practice, it is reasonable to assume that Zone 2 Medium Probability is a reasonable, albeit somewhat conservative, approximation of the 1% (100 year) flood extent in the year 2108 (i.e. in 100 years). This would suggest that the extent of flooding in future years will not alter dramatically, however properties that are currently at risk will be subject to more frequent and more severe flooding.
- The risk of **groundwater and surface water flooding** in West Berkshire is relatively high, affecting homes and businesses throughout the District. It is not possible to categorise flooding from other (non fluvial) sources in terms of the PPS25 flood zones, however it is essential that these potential risks are not overlooked. For this reason, a series of 'Critical Drainage Areas' (CDAs) have been identified to inform the planning process (Appendix F).

215. The recommended responses to the risks of flooding identified within the District are provided below:

Planning Response to Flood Risk (West Berkshire Council)

216. A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test. Specific planning recommendations have been provided for all urban areas within West Berkshire. Protection should be given through the planning process to prevent future development within areas of existing natural floodplain.

217. It is important that strategic planning decisions should consider the risks from groundwater and/or surface water flooding. Areas affected by these sources of flooding have been identified as Critical Drainage Areas (CDA). Any development which is located in a CDA should be accompanied by a detailed FRA. Emerging national policy following the events of July 2007 highlights the importance of considering the potential risk of flooding from other sources. Consideration should be given (in due course) to developing a Surface Water Management Plan in liaison with the Environment Agency and Thames Water, to appraise and mitigate the risk of surface water flooding into the future.

218. Where, following the application of the Sequential Tests, other planning considerations require further consideration of sites that are at risk of flooding, specific recommendations have been provided to assist the Council and the developer to apply the Exception Test[19]. These should be applied as development control recommendations for all future development (Section 6.4).

219. Council policy should be robust enough to ensure that the recommended development control measures within this SFRA can be imposed consistently at the planning application stage. It is the responsibility of the Council to establish these policies. This is essential to achieve future sustainability within West Berkshire with respect to flood risk management.

[19] It is highlighted that the development control recommendations will assist the developer to meet *only* point (3) of the Exception Test (i.e. "*a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall*").

220. Emergency planning is essential to minimise the risk to life posed by flooding within the district. It is recommended that West Berkshire Council review their adopted emergency response plan in light of the findings and recommendations of the SFRA.

A Living Document

221. The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the District. A rolling programme of detailed flood risk mapping within the South East region is underway. This, in addition to observed flooding that may occur throughout a year, will improve the current knowledge of flood risk within the District and may marginally alter predicted flood extents within West Berkshire. Furthermore, Communities and Local Government (CLG) are working to provide further detailed advice with respect to the application of PPS25, and future amendments to the PPS25 Practice Guide are anticipated. Given that this is the case, a periodic review of the West Berkshire SFRA is imperative.

222. It is recommended that the West Berkshire SFRA is reviewed on a regular basis. A series of key questions should be addressed as part of the SFRA review process, and these are provided in Appendix K.

APPENDIX A

Historical Flood Incidences

APPENDIX B

Environment Agency Flood Defences

APPENDIX C

Thames Water DG5 Sewer Flooding Information

APPENDIX D

Maps of Fluvial Flood Risk (Zones 3a, 3b and 2)

APPENDIX E

Overland Flow Paths & Geology

APPENDIX F

Critical Drainage Areas

APPENDIX G

Borehole Distribution in West Berkshire

APPENDIX H

Safe Access and Egress Design Requirements (June 2007)

‘Safe’ access and egress is to be designed to meet the following strict criteria:

Developments within Zone 3a High Probability and Zone 2 Medium Probability that **ARE NOT** offered protection from flood defences:

- Dry escape, above the 100 year flood level taking into account climate change, should be provided for all ‘more vulnerable’ (including residential) and ‘highly vulnerable’ development;
- 'Safe' should preferably be dry[20] for all other uses such as educational establishments, hotels and 'less vulnerable' land use classifications.

Developments within Zone 3a High Probability and Zone 2 Medium Probability that **ARE** offered protection from flood defences:

- 'Safe' access should preferably be dry[23] for ‘highly vulnerable’ uses;
- 'Safe' access should incorporate the ability to escape to levels above the breach water level[21].

For *major ‘highly vulnerable’ development*, ‘safety’ will also need to be ensured through the development of a robust evacuation plan. This should clearly define routes to dry (i.e. ‘unflooded’) land. This may include routes through flood waters, providing the depth and speed of flow across the evacuation route are below the risk defined by the *“some”* threshold in 'Flood Risk to People' (Defra, FD2320)[22].

For *infrastructure development*, ‘safety’ will also need to be ensured through the development of a robust evacuation plan. This should clearly define dry escape routes (above the 100 year plus climate change flood level) to dry (i.e. ‘unflooded’) land.

In exceptional circumstances, dry access (above the 100 year plus climate change flood level) for ‘more vulnerable’ and/or ‘highly vulnerable’ development may not be achievable. In these exceptional circumstances, liaison must be sought with the Environment Agency and West Berkshire Council’s Emergency Planning Team to ensure that the safety of site tenants can be satisfactorily resolved.

[20] Above the 100 year, plus climate change, flood level

[21] Defined assuming the full hydrostatic loading of the flood defence upon collapse (as a worst case scenario)

[22] Refer Defra Research Paper FD2320 ‘Flood Risks to People”

APPENDIX I

Vulnerable Land Uses

APPENDIX J

Planning Policy Framework

APPENDIX K

SFRA Review Triggers

West Berkshire SFRA - A Living Document

The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the District. A rolling programme of detailed flood risk mapping within the South East region is underway. This, in addition to observed flooding that may occur throughout a year, will improve the current knowledge of flood risk within the District and may marginally alter predicted flood extents within West Berkshire. Furthermore, Communities and Local Government (CLG) are working to provide further detailed advice with respect to the application of PPS25, and future amendments to the PPS25 Practice Guide are anticipated. Given that this is the case, a periodic review of the West Berkshire SFRA is essential.

It is recommended that the West Berkshire SFRA is reviewed on a regular basis. The following key questions should be addressed as part of the SFRA review process:

Question 1

Has any flooding been observed within the District since the previous review? If so, the following information should be captured as an addendum to the SFRA:

- What was the mapped extent of the flooding?
- On what date did the flooding occur?
- What was the perceived cause of the flooding?
- If possible, what was the indicative statistical probability of the observed flooding event? (i.e. how often, on average, would an event of that magnitude be observed within the District?)
- If the flooding was caused by overtopping of the riverbanks, are the observed flood extents situated outside of the current Zone 3a? If it is estimated that the frequency of flooding does not exceed 1% (1 in 100) then the flooded areas (from the river) should be incorporated into Zone 3a to inform future planning decision making.

Question 2

Have any amendments to PPS25 or the Practice Companion Guide been released since the previous review? If so, the following key questions should be tested:

- Does the revision to the policy guidance alter the definition of the PPS25 Flood Zones presented within the SFRA?
- Does the revision to the policy guidance alter the decision making process required to satisfy the Sequential Test?
- Does the revision to the policy guidance alter the application of the Exception Test?
- Does the revision to the policy guidance alter the categorisation of land use vulnerability, presented within Table D2 of PPS25 (December 2006)?

If the answer to any of these core questions is ‘yes’ then a review of the SFRA recommendations in light of the identified policy change should be carried out.

Question 3

Has the Environment Agency issued any amendments to their flood risk mapping and/or standing guidance since the previous policy review? If so:

- Has any further detailed flood risk mapping been completed within the District, resulting in a change to the 20 year, 100 year or 1000 year flood outline? If yes, then the Zone 3b and Zone 3a flood outlines should be updated accordingly.
- Has the assessment of the impacts that climate change may have upon rainfall and/or river flows over time altered? If yes, then a review of the impacts that climate change may have upon the District is required.
- Do the development control recommendations provided in Section 6.4 of the SFRA in any way contradict emerging EA advice with respect to (for example) the provision of emergency access, the setting of floor levels and the integration of sustainable drainage techniques? If yes, then a discussion with the EA is required to ensure an agreed suite of development control requirements are in place.

It is highlighted that the Environment Agency review the Flood Zone Map on a quarterly basis. If this has been revised within the District, the updated Flood Zones will be automatically forwarded to the Council for their reference. *It is recommended that only those areas that have been amended by the Environment Agency since the previous SFRA review are reflected in Zone 3 and Zone 2 of the SFRA flood maps.* This ensures that the more rigorous analyses carried out as part of the SFRA process are not inadvertently lost by a simple global replacement of the SFRA flood maps with the Flood Zone Maps.

Question 4

Has the implementation of the SFRA within the spatial planning and/or development control functions of the Council raised any particular issues or concerns that need to be reviewed as part of the SFRA process?