Epsom & Ewell
Strategic Flood Risk Assessment (SFRA)

May 2008 (Final)

NON-TECHNICAL EXECUTIVE SUMMARY

1. The Borough of Epsom & Ewell lies within the county of Surrey. The Borough covers an area of approximately 3,407 hectares and has a population of approximately 68,000 (source: 2001 Census) with an estimated 28,725 households. NaFRA statistics show that 1135 properties lie within Flood Zone 3 (3.7% of total households) and a further 241 properties lie within Flood Zone 2 (0.8% of total households). This equates to at total of 2526 people in Epsom & Ewell residing in Flood Zone 3 and 2.

2. The topography of Epsom & Ewell can be divided between the Epsom Downs in the south of the Borough and the flatter, lower-lying land in the north. The Epsom Downs are an area of chalk upland that is part of the greater North Downs. The north of the Borough is largely urbanised with the key communities being the town of Epsom and the village of Ewell.

3. The solid geology in Epsom & Ewell is of four separate strata. The higher ground in the south-east of the Borough is made up of cretaceous chalk. The Thanet Sand formation and the Lambeth Group, bands which are both present in the heart of the Borough, border the chalk. London Clay makes up the solid geology of the north-western half of Epsom & Ewell. There are drift deposits of gravels within the clay, some of which may be terrace gravels left behind when the River Thames changed its course during an ice-age.

4. The Borough of Epsom & Ewell is dissected by the Hogsmill River and its tributaries. The flood risk mapping shows that a relatively small proportion of the Borough is susceptible to river flooding, with the extents of Flood Zones 2, 3a & 3b being largely confined to the areas adjoining the river corridors.

5. The Hogsmill catchment spreads wider than the Epsom & Ewell Borough boundary. Although no watercourses are present in the upper reaches of the Hogsmill catchment, a considerable contributing area exists in the Boroughs of Reigate and Banstead and Sutton. The contributing area of both of these Boroughs is already highly developed and thus runoff in extreme events is significant to flood risk within Epsom & Ewell. Future development could reduce flood risk through sustainable drainage measures. Planning decisions taken outside of the Borough may strongly influence flood risk within it.

6. Many of the reports of groundwater flooding in Epsom & Ewell have arisen in the areas at the northern foot of the Downs, at the junction between the permeable chalk and the less permeable and impermeable strata in the north-west of the Borough. The risk of groundwater flooding is typically variable and heavily dependent upon local geological, topographical and weather conditions, as well as the local abstraction regimes, at any particular time. Nevertheless, areas at risk of groundwater flooding in Epsom & Ewell are known.

Outcomes of the Epsom & Ewell SFRA

7. Epsom & Ewell has been delineated into zones of low, medium and high probability of fluvial flooding. This delineation is based largely upon existing available information provided by the Environment Agency and the Council. The spatial variation in fluvial (river) flood risk across the Borough has been delineated in the following manner:

Flood Zone 3b (Functional Floodplain)

8. Areas subject to a 5% probability of flooding occurring in any one year (1 in 20 year) have been delineated as Flood Zone 3b Functional Floodplain. It is important to recognise that all areas within Zone 3b are areas that are subject to relatively frequent

flooding, and may be subject to fast flowing and/or deep water. Very careful consideration must be given to future sustainability and safety issues within this area.

Flood Zone 3a (High Probability)

9. Areas subject to a 1% probability of flooding occurring in any one year (1 in 100 year) have been delineated as Flood Zone 3a High Probability. Development within these areas may only be considered following application of the Sequential Test, and 'more vulnerable' development should be avoided wherever possible.

10. The SFRA has outlined specific development control recommendations that should be placed upon development within Zone 3a High Probability to minimise the damage to property, the risk to life in case of flooding and the need for sustainable drainage techniques. It is essential that the developer carries out a detailed Flood Risk Assessment to consider the site-based constraints that flooding may place upon the proposed development.

Flood Zone 2 (Medium Probability)

11. Areas subject to between a 1% and 0.1% probability of flooding occurring in any one year (1 in 100 to 1 in 1000 year) have been delineated as Flood Zone 2 Medium Probability. 'Highly Vulnerable Development'[1], for example emergency services, should be avoided in these areas. There are generally no other restrictions placed upon land use in these areas. However, it is important to ensure that the developer takes account of possible climate change impacts to avoid a possible increase in the risk of flooding in future years (achieved through completion of a site-specific Flood Risk Assessment).

Flood Zone 1 (Low Probability)

12. All areas outside of Flood Zones 2, 3a & 3b have been delineated as Flood Zone 1 Low Probability. There are no restrictions placed on land use within Zone 1 Low Probability (i.e. all remaining areas of the Borough) by PPS25. It is essential, though, that consideration is given to the potential risk of flooding from other sources (outlined in 'Localised Flooding Issues', below), ensuring that future development is not inadvertently placed at risk. It is also essential to ensure that future development does not exacerbate the current risk posed to existing homes and businesses.

Localised Flooding Issues

13. Properties and infrastructure within the Borough of Epsom & Ewell are also at risk of flooding from sources other than rivers. These include groundwater flooding, the surcharging of the underground sewer system, the blockage of culverts and gullies (which results in overland flow) and surface water flooding. Evidence of localised flooding of this nature has been captured through consultation with local authorities, Thames Water and the Environment Agency.

14. PPS25 does not address issues of this nature within its delineation of flood zones and does not advise what kind of development is acceptable in areas of localised flooding. Incidents of this nature can be often be addressed through the design process and, therefore, will not always affect decision-making with respect to the allocation (or otherwise) of sites within the Borough. The summer flooding of 2007 throughout England highlights that this is certainly not always the case and uncontrolled flooding as a result of particularly heavy rains can create significant damage and disruption.

[1] Refer Table D2 (Appendix D) of PPS25

15. The PPS25 Practice Guide (A Living Draft, February 2007) advocates the application of a sequential approach when allocating land, taking into consideration all sources of flooding. From a spatial planning perspective, with the exception of areas known to be susceptible to regular (and problematic) groundwater flooding, it may be unreasonable to restrict future development within areas that may have suffered a localised flooding incident in the past. Cases such as these need to be assessed individually to see whether development will be at risk of or exacerbate future flooding and a decision made thereon.

16. It is essential not to overlook the potential risk of localised flooding during the design process. Whilst the incidents that have been identified may not always result in widespread damage or disruption, a proactive approach to risk reduction at the design stage can mitigate the potential for damage, both to the development itself and elsewhere. Specific development control recommendations have been provided accordingly.

17. As a minimum, the implementation of Sustainable Drainage Systems (SUDS) must be ensured and careful consideration to overland flow routes (and avoidance of their obstruction), as part of the site design, should be encouraged.

18. Council policy is essential to ensure that the development control recommendations can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within Epsom & Ewell with respect to flood risk management. It is essential to ensure that a consistent approach to flood risk management is developed in policy as part of the Council's LDF. Guidance is provided in a series of development control recommendations, which are presented by the Epsom & Ewell Strategic Flood Risk Assessment as well as information from the Integrated Urban Drainage Pilot Study.

19. Epsom and Ewell Borough Council are partners in the Hogsmill Integrated Urban Drainage (IUD) Pilot Study. The study seeks to establish 'best practice' approaches for sustainable drainage techniques throughout the catchment. The study outputs will have a strong planning element that should influence future SFRAs and there are clear synergies between the Defra study and the Epsom & Ewell SFRA. Future revisions of the SFRA process should review the outcomes of this research initiative as it is also likely to provide additional information and toolkits that will help inform planning decisions. An online 'Flood Risk Tool' has been produced, which allows the user to view the best current information for flood risk issues or constraints within the Hogsmill Catchment. Discussions are currently occurring to identify the availability of the tool for use.

20. Emergency planning is crucial for the minimisation to the risk to life posed by flooding within the Borough. It is recommended that Epsom & Ewell Borough Council review their adopted flood risk response plan in light of the findings and recommendations of the SFRA.

21. It is recommended that the Council protects land that can provide multiple benefits to communities by reducing flood risk as well as providing amenity and habitat improvement. This can provide both local and strategic benefits. Sites include:

    - Horton Country Park
    - Roseberry Park

    The approximate location of these two sites can be seen in Appendix G and are labelled as 'Multiple Benefit Areas'.

22. Where planning can enable change of land-use to improve infiltration to the aquifer this is to be strongly encouraged. Infrastructure needs to be planned and managed to accommodate more surface water flows.

A Living Document

23. The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. A rolling programme of detailed flood risk mapping within the Thames 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 Borough and may marginally alter predicted flood extents within Epsom & Ewell. 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 Epsom & Ewell SFRA is advised.

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Glossary

AEP	Annual Exceedance Probability: 5% (1 in 20 years) 3.33% (1 in 30 years) 1% (1 in 100 years) 0.1% (1 in 1000 years)
CFMP	Catchment Flood Management Plans. A CFMP is a high level strategic planning tool which explores and defines long-term sustainable policies for flood risk management.
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.
CLG	Communities and Local Government is managed by a Board of directors. They support Ministers to achieve the Department's vision of confident, vibrant, sustainable communities where everyone has a say in shaping their environment. CLG aim to aim to deliver this vision by working to offer more choice and better quality in public services, addressing the issues of climate change, building cohesion and tackling anti-social behaviour and extremism
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)
Defra	Defra (Department for Environment, Food and Rural Affairs) is a UK Government Department. The overarching challenge for Defra is to enable everyone to live within our environmental means by tackling climate change internationally and through domestic action to reduce greenhouse gas emissions, and to secure a healthy, resilient, productive and diverse natural environment.
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.
DTM	Digital Terrain Modelling. DTMs are topographic models of the bare Earth that can be manipulated by computer programs. DTM files contain elevation data of terrain in a digital format that relates to a rectangular grid. Vegetation, buildings and other cultural features are removed digitally - leaving just the underlying terrain
Flood Zone Map	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency
Flood Zone 1 Low Probability	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river sea flooding in any year (<0.1%)

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 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 3b Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. 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).
Fluvial	Of, relating to, or inhabiting a river or stream.
Formal Flood Defence	A structure built and maintained specifically for flood defence purposes
GEMS	Groundwater Emergence Maps. GEMs were created by Jacobs as part of a groundwater flooding scoping study, which was commissioned by Defra and set out to provide information on the scale, distribution and nature of groundwater flooding in England. The maps have been produced at a national / regional scale and define broad areas susceptible to groundwater flooding (where groundwater is thought to be at or close to the ground surface in an exceptionally wet winter), based upon geological and topographical data. Properties within the areas identified could be susceptible to anything from groundwater emergence into basements / cellars and underground services; to flooding above the ground surface or incursion into properties. However, unlike the data for fluvial flooding in this report, there is currently no associated estimate of an annual probability exceedance (The probability of it occurring in any one year) available for the GEMs
GOSE	Government Office for the South East. Their role is to represent central government in the region and to promote better and more effective integration of Government policies and programmes at a regional and local level
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.
IfSAR	Interferometric Synthetic Aperture Radar. IfSAR is an aircraft-mounted sensor designed to measure surface elevation, which is used to produce topographic imagery
IUD	Integrated Urban Drainage. Defra recently backed a number of IUD pilot studies that will test new approaches to reduce the impact of urban drainage flooding, so that towns and cities across the country are better prepared for the impacts of climate change.
Local Development Framework (LDF)	Consists of a number of documents which together form the spatial strategy for development and the use of land
LDS	Local Development Scheme. The Local Development Scheme is a public statement of the Council's programme for the preparation of Local Development Documents which will form the Local Development Framework (LDF)

LiDAR	Light Detection and Ranging. LiDAR is a technology that employs an airborne scanning laser rangefinder to produce detailed and accurate topographic surveys. LiDAR can be used to accurately measure the topography of the ground, even where overlying vegetation is quite dense.
Main River	Main rivers are usually larger streams and rivers, but also include smaller watercourses of strategic drainage importance. A main river is defined as a watercourse shown as such on a main river map, and can include any structure or appliance for controlling or regulating the flow of water in, into or out of a main river. The Environment Agency's powers to carry out flood defence works apply to main rivers only. Main rivers are designated by Defra.
NaFRA	National Flood Risk Assessment. NaFRA covers the whole of England and Wales and was undertaken in 2004 using a method called Risk Assessment for Strategic Planning (RASP). RASP is a method for flood risk assessment that uses a risk-based approach to factor in the location, type, condition and effects of flood defences. The RASP method works by calculating the actual likelihood of flooding to areas of land within the floodplain of an extreme flood (0.1% or 1 in 1000 chance in any year). The method divides the flood plain into 100m squares (called impact zones), or smaller areas where an impact zone is intersected by a river. It then calculates the likelihood that the centre of each 100m square will start to flood (i.e. get wet) during a whole range of floods of 37 different magnitudes. The method considers the probability that the flood defences will overtop or breach, and the distance of the impact zone from the river or the sea.
Ordinary Watercourse	An ordinary watercourse is every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows that does not form part of a main river. The local authority, or Internal Drainage Board where relevant, has powers for ordinary watercourses that are similar to those the Environment Agency can use on main rivers.
One Dimensional River Model	A One Dimensional river model presumes that a river flows in a single plane, i.e. in a straight line. This is a simplistic approach to river modelling, but in most rural areas, one-dimensional models give good results.
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)	In hydrology, pluvial refers to any water that brought about by precipitation. Pluvial flooding is usually associated with high intensity rainfall events (typically >30mm/h) but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or otherwise has low permeability resulting in surface water flow and ponding in depressions in the topography.
PPG25	Planning Policy Guidance 25: Development and Flood Risk Office of the Deputy Prime Minister (ODPM), 2001
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	The risks remaining after applying the sequential approach and taking mitigating actions are known as the residual risks.
SEA	Strategic Environmental Assessment. An SEA analyses the environmental effects of development policies, plans, programmes and other proposed strategic actions.
SUDS	Sustainable Drainage Systems. SUDS use techniques to control surface water run-off as close to its origin as possible, before it enters a watercourse. This involves moving away from traditional piped drainage systems to engineering solutions that mimic natural drainage processes i.e. permeable and porous pavements.
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).
Threshold	The lowest point of the door entrance to the house.
Two Dimensional River Model	When studying urban and some particularly flat rural areas one-dimensional models may not prove accurate. They lack the ability to model flood patterns and the fact that flooding reacts in different ways to common features of the urban landscape. In such cases, a two-dimensional mathematical model should be used, which is capable of analysing flood patterns in more than one plane.
UKCIP	United Kingdom Climate Impacts Programme. UKCIP provides scenarios that show how our climate might change and co-ordinates research on dealing with our future climate. UKCIP shares this information, free of charge, with organisations in the commercial and public sectors to help them prepare for the impacts of climate change
UKWIR	United Kingdom Water Industry Research. UKWIR was set up by the UK water industry in 1993 to provide a common research programme for UK water operators. UKWIR's members comprise 24 water and sewerage undertakers in England and Wales, Scotland and Northern Ireland.

1 Introduction

Background to Epsom & Ewell

24. The Borough of Epsom & Ewell lies within the county of Surrey. The Borough covers an area of approximately 3,407 hectares and has a population of approximately 68,000 (source: 2001 Census) with an estimated 28,725 households.

25. Urban areas account for approximately 50% of all land coverage in Epsom & Ewell. Open spaces account for 42% of the Borough, most of which is classified as metropolitan green belt due to Epsom & Ewell being on the urban fringe of Greater London. Transport, buildings and other, non-specified, land uses account for the remaining 8%.

26. The topography of Epsom & Ewell can be divided between the Epsom Downs in the south of the Borough and the flatter, lower-lying land in the north. The Epsom Downs are an area of chalk upland that is part of the greater North Downs. They run in a south-west to north-easterly direction across the Borough and the land is largely dedicated to Epsom Racecourse, as well as a golf course and areas for walkers. The north of the Borough is largely urbanised with the key communities being the town of Epsom and the village of Ewell.

27. The principal watercourse in the Borough is the Hogsmill River. The source of the Hogsmill is in Ewell village. From here, the river flows north-west towards the Borough boundary and its confluence with the Bonesgate Stream. The other watercourses within Epsom & Ewell, all of which are tributaries of the Hogsmill Stream, include the Horton Stream, Green Lanes Stream & Ewell Court Stream.

Overview of Flood Risk within the Borough

28. The watercourses in Epsom & Ewell that pose significant flood risk to buildings and infrastructure are the Hogsmill River and its tributaries, which include the Bonesgate Stream, the Horton Stream, Green Lanes Stream and Ewell Court Stream. Most of the Ewell Court Stream and lengths of Green Lanes Stream are culverted.

29. These watercourses are predominantly urban. The Hogsmill River, Green Lanes Stream and Ewell Court Stream all either originate in built-up areas or have their source just outside development. The exception to this is the Horton Stream, which largely flows through open space to the west of Epsom.

30. The fluvial (river) flood risk mapping (Appendix C and D) shows that a relatively small proportion of the Borough is susceptible to river flooding, with the extents of Flood Zones 2, 3a & 3b being largely confined to the areas adjoining the river corridors.

31. The various ways in which flooding can occur are known as flood mechanisms. It is found helpful to consider this using a Source-Pathway-Receptor approach, where:

- the source is where the floodwater originates from;
- the pathway is the route it is likely to take to cause flooding; and
- the receptor is the place of impact and is often where damage is realised.

32. The Hogsmill catchment and the Borough of Epsom & Ewell are actually affected by five types of flood mechanism, which are shown in Section 6, Table 1.

33. The Hogsmill catchment spreads wider than the Epsom & Ewell Borough boundary. Although no watercourses are present in the upper reaches of the Hogsmill catchment,

a considerable contributing area exists in the Boroughs of Reigate and Banstead and Sutton. The contributing area of both of these Boroughs is already highly developed and thus runoff in extreme events is significant to flood risk within Epsom & Ewell.

34. Of equal importance within the Borough is the risk of localised flooding. Incidents of this nature can arise from sewer flooding, the blockage (or limited capacity) of culverts, or rapid runoff during intense rainfall (often referred to as 'flash flooding'). The most recent event of this kind occurred in July 2007 and, through discussions with the Council, incidents of localised flooding throughout the Borough have been identified in Appendix E.

35. As well as surface water flooding, some of the most recent flood events in Epsom & Ewell were those of groundwater flooding in 2000/2002. Flooding caused by groundwater can be localised and can occur with little warning and at any location within high risk areas, causing much damage to property and severe disruption. It is essential to ensure that future planning decisions acknowledge this and do not inadvertently increase the potential risk of localised flooding.

Flood Risk and Spatial Planning

36. It is essential that spatial planning decisions within the Borough are taken in an informed and balanced manner. Flood risk is a key local issue, and future development should (wherever possible) be steered away from areas that may be at risk. It is also crucially important that there is a clear understanding of the impact that future development may have upon the existing flooding regime. Even if not directly at risk itself, future development can exacerbate existing problems if not carefully designed.

37. To assist the planning process, 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 risk of flooding across the Borough. Robust information on flood risk is essential to inform and support the Council's revised flooding policies in its emerging Local Development Framework (LDF).

38. Jacobs was commissioned to develop the Epsom & Ewell SFRA in July 2007. Epsom & Ewell Borough Council is currently developing its planning framework and this SFRA intends to supplement the evidence base that will inform this process. The SFRA forms an important part of the evidence base that will inform the production of the LDF.

Future Development in Epsom& Ewell

39. Epsom & Ewell is an attractive Borough with a high quality of life. It has easy access to the City of London and the wider South East Region making it popular with commuters to London. The Borough contains areas of designated Metropolitan Green Belt and the Epsom Downs fall into designated Areas of Great Landscape Value (AGLV).

40. Epsom and Ewell village are the Borough's main settlements. It is recognised that some regeneration needs to take place within the existing built-up area of the Borough. The planning approach is that future housing, commercial and business development will take place predominately on previously developed land within these areas. Redevelopment is expected to take place in Epsom and Ewell village centres and at the former hospital sites of West Park and St Ebba's. However, because of the general development pressure, this SFRA will consider flood risk throughout each character area and not particular development sites.

2 SFRA Approach

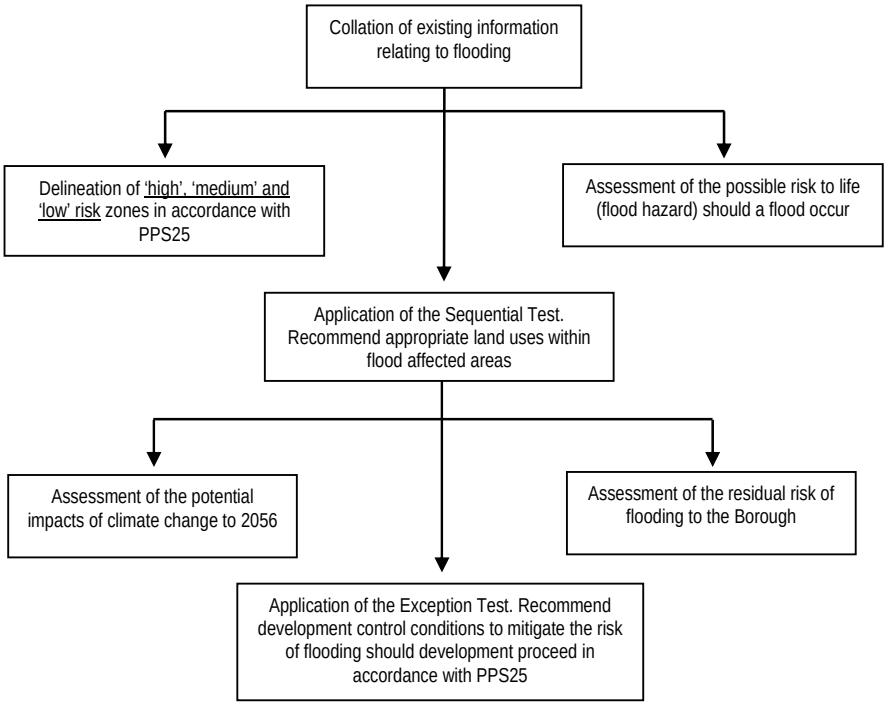
41. The primary objective of the Epsom & Ewell SFRA is to inform emerging policies, including the allocation of land for future development, within the emerging Local Development Framework (LDF). The SFRA also has a broader purpose and, in providing a robust depiction of flood risk across Epsom & Ewell,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

- Inform the development of the policy that will underpin decision making within Epsom & Ewell, 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 Epsom & Ewell;
- Help to identify and implement strategic solutions to flood risk, providing the basis for possible future flood attenuation works;
- Support and inform Epsom & Ewell Borough Council's emergency planning response to flooding.

42. The Government provides only limited guidance on the specifics of the methodology for the SFRA process. Therefore, to meet these broader objectives, the SFRA has been developed in accordance with PPS25: Development & Flood Risk and it's Practice Guide and through consultation with Epsom & Ewell Council and the Environment Agency.

43. A considerable amount of knowledge exists with respect to flood risk within Epsom & Ewell due to Jacobs' involvement in the Hogsmill Integrated Urban Drainage pilot study. The Epsom & Ewell SFRA has built upon this existing knowledge, delineating the Borough into zones of 'high', 'medium' and 'low' probability of flooding, in accordance with PPS25, as well as looking at other sources of flooding. This information has been used to provide a reliable evidence base for the development of flooding-related policy, as well as the location of development (site allocations and windfall).

44. A summary of the adopted SFRA process is provided in the figure below, outlining the specific tasks undertaken.



45. 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 Epsom & Ewell and future development within the Borough could influence the risk of flooding posed to the Royal Borough of Kingston downstream and similarly, development in Reigate and Banstead Borough could impact on Epsom and Ewell if it is not carefully managed. All local authorities clearly need to understand the core issues that flood risk raises within their respective areas and they must adapt their decision making accordingly. They must also be aware of the impact that planning decisions may have, not only locally, but upon adjoining Boroughs.

46. A number of other authorities across the Home Counties and within Greater London are currently carrying 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.

47. Whilst the delivery teams and programmes supporting these studies vary from one Borough to the next, all should be developed in close 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 vital. Discussions with the Environment Agency have been carried out throughout the SFRA process to this end, seeking clarity and consistency where needed.

A Living Document

48. The SFRA has been informed by existing knowledge with respect to flood risk within the Borough. It is based upon emerging and existing policy guidance, including PPS25 (December 2006) and the supporting Practice Guide Companion to PPS25 (draft, February 2007).

49. The Environment Agency regularly review and update their Flood Zone maps and a rolling programme of detailed flood risk mapping within the Thames region is underway. This will improve the current knowledge of flood risk within the Borough and may alter predicted flood extents over time. It is important that the SFRA is adopted as a living document and is reviewed regularly in light of emerging policy directives and improving understanding of flood risk within the Borough.

50. Specific questions have been recommended to guide the review process and these have been provided at the end of Section 8.

3 Policy Framework

3.1 Introduction

51. This section provides a brief overview of the strategy and policy context relevant to flood risk in Epsom and Ewell.

52. The success of the SFRA is heavily dependent upon the Council's ability to implement the recommendations put forward for future sustainable flood risk management at all stages of the planning and development process (see Section 7.4). A framework of national and regional policy provides guidance and direction to local planning authorities in formulating robust local planning policies. This in turn will ensure a sound, sustainable approach to flood risk and development.

3.2 National Planning Policy

3.2.1 Overview

53. National planning policy is set out in a number of Planning Policy Statements (PPSs) and Planning Policy Guidance Notes (PPGs). The Government is currently reviewing all PPGs with revised advice being set out in equivalent PPSs and, where necessary, accompanying best practice guidance.

54. PPSs and PPGs cover a full range of planning issues drawing on the central issue of sustainable development. Common themes include the re-use of 'deliverable' previously developed land, promoting economic growth, and the intention to steer inappropriate development away from areas at risk of flooding. Under paragraph 4.24 of 'PPS12: Local Development Frameworks' it is a requirement of Regional Assemblies and Local Authorities to ensure their Regional Spatial Strategies (RSSs) or Local Development Frameworks (LDFs) are in conformity with the guidance in PPSs and PPGs. The regional and local policy context for SFRAs is set out in the next section.

3.2.2 Planning Policy Statement 25: Development and Flood Risk

55. PPS25 was published in December 2006, and underpins the process by which local planning authorities are to account for flood risk as an integral part of the planning process. The overarching principles set out by PPS25 for the management of flood risk at a planning authority level are encapsulated in Paragraph 6 of the document:

"Regional planning bodies (RPBs) and local planning authorities (LPAs) should prepare and implement planning strategies that help to deliver sustainable development by:

Appraising risk

- *identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;*
- *preparing Regional Flood Risk Appraisals (RFRAs) or Strategic Flood Risk Assessments (SFRAs) as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal of their plans;*

Managing risk

- *framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;*
- *only permitting development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;*

Reducing risk

- *safeguarding land from development that is required for current and future flood management, e.g. conveyance and storage of flood water, and flood defences;*
- *reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SUDS);*
- *using opportunities offered by new development to reduce the causes and impacts of flooding, e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SUDS; recreating functional floodplain; and setting back defences;*

A partnership approach

- *working effectively with the Environment Agency, other operating authorities and other stakeholders to ensure that best use is made of their expertise and information so that plans are effective and decisions on planning applications can be delivered expeditiously; and*
- *ensuring spatial planning supports flood risk management policies and plans, River Basin Management Plans and emergency planning."*[2]

56. These broad key planning objectives effectively set the scope for the specific outcomes of the SFRA process. The SFRA in turn then informs planning decisions to ensure that the objectives set out above can be achieved.

57. The guidance in PPS25 also indicates that Sustainability Appraisals should be informed by the SFRA for their area. Under the Town and Country Planning (Local Development) (England) Regulations 2004, a Sustainability Appraisal (SA) is required for all Local Development Documents (LDDs) which form part of Local Development Frameworks (LDFs). The purpose of SA is to promote sustainable development through better integration of sustainability considerations in the preparation and adoption of plans. The Regulations stipulate that SAs of LDFs should meet the requirements of the Strategic Environmental Assessment (SEA) Directive.

58. It is important to reiterate that PPS25 is not applied in isolation as part of the planning process. The formulation of Council policy and the allocation of land for future development must also meet the requirements of other planning policy statements, including (for example) PPS3: Housing.

59. The SFRA aims to assist in this process through the provision of a clear and robust evidence base upon which informed decisions can be made.

[2] Communities and Local Government (2006), pg 2, para 6, PPS25: Development and Flood Risk, HMSO

3.2.3 Development and Flood Risk: A 'Living Draft' Practice Guide Companion to PPS25

60. In February 2007 the companion guide to PPS25 was published as a consultation paper[3]. This document provides additional guidance on the principles set out in PPS25, which should be considered by Epsom and Ewell Borough Council in preparing its LDF. Until the practice guide is published, the level of weight applied to the 'Living Draft' should reflect its current 'consultation draft' status. Notwithstanding this the companion guide is considered to provide a helpful indication of the ways in which the principles of PPS25 might be applied in practice.

3.2.4 Planning Policy Statement: Planning and Climate Change[4]

61. A new annexe to PPS1: Delivering Sustainable Development has been published. The document highlights the issue of climate change and is the most up-to-date planning policy statement on this subject. The new annexe to PPS1 sets out ways planning should prepare for its effect, which includes managing flood risk. However, little detail is given about flooding in this document as PPS25 already covers this topic.

3.3 Regional Planning policy

3.3.1 Regional Planning Guidance for the South East (RPG9)[5]

62. 'Regional Planning Guidance for the South East' (RPG9) published in March 2001 is the adopted regional spatial strategy and covers the period up to 2016.

63. Policy INF1[6] states that "development should be guided away from areas at risk or likely to be at risk in the future from flooding, or where it would increase the risk of flood damage elsewhere". Although this does not go quite as far as PPS25, it does follow similar principles. The policy continues by stating that "existing flood defences should be protected where they continue to be relevant". Similar statements are found in PPS25.

64. Chapter 8 of RPG9 sets out the annual average level of housing provision required in Surrey in Policy H2. The figure given is 2,360 for each year up until 2006. However, this figure is due to be superseded by the figures on a county basis which are part of the South East Plan.

[3] Communities and Local Government (2007) Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft' A Consultation Paper
[4] Communities and Local Government (2006) Consultation Planning Policy Statement: Planning and Climate Change: Supplement to Planning Policy Statement 1
[5] Government Office for the South East, Government Office for East of England, Government Office for London (2001) Regional Planning Guidance for the South East (RPG9)
[6] Government Office for the South East, Government Office for East of England, Government Office for London (2001) Regional Planning Guidance for the South East (RPG9), pg 73, Policy INF1, GOSE

3.3.2 The Draft South East Plan[7]

65. Under the Planning and Compulsory Purchase Act 2004, RPG9 is to be replaced by a new Regional Spatial Strategy (RSS) entitled the South East Plan. The Draft South East Plan has been prepared by the South East England Regional Assembly (SEERA) and proposes the region's vision for the next 20 years until 2026. The Examination in Public was carried out in spring 2007, and the Panel report was published by the Government Office for the South East on 29 August 2007. The document is expected to be adopted around autumn 2008.

66. The proposed policies in the Draft Plan follow many of the principles set out in PPS25 and do not impose further policy limitations for Epsom and Ewell Borough Council to be aware of when developing their LDF policy.

67. Of most relevance to flooding in the Draft Plan is Policy NRM3[8] which refers authorities to follow the sequential approach to development and flood risk. The policy also states that in flood zones 2 and 3, or areas with past groundwater flooding, or where development would increase elsewhere, development that is deemed inappropriate should not be permitted or allocated, unless there are exceptional circumstances. In addition, the policy notes that SFRAs should be prepared and that development should not be detrimental to the function or maintenance of flood defences. The use of SUDS is also encouraged.

68. Policy CC2[9] states that the South East region should adapt to the risks and opportunities presented by climate change through a number of measures, which include measures relating to flooding. The policy states that: strategic development should be guided to locations offering greater protection from impacts such as flooding; SUDS should be incorporated into new buildings; flood storage capacity should be increased; and the most should be made of opportunities and options for sustainable flood management.

69. One of the main objectives of the Draft Plan for achieving sustainable development, noted in the integrated regional framework (IRF), relates to flood risk. IRF objective 2 is "to reduce the risk of flooding and the resulting detriment to public wellbeing, the economy and environment". This is a strategic policy, showing that SEERA considers flooding to be an important issue, and it is highlighted as one of the region's key environmental challenges.

70. The need to increase flood storage capacity is highlighted by Policy NRM1: sustainable water resources, groundwater and river water quality management[10]. The policy suggests encouraging winter water storage reservoirs, and other sustainable farming practices which disperse runoff and increase flood storage capacity.

71. Housing targets are set out under Policy H1[11]. The proposed target for the south east is to provide an annual average of 28,900 net additional dwellings between 2006 and 2026. Epsom and Ewell's proposed target is 181 for each year, which totals up to 3,620 over the period 2006-2026.

72. The Draft Plan concentrates growth in nine sub-regions which includes the London Fringe area whereby Epsom and Ewell is located. The sub-regions have specific sub-regional policy frameworks in the form of sub-regional strategies. These strategies identify key planning issues relevant to each sub-region. In the case of the London

[7] South East Regional Assembly (2006) The South East Plan: A Clear Vision for the South East, The Draft South East Plan , SERA
[8] South East England Regional Assembly (2006) pg 123, Policy NRM3 Sustainable Flood Risk Management, The Draft South East Plan, SERA
[9] South East England Regional Assembly (2006) pg 43, Policy CC2 Climate Change, The Draft South East Plan, SERA
[10] South East England Regional Assembly (2006) pg 109, Policy NRM1 sustainable water resources, groundwater and river water quality management, The Draft South East Plan, SERA
[11] South East England Regional Assembly (2006) pg 82, Policy H1 Housing Provision, The Draft South East Plan, SERA

Fringe area, flooding is not considered as a key issue. Given that Epsom and Ewell falls within the London Fringe area, the sub-regional strategy repeats the Draft South East Plan's proposed allocation of 181 dwellings for the Borough. This is a relatively small proportion of the proposed 1,868 dwellings per annum allocated for the sub-region.

3.3.3 SE Plan Panel Report

73. Of particular relevance to flooding issues in Epsom and Ewell, the SE Plan Panel Report has recommended that Policy NRM1 should be amended to cover Sustainable Water Resources and Groundwater only and that a new policy (NRM1a) should be created to deal with Sustainable River Water Management. Additionally, the Panel suggests that Policy (NRM1) should include a commitment from the Regional Assembly to work with the Government, the Environment Agency, Ofwat and regional stakeholders to ensure the delivery of the water efficiency savings that are necessary for implementing the draft Regional Spatial Strategy (RSS) and to include clarification of BREEAM standards and SUDS.

74. Further recommendations include changes to Policy NRM3 and supporting text to reflect more fully the advice and priorities in PPS25, including expanding on the role of SFRAs.

75. Housing delivery targets for the region are also affected by the Panel recommending an increase from 28,900 dwellings per annum (dpa) to 32,000dpa for the South East as a whole. Within the London Fringe sub-regional area, it is recommended that housing provision increases by 23% over the Plan period meaning an additional 8,760 dwellings. This would increase the annual housing targets to a total of 2,306dpa, an increase of 438 dwellings. For Epsom and Ewell, this would mean an additional 18dpa bringing the Borough's total annual requirement to 199 dwellings.

76. The Secretary of State is expected to publish any proposed changes to the draft RSS for consultation in early 2008.

3.3.4 The Surrey Structure Plan

77. The Structure Plan was adopted by Surrey County Council in 2004 and, under the provisions of the Planning and Compulsory Purchase Act 2004, will be superseded by the South East Plan. This is forecast for around autumn 2008. Until this time various Structure Plan policies have been 'saved'.

78. Initially the majority of policies were saved for a period of 3 years from the inception date of the 2004 Act. However, this 3 year period has since expired and the 'saved' policies have been revised by virtue of a direction received by the Council from the Secretary of State. The revised policies will continue to form part of the Development Plan until it is superseded by the South East Plan.

79. As a result of the 'saved' policies revision, Policy SE3 which addressed 'Flooding and Drainage' has recently been deleted, meaning that it is no longer considered in the determination of planning applications. The consequence of this omission is that there is no longer a countywide flood-related policy. This policy vacuum will exist until the adoption of an equivalent policy or policies under the South East Plan.

3.4 Local Planning Policy

3.4.1 Adopted Epsom and Ewell Borough Local Plan

80. The Epsom and Ewell Borough Local Plan was adopted on 18 May 2000, setting out the Council's policies and proposals for development and land use in the Borough over the plan period up until 2006.

81. Like the Surrey Structure Plan, the Planning and Compulsory Purchase Act 2004 allowed all Local Plan policies to be 'saved' for a three year period, unless expressly replaced by 'new' policies. The Council applied to the Secretary of State with a list of policies to be saved and deemed essential, until such time that relevant Development Plan Documents are adopted to replace them through the LDF. Saved policies must reflect the principles of LDFs and be consistent with current national policy.

82. The Epsom and Ewell Core Strategy was adopted in the summer 2007 and has therefore superseded some Local Plan policies. This was taken account of in the revision of the 'saved' policies under the recent direction issued by the Secretary of State. As a consequence, Policy DC3, 'Surface Water Runoff and the Floodplain', has been deleted. The replacement policy can be found in the Core Strategy, though more detailed flood risk and development policies will emerge through the adoption of the Development Control Policies DPD due towards the end of 2009.

3.5 Emerging Local Planning Policy

3.5.1 Epsom and Ewell Local Development Framework

83. Epsom and Ewell Borough Council is currently preparing its Local Development Framework (LDF), as required under the Planning and Compulsory Purchase Act 2004. The LDF will replace the existing adopted Local Plan and be used for land use development decisions. The Local Development Scheme (LDS) sets out which Local Development Document's (LDDs) the Council will prepare as part of its LDF.

84. The Council adopted its Core Strategy on 24 July 2007. The Strategy sets out the vision, aims and strategy for spatial development in the Borough up to at least 2026 and forms part of the statutory development plan. Under its 'Flood Protection' section, the Strategy takes account of PPS25 and recognises the importance of avoiding and managing flood risk in considering development proposals. It also refers to applying the sequential approach in allocating development sites. Policy CS 6 requires development proposals to avoid:

"… increasing the risk of, or from, flooding…"[12]

85. The latest LDS was approved by GOSE in spring 2007. Elements are being reviewed and some amendments to the scheme are likely. In the meantime, we have been advised by the Council that the following documents will be produced in the next 3 years:

[12] Epsom & Ewell Borough Council (2007), pg 26, Policy CS 6, Core Strategy, E&EBC

- **Development Control Policies and Site Allocations DPD, including:**
    - Preferred Options Participation
    - Flood Risk Policies
    - Submission
    - Public Examination
    - Adoption
- **Epsom Town Centre Area Action Plan, including:**
    - Issues and Option Participation
    - Preferred Options Participation
    - Submission
    - Public Examination
    - Adoption
- **Developer Contributions SPD (Part 1 – Affordable Housing), including:**
    - Draft SPD Consultation
    - Adoption
- **Developer Contributions SPD (Part 2 – Infrastructure), including:**
    - Draft SPD Consultation
    - Adoption
- **Design Guidance SPD, including:**
    - SUDS Guidance
    - Stakeholder Engagement
    - Draft SPD Consultation
    - Adoption
- **Housing Delivery SPD, including:**
    - Stakeholder Engagement
    - Draft SPD Consultation
    - Adoption

4 Data Collection

4.1 Overview

86. A considerable amount of data has been collated to inform the analysis (and delineation) of flood risk throughout the Borough:

- Historical river flooding information;
- Information relating to both strategic and localised flooding issues including; surface water, groundwater, sewer related and/or surface water flooding, was collated in consultation with the Council, Thames Water and the Environment Agency;
- Detailed flood risk mapping;
- Environment Agency Flood Zone Maps (July 2007);
- Topography (Synthetic Aperture Radar [SAR} and Light Detection and Ranging [LiDAR]).

87. All of this data has been sourced from Epsom & Ewell Borough Council, the Environment Agency, Thames Water & Sutton and East Surrey Water and Surrey County Council. It has formed the core dataset that has informed the SFRA process. The application of this data in the delineation of zones of 'high', 'medium' and 'low' probability of flooding, along with the formulation of planning and development control recommendations, is explained in Section 5. An overview of the core datasets, including their source and their applicability to the SFRA process, is outlined below.

4.2 Consultation

88. Consultation has formed a key part of the data collation phase for the Epsom & Ewell SFRA. The following key stakeholders have been comprehensively consulted during the current study and during the Hogsmill IUD study to inform the investigation:

Epsom & Ewell 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 Epsom and Ewell Council's existing emergency response to flooding

The 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 recommendation

Thames Water Utilities

- Thames Water Utilities is responsible for the management of surface water drainage network and sewerage within Epsom & Ewell. Surrey County Council is responsible for highway drainage, the majority of which goes into the Thames Water network, with the remaining highways drainage going directly to ordinary watercourses. Thames Water was consulted to discuss the risk and number of incidences of localised flooding associated with the existing drainage/sewer system. As a matter of policy, Thames Water is unable to release any specific locations of known flooding incidents related to their urban drainage and sewerage network. This is due to data confidentiality. However, through consultation with Thames Water, Environment Agency historic flood risk mapping a national Groundwater Study and from local knowledge, general areas at risk from surface water, foul, and groundwater have been identified and mapped in Appendix E. The Hogsmill Integrated Urban Drainage Defra Pilot Study, to which Thames Water is a partner, enabled the mapping of areas likely to be at risk from exceedance of the surface water system. This data is not yet available for public consultation and cannot yet be included with this document. However, Epsom and Ewell Borough Council are also partners on the Pilot Study and have access to the data.

Sutton & East Surrey Water

- Sutton and East Surrey Water only supply water and do not manage waste or drainage. However, they do utilise the water resources from the aquifer beneath the North Downs. The rate of abstraction and consequential maintenance of groundwater levels has a direct impact on the potential for groundwater flooding within the groundwater flood zone. The volume of surface water runoff from the chalk upper catchment could be reduced if aquifer recharge could be improved. This would have the double benefit of increasing scarce water resources and reducing flood risk. Sutton & East Surrey Water have indicated that they are willing to actively cooperate in such schemes.

Surrey County Council

- Surrey County Council Highways have been consulted regarding highway drainage within the Borough as part of the Defra IUD Pilot Study. Surrey County Council has been contacted regarding information on their Flood Risk Task Group and Wet Spot data. However, data was not forthcoming.

4.3 Environment Agency Flood Zone Maps

89. The Environment Agency's Flood Zone Map (July 2007) was adopted as the 'first pass' method of assessing fluvial flood risk within Epsom & Ewell as part of the SFRA development.

90. The Environment Agency's Flood Maps identify the extents over which flooding could occur, from rivers and the sea, ignoring the presence of flood defences. Therefore, the Flood Zones ignore the effect of defences in reducing the probability of flooding but do not underestimate the extents of flooding where defences increase the area potentially at risk. Maps of the main rivers are based on detailed one-dimensional modelling which takes account of hydraulic structures. However, the upper tributaries use a multi-scale two-dimensional dynamic flood model (called JFLOW). The JFLOW flood outlines can be clearly seen at the source of the Hogsmill, on Ewell Court Stream and Green Lanes Stream where no watercourses are present. The JFLOW outline instead identifies the natural valley and these outlines are particularly helpful to understand the cumulative effects of surface water flow upstream of open watercourses.

91. Because no watercourse is present for some of these JFLOW outlines, it is felt, for the purposes of this study, that it is misleading to refer to them as PPS25 Flood Zones. This is because the PPS25 Flood Zones are based around the probability of fluvial or tidal flooding. Because no watercourse is present on some of the JFLOW outlines (such as in Epsom town centre and 'upstream' of the source of the Hogsmill), they have been redefined as Critical Drainage Areas. This term is intended to cover flooding that is caused by non-fluvial and non-tidal sources such as pluvial flooding or flooding from sewerage surcharge due to overloading in a heavy rainfall event. Similarly, groundwater flooding that has emerged from the chalk aquifer and follows the topography (and, perhaps, contributes to overland flow and/or sewerage surcharge) may also be included.

92. The Environment Agency's Flood Maps show two flood zones: Flood Zone 3, the area that is susceptible to a 1% chance of flooding from rivers, and a 0.5% chance of tidal flooding in any one year; it also indicates Flood Zone 2, the area that has between a 1% to 0.1% chance of flooding from rivers and/or the sea in any given year. The latter is also known as the Extreme Flood Outline. The Borough of Epsom & Ewell has no tidal flood risk.

93. 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. The Environment Agency has an ongoing programme of improvement and updates are made on a quarterly basis.

4.4 Historical Flooding

94. Areas within the Borough that are known to have experienced flooding, from all sources, in recent years have been identified. These have been highlighted in the adjoining historical flood incidence map (see Appendix E) and discussed in Section 6. The cause (and affected area) of each incident is not directly known in many cases.

95. It is important to highlight that, within the study area, recent incidents of flooding have been attributed to sources other than rivers. Some flood incidences were the result of groundwater flooding or flooding exacerbated by groundwater. The July 2007 flood incidences were directly attributable to a period of short, intense, rainfall, which caused surface water flooding. Some of this surface water flooding is from rainfall runoff flowing overland where there is no drainage network from the North Downs into Epsom. Within the urban area where there is a drainage network, the volume of surface water exceeds the capacity of the sewers and continues to flow overland.

4.5 Detailed Hydraulic Modelling

96. A number of detailed flood studies have been carried out by the Environment Agency, which Jacobs participated in or were given access to for the purpose of this study. These studies include The Hogsmill Flood Risk Management (FRM) Strategy Study, the Hogsmill Integrated Urban Drainage (IUD) Defra Pilot Study and the Section 105 Flood Mapping Study. These studies have generally incorporated the development of detailed hydraulic models, which provide a more robust understanding of the localised fluvial flooding regime. [13]

97. The flood extents derived from detailed hydraulic models are generally considered to be a more realistic representation of flood risk than the JFLOW modelling. For this reason, the Environment Agency has updated their Flood Zone map outlines with more detailed models (where available and appropriate). As stated earlier, the Hogsmill flood zone maps are a combination of different models. For this SFRA the 1% AEP modelled

[13] The output data from these studies is intended to be made available in 2008 as a Planning Tool with GIS layers produced on Environment Agency and Defra projects viewable on a website hosted by Jacobs.

outline is used to delineate flood risk Zone 3a and the 5% AEP modelled outline is used as the starting point to delineate Zone 3b, the Functional Flood Plain (please see section 5.1 for detailed definitions of the Flood Zones).

98. It should be noted that the detailed hydraulic models developed on behalf of the Environment Agency assume 'typical' conditions within the respective 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), culverts are permitted to block, the condition of the river channel is allowed to deteriorate, or, simply, the climatic inputs to the watercourse vary over space and time.

4.6 Flood Defences

99. 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, a Local Authority, or an individual riparian (riverside) owner. 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, such as railway embankments, for example.

100. No formal flood defences have been identified within Epsom & Ewell Borough Council area.

101. No de facto flood defences have been identified in Epsom & Ewell as part of the SFRA process. However, as the definition provided above illustrates, de facto flood defences may be present in the Borough of Epsom & Ewell that will provide some flood defence function at a local level. For example, the railway lines that dissect the Borough may well act as a de facto flood defence, holding up flood waters and overland flow on their upstream side. This was the case in Epsom town centre in 2007.

4.7 Integrated Drainage Flood Management Techniques

102. Although not actually termed flood defence, the integrated urban drainage approach, can utilise other techniques to control water closer to source to manage flood risk.

103. Recent studies set out to understand the mechanisms by which flooding occurs, where the risk areas are and to identify where flood risk management techniques could work. These studies have mapped overland flow paths, where surface water is most likely to flow, local depressions in the ground which cause ponds to form, changes of slope which affects the depth of flooding and types of geology which could lead to groundwater flooding. It is important that these areas are reserved as open space for existing or future flood management functions.

104. The Defra IUD Pilot study partnership has enabled the Environment Agency river models and Thames Water's surface water network model to be used in a more integrated way to understand flood mechanisms and to develop techniques.

105. The developed techniques include:

- Utilising open-spaces to interrupt the surface water drainage pipe network (never combined or foul network), and/or surface water overland flow which has exceeded the network capacity, to temporarily hold and attenuate flood flows. These sites may be dual purpose and be an opportunity to remain as amenity for recreation or diversified habitat.
- Reserving corridors where overland flow routes are.

- Modifying road infrastructure to act as flow routes in extreme events.
- Utilising open-spaces to attenuate overland flow on chalk geology to reduce flooding and improve aquifer recharge.
- Timing the abstraction of water resources to drawdown the water table to reduce flood risk and improve scarce water resources at the same time.

4.8 Groundwater Emergence Maps

106. The Groundwater Emergence Maps (GEMS) were created by Jacobs as part of a groundwater flooding scoping study, which was commissioned by Defra and set out to provide information on the scale, distribution and nature of groundwater flooding in England. The maps have been produced at a scale suitable for national assessment and, as such, do not pinpoint sites where groundwater flooding will occur. Instead, they define broad areas of risk based on geology and topography. Properties within the zone could be expected to experience anything from groundwater emergence into cellars to surface flooding and incursion into properties. The GEMS were used in the Epsom & Ewell SFRA to show what parts of the Borough are within the broad areas of risk.

4.9 Topography & Geology

107. An IfSAR (Interferometric Synthetic Aperture Radar) bare-earth digital terrain model (DTM) was obtained to develop surface water flow paths and depressions in the ground that form flood risk pathways and receptors, respectively. See Appendix F.

108. The Environment Agency has used the more precise LiDAR (Light Detection and Ranging) DTM for the detailed river and flood plain modelling, which provides a three dimensional representation of the land form. Unfortunately, LiDAR coverage is limited to a narrow band either side of main rivers and, therefore, is not useful for the mapping of surface water flow paths and depressions across the wider Borough

109. Geological information has been provided by the Council, which provides an overview of the solid geology of the area. See Appendix H.

5 Data Interpretation

110. The data captured from key sources to inform the development of the Epsom & Ewell SFRA is outlined in Section 4 above. This section provides an overview of how this data has been interpreted to meet the requirements of PPS25. The findings of these analyses are presented in Section 6 below.

5.1 Delineation of the PPS25 Flood Zones (Fluvial Flood Risk)

111. It is emphasised that the risk of an event (in this instance a flood event) is a function of both the probability that the flood will occur and the consequence as a direct result of the flood. PPS25 emphasises the aim of planning policy on development and flood risk is that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk.

112. To this end, a key outcome of the SFRA process is the establishment of flood maps that will inform the application of the Sequential Test in accordance with Appendix D (Table D1) of PPS25. To inform the planning process, it is necessary to review flood risk across the area, categorising the area in terms of the likelihood (or probability) that flooding will occur.

113. The Borough has been delineated into the flood zones summarised below.

Flood Zone 3b Functional Floodplain

Areas of the region susceptible to flooding within which "*water has to flow or be stored in times of flood*" (PPS25).

Flood Zone 3a High Probability

Land assessed as having a 1% or greater annual chance of flooding.

Flood Zone 2 Medium Probability

Land assessed as having between a 1% annual chance and 0.1% annual chance of river flooding in any year.

Flood Zone 1 Low Probability

Land assessed as having a less than 0.1% annual chance of river flooding in any year. Effectively, for the SFRA, this is all the land not identified as Flood Zone 2, 3a or 3b.

114. The delineation of the PPS25 flood zones is discussed below in this section, and presented in the adjoining Flood Risk Maps.

Delineation of Zone 3b Functional Floodplain

115. 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 5% AEP (1 in 20) 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[14]".) For the purposes of the Epsom & Ewell SFRA, Zone 3b has been defined in the following manner:

- land subject to flooding in the 5% AEP (1 in 20 year) flood event (i.e. relatively frequent inundation expected, on average once every 20 years).
- 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 where the flow of flood water is not prevented by permanent buildings or other solid barriers from inundation during times of flood;

116. Detailed modelled flood extents for the 5% AEP design event (where available) were adopted for the basis of Zone 3b Functional Floodplain delineation. This includes the Hogsmill River, the Bonesgate Stream, the lower reaches of the Horton Stream and Green Lanes Stream.

117. In some areas within Epsom & Ewell, it is evident that existing urban areas are affected by flooding in the 5% AEP (20 year) flooding event. The Practice Companion Guide to PPS25 highlights the importance of considering existing land use when delineating areas that are to be treated as 'functional floodplain' for planning purposes.

118. Discussions with the Environment Agency have confirmed that, due to the obstructions to surface water flow paths posed by existing development within flood affected areas, existing buildings (that are impermeable to floodwater) should not be considered as falling within the functional floodplain. The land surrounding existing buildings form important flow paths and flood storage areas however. These must be protected, and planning decisions should be taken accordingly.

Delineation of Flood Zone 3a High Probability

119. Flood Zone 3a High Probability is defined as those areas of Epsom & Ewell that are situated within the 1% AEP (100 year) fluvial flood extent.

120. The detailed modelling outputs developed by the Environment Agency and incorporated into the Flood Zone Maps, where available (ref. Section 4.3 and 4.5), have been adopted for the delineation of Flood Zone 3a High Probability.

Delineation of Flood Zone 2 Medium Probability

121. Flood Zone 2 Medium Probability is defined as those areas of Epsom & Ewell that are situated between the 0.1% AEP (1 in 1000 year) and the 1% AEP (1 in 100 year) flood extents. In this instance, Flood Zone 2 Medium Probability is defined in accordance with the Environment Agency Flood Zone Map.

Delineation of Flood Zone 1 Low Probability

122. Flood Zone 1 Low Probability is defined as those areas of Epsom & Ewell that are situated outside the 0.1% annual chance 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).

[14] Table D1, PPS25

Sensibility Check of Flood Zone Data

123. Detailed flood risk mapping has been provided by the Environment Agency to delineate areas that are at high probability of flooding from rivers within the Borough. These detailed maps are not all encompassing and, therefore, in some areas reliance has been placed upon the Environment Agency JFLOW data. As this is a National scale model, there are known limitations. Therefore, for planning purposes, a 'sensibility check' has been carried out to ensure that it provides a reliable depiction of the anticipated floodplain extents. In simple terms, this check ensures that the Environment Agency JFLOW data reflects the fact that water flows downhill, and that water levels across the river (i.e. on either bank of the river at the same location) are equal.

124. A small amendment has been made to the Environment Agency's JFLOW data in the Epsom & Ewell SFRA. Through consultation with the Environment Agency and the Hogsmill IUD team, it has been decided that the branches of the Flood Zones that extended through Epsom Town Centre and East Ewell, which were not connected to watercourses, are not fluvial Flood Zones as PPS25 would define. Instead, they have been termed as Critical Drainage Areas (see Section **Error! Reference source not found.**) and the Flood Zones have been amended accordingly.

5.2 Assessment of Flood Hazard

125. The assessment of flood risk has thus far considered the maximum extent to which flooding will occur during a particular flood event. This provides the basis for assessing broadly the areas potentially impacted by flooding. Of equal importance is the rapid onset of flooding as river levels rise. The inundation of floodwaters into low lying areas can pose a considerable risk to life.

126. Substantial research has been carried out internationally into the risk posed to pedestrians during flooding[15][16]. 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'. However, it should be noted that Flood Hazard is also a function of water and air temperature as well as the presence of slip and trip hazards.

127. For example, if a flood flow is relatively deep (~0.4 metres) 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 of 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.

128. The risk to life (as a result of flooding) within the Borough of Epsom & Ewell has been assessed in qualitative terms to inform the allocation of land within the Borough for future development. The analysis has considered the risks associated with surface water flow (i.e. as fluvial flooding breaks out of the river banks) and accumulation in land that is low-lying relative to its surroundings, which are called depressions. Depressions are annotated on the topographical mapping in Appendix F. There are no known formal flood defences in Epsom and Ewell Borough and thus the failure of such have not been analysed. Similarly, there are no identified water storage reservoirs that pose a hazard in the event of failure so no dam-break impacts were assessed. The only significant open water and which is not under the Reservoirs Act, is at Ewell Court which can drain unobstructed to the Hogsmill over open land.

[15] **Flood Risk Assessment Guidance for New Development** (R&D Technical Report FD2320, Udale-Clarke, Dyer, Scott, October 2005)

[16] Flood risks to people (R & D Technical Report FD2321/TR1 & TR2 Environment Agency and Ramsbottom et al, 2006)

129. The determination of flood hazard requires both the depth and velocity to be known. This can only be calculated by use of a two-dimensional (2D) model. However, as no 2D modelling has been carried out within Epsom and Ewell Borough flood hazard has been assessed simply by identifying potentially flooded areas from flood mapping and surface water flow paths with a 50m buffer. See Appendix F.

5.3 Assessment of Localised Flood Risk

130. The risk of flooding from other (non fluvial) sources is an important consideration. The recent flooding that affected England, and particularly the South East, in July 2007 highlighted the potential risk that groundwater, surface water runoff and sewer flooding can have upon an area. Epsom town experienced minor surface water problems from non-fluvial sources.

131. Within Epsom & Ewell, information has been provided by the Council relating to anecdotal observations of localised flood risk in the July 2007 event. These incidents were reported as both Flooding (property) and Flooding (no-property). The sites are mapped with other incidents on the Historical Flooding Incidents map in Appendix E.

132. Sites of historic flood risk have been identified and mapped from information provided by the Environment Agency, Epsom and Ewell Borough Council, Thames Water and Defra.

133. 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 accurately predict the potential risk of localised flooding, particularly given that many of these incidents will be as a result of a combination of local influences.

134. The topography and geology of the Borough provides a means of identifying those areas within which surface water runoff is likely to cause the most disruption and potentially damage property. Highly impermeable soils that reduce the capacity of infiltration into the ground during periods of high rainfall or frozen ground increase rainfall runoff significantly. Localised ‘depressions’ in the topography (where ponding is likely to occur) can be considered potentially at risk of localised flooding and this should be taken into account as part of the design process.

135. More generally, though, development can fundamentally alter drainage patterns, obstructing surface water flow routes and altering the volume and speed of runoff. The SFRA has therefore captured all readily available information relating to localised flooding in an effort to inform future detailed Flood Risk Assessments (FRAs). It is essential to highlight that this should not be considered a comprehensive representation of all localised flood risks as indeed not all observed incidents may have been reported (and the blockage of culverts and gullies can happen anywhere).

5.4 Potential Impacts of Climate Change upon Flood Risk

136. 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 rivers’ 1% annual chance flood flow can be expected within the next 20 years, increasing to 20% within the next 100 years.

137. It is essential that decision makers (Epsom & Ewell Borough Council and owners/developers) consider the possible change in flood risk over the lifetime of the development as a result of climate change. The likely effects of the increase in fluvial, surface water and groundwater flow over the lifetime of the development should be

assessed in accordance with the guidance provided in Annex B of PPS25.

138. In the absence of a definitive flood outline, the anticipated extent of the 1% annual chance flood affected area in 2115 can be approximated by the current 0.1% annual chance flood outline, i.e. Zone 2 Medium Probability. Within the river valleys, this indicates an increase in the areas at risk of flooding and, in planning terms, it is essential that Epsom & Ewell Borough Council acknowledge the potential impact that climate change may have within their Borough.

139. It is important to remember 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 Borough. 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, as well as the risks of fluvial flooding.

140. The Hogsmill IUD study has highlighted how climate change may affect rainfall runoff in the chalk part of the catchment. In normal intensity rainfall events, the rain can infiltrate into the ground, attenuating flows. However, in very intense rainfall events the rate of rainfall is greater than the grounds infiltration capacity, causing overland flow from an area that does not usually contribute overland flows to the watercourses. It is currently predicted that intense rainfall events may increase in frequency with climate change.

141. Appendix B (Table B.2) of PPS25 states that peak rainfall intensities are anticipated to increase by as much as 30% by the year 2115.

142. In the absence of a definitive flood outline, the anticipated extent of the 1% AEP (100 year) flood affected area in 2115 can be approximated by the current 0.1% AEP (1000 year) flood outline, i.e. Zone 2 Medium Probability

6 Flood Risk in Epsom & Ewell

6.1 Overview

143. A relatively small percentage of properties within Epsom and Ewell are at risk of flooding from rivers. However, the urbanised areas, steep topography and potential rainfall runoff from the Epsom Downs introduces a relatively high susceptibility to surface water, groundwater and localised flooding in certain parts of the Borough. The risk of flooding posed to properties arises from a number of sources including river flooding, surface water, localised runoff and sewer flooding. However, the most significant of these is surface water runoff on a large scale. The watercourses in Epsom & Ewell that pose significant flood risk to buildings and infrastructure are the Hogsmill River and its tributaries, which include the Bonesgate Stream, the Horton Stream, Green Lanes Stream and Ewell Court Stream. Most of the Ewell Court Stream and lengths of Green Lanes Stream are culverted.

144. These watercourses are predominantly urban. The Hogsmill River, Green Lanes Stream and Ewell Court Stream all either originate in built-up areas or have their source just outside development. The exception to this is the Horton Stream, which largely flows through open space to the west of Epsom. Some of the course of the Horton Stream is through the Horton Park County Club golf course, though, so it is likely that it is actually closely managed. Also, recent developments have seen the Horton Stream culverted in places.

145. Therefore, the communities of Epsom & Ewell are dissected by the Hogsmill River and its tributaries. Given the proximity of development to the watercourses, it might be expected that a considerable amount of buildings and infrastructure would be at risk. The flood risk mapping actually shows that a relatively small proportion of the Borough is susceptible to river flooding, with the extents of Flood Zones 2, 3a & 3b being largely confined to the areas adjoining the river corridors. However, it is important to note that even though a relatively small proportion of Epsom & Ewell is at risk of fluvial flooding, the consequence of flooding to homes and businesses can be severe. 95% of the damage sustained by residential property as a result of flooding occurs in the first 9 inches (depth) of water above the threshold of the building. Even if flooding is shallow, it can cause substantial damage.

146. NaFRA statistics show that 1135 properties lie within Flood Zone 3 (3.7% of total households) and a further 241 properties lie within Flood Zone 2 (0.8% of total households). This equates to at total of 2526 people in Epsom & Ewell residing in Flood Zone 3 and 2.

147. The Hogsmill catchment spreads wider than the Epsom & Ewell Borough boundary. Although no watercourses are present in the upper reaches of the Hogsmill catchment, a considerable contributing area exists in the Boroughs of Reigate and Banstead and Sutton. The contributing area of both of these Boroughs is already highly developed and thus runoff in extreme events is significant to flood risk within Epsom & Ewell. Future development within Epsom & Ewell, as well as in adjoining areas, could reduce flood risk through sustainable drainage measures. Planning decisions taken outside of the Borough may strongly influence flood risk within it.

148. It is important to note that flooding within the Borough can arise from sources other than rivers. The PPS25 flood zones (and, consequently, the application of the sequential test to guide development towards areas of lowest risk) are based solely upon the probability of fluvial flooding. It is essential that the Council are aware of other, more localised, sources of flood risk, including sewer, surface water and groundwater flooding and that these localised sources of flooding can cause significant damage and disruption.

149. With regard to sewer and surface water flooding, less extreme events are often the result of causes that can be overcome through the regular maintenance of the drainage system. However, flooding caused by storm events greater than 6.6% annual chance

cannot be so readily managed. Outputs from the Hogsmill IUD suggest that most surface water sewers are only approximately designed to the 6.6% rainfall event and, therefore, any storm event greater than this will cause the sewers to surcharge and flooding will occur. Upgrading undersized drainage system may be a possible solution, but this can either increase flood risk downstream or may not be economically viable. The introduction of more pro-active drainage management which optimises the use of control at source and management of exceedance flows overland by infrastructure management is the sustainable way forward. Flooding of this nature need not preclude development, but developers need to be aware of relevant sources, pathways and receptors and plan development to accommodate flood flows which will occur. It is important that all sources of flood risk are acknowledged at the planning stage and addressed in the design process. If this doesn't happen, the likelihood and severity of flooding may increase, which is unacceptable in terms of sustainable development. The current minimum standard of protection that Thames Water will accept, in terms of site drainage and protection is the 3.3% event. This means that site drainage has to accommodate the 3.3% rainfall event before any surcharging or flooding of the sewer network. It should also be known that developments currently have the 'right to connect' to the sewer network, but this right is soon to be removed and only sewers of a certain standard will be allowed to connect to the sewerage network. This should pressure developers to take more responsibility for the drainage of their sites and utilise more source control of surface water.

150. Although the Thames Water network may only be designed to withstand the 3.3% event before surcharging, PPS25 requires control of up to the 1% plus climate change allowance for the discharges (rates and volumes) from the site, as well as consideration of exceedance routing for more extreme events. Rates should preferably be controlled to Greenfield conditions. Climate change for these events is then considered in the additional storage volumes required on site and not to an increase discharge rate.

151. Records exist of surface water flooding and recent observed events (such as those of July 2007) have allowed Jacobs to accurately map areas where surface water flooding has occurred. See Appendix E.

152. Jacobs have also used DTM to develop the likely routes of surface water flow paths through which surface water, groundwater and foul water floods could flow.

153. The risk of groundwater flooding is typically variable and heavily dependent upon local geological, topographical and weather conditions, as well as local abstraction regimes.

154. Groundwater flooding is hard to predict and challenging to mitigate. Even with a carefully monitored network of boreholes, it can be difficult to tell when and where groundwater flooding will occur.

155. Nevertheless, areas at risk of groundwater flooding in Epsom & Ewell have been identified. The sources of recent groundwater flood events has been mapped and, in combination with the GEMs (see Section 4.7), there is a strong indication of where groundwater flooding may arise. Mitigation to reduce groundwater flooding may be achieved by managed abstraction by Sutton and East Surrey Water who could strategically draw down the water table in drawing their water resources.

156. The mechanisms of flooding within the Hogsmill catchment, and therefore relevant to Epsom and Ewell, are detailed in Table 1, below. The format follows the Environment Agency's Source - Pathway – Receptor model. This information will be easily available through the Hogsmill IUD Flood Risk Tool (www.floodrisktool.org).

Table 1 – Mechanisms of flooding

Source	Pathway	Receptor
Comments specific to Epsom & Ewell within the Hogsmill catchment in italics		
1. Groundwater		
Groundwater flooding occurs where the level of groundwater in the ground rises above ground level, leading to springs.	The pathway is where the geological boundary forming the base of the water bearing deposits emerges at the ground surface.	Infrastructure located on or just down-slope of the geological boundary from which the springs originate.
a) The Chalk of the North Downs acts as a regional water bearing aquifer that both stores and permits water to travel underground. The spring line from this aquifer runs across the catchment. The source of the Hogsmill River at Ewell and the Green Lanes Stream at Epsom are from such springs. *b) Drift deposits of gravel overlying some of the Clay lower catchment can be quite permeable absorbing infiltration which then emerges around its perimeter*		*Historical records of flooding indicate that properties at Epsom and Ewell within the groundwater envelope are most affected with individual sites at West Ewell and Ewell Court within drift deposits recorded.*

2a. Overland flow – the Chalk (upper) catchment		
Source	**Pathway**	**Receptor**
On natural Chalk-land without urban infrastructure, the rainfall generally soaks into the permeable Chalk. Surface runoff only arises at times of extreme rainfall events when the rainfall exceeds the rate of infiltration by the water into the Chalk. Runoff will increase where the permeable ground is covered by impermeable man made developments.	The run-off exceeding the Chalk infiltration will tend to drain via natural valleys, but may be modified by local ditches and embankments.	Infrastructure in, and across, natural valleys.
The Chalk extends from just south of the M25, on Headley Heath, to just north of the Epsom to Ewell railway line; dissecting the catchment in a north-easterly direction. Most development in this area drains to soakaway.	*Two principal surface water flow paths form within this area of the catchment.*	*The western path flows through Langley Vale band enters Epsom at Woodcote. A series of paths flowing from Epsom Downs into south-east Epsom are linked to this. The eastern path mainly originates in Nork (Reigate & Banstead) and flows into Ewell and East Ewell.*

2b. Overland flow – the Clay (lower) catchment		
Source	**Pathway**	**Receptor**
On a natural Clay catchment the rainfall tends to flow rapidly to ditches, drains and watercourses. These tend to be well defined but may be modified by land-use. In particular depressions may be formed where water is trapped and cannot escape. At times of more extreme rainfall events the rainfall run-off may flow down original flow pathways of natural valleys as well as coming out-of-bank resulting in surface water flooding.	Natural valleys. Depressions in urban areas resulting from placing of fill or other activities by man. In extreme floods this can include flood banks which trap water on the flood plain.	Infrastructure in, and across, natural valleys, and in man made depressions.
There are four principal source areas and routes for surface water flow paths over the Clay catchment that are conduits for surface water run-off and are also likely conduits for surface water drainage exceedance.		*The Ewell Court, which joins the eastern chalk route from East Ewell, Stoneleigh, West Ewell from the hospital complex and Bonesgate (Horton Country Park) affect local properties.*

3. Surface water drainage network – exceedance of the network capacity		
Source	**Pathway**	**Receptor**
Surface water networks are developed in parallel with infrastructure development, to replace surface water flow enabling that development to occur. Surface water drainage flooding occurs when the volume of surface water arising from rainstorms exceeds the capacity of the surface water drainage network, known as exceedance. Exceedance can occur from water which: a) Cannot get into the system because it is full; b) Spills out from man-holes due to upstream pressure in the pipeline known as surcharging.	The flood water from manholes will tend to follow the surface water flow paths at variable depths and extents. Except where there is contamination with foul sewage, or close to the source, it may be difficult to identify it as surface water drainage flooding.	Infrastructure around and down-slope of manholes and gullies.
The surface water drainage network commences where the chalk geology ceases, coincident with the groundwater envelope in the Epsom, Ewell and East Ewell areas. In common with all other drainage, the network capacity is designed to accommodate up to a 5% AEP (1 in 20 annual chance) at which point the capacity of some parts of the network will be exceeded. Exceedance of the surface water network during extreme events and the potential impacts are being studied by the partners of the Defra Integrated urban Drainage Pilot Study for the Hogsmill catchment. This research study is not complete at the time of reporting but the results may be used in the next SFRA update.		*The indications are that the surface water network will be overwhelmed by high volumes of runoff particularly from the large chalk catchment. The areas most at risk are Epsom town centre, Ewell, East Ewell and New Malden. Exceedance flow will tend to follow the surface water flow paths indicated on the maps but localised flooding may also occur.*

4. Foul sewer network – exceedance of the network capacity		
Source	**Pathway**	**Receptor**
Foul water networks are also developed in parallel with infrastructure development to carry waste from properties. In the Hogsmill these are almost entirely separate by design from the surface water system and should be unaffected by rainfall. However, in practice surface and groundwater infiltration into the sewer and surface water misconnections by property owners do cause capacity exceedance. Some flooding is also caused by local blockages.	The foul flood water from manholes will tend to follow the surface water flow paths and mix with surface water at variable depths and extents.	Infrastructure around, and down-slope of, manholes.
The exceedance sites are mapped individually from flood history and do not represent numbers of properties.		*Foul flooding incidents tend to be localised and are addressed by Thames Water Utilities as a priority. Historic sites may not indicate significant future risk.*

5. Watercourse (fluvial) flooding – exceedance of the watercourse capacity		
Source	**Pathway**	**Receptor**
Every watercourse (river, stream and ditch) has a finite capacity. Once the capacity of the structure is exceeded, water flows out of bank at low points. Typically channels are enlarged and defences rose in response to actual flooding experience. However, the risk remains that the next flood will be higher than anything experienced previously and overtop defences or exceed the enlarged channel.	The flood water flowing out of bank will fill low-lying areas within the floodplain and in some cases, tend to follow the surface water flow paths with variable depths and extents.	Infrastructure along the sides of watercourses.
The main sources of fluvial flooding are on the Hogsmill between the Horton Stream and Bonesgate Stream confluences and Green Lanes Stream upstream of Chessington Road.	*The main area at risk is West Ewell / Stoneleigh.*	

6.2 Historical Fluvial Flooding

157. Fluvial flooding has occurred from the Green Lane Stream at Upper Court Road in Epsom.

6.3 Fluvial Flood Risk

158. The probability of fluvial flooding within Epsom & Ewell has been delineated into zones of high, medium and low likelihood, in accordance with PPS25.

159. As a catchment, the Hogsmill is not characterised by broad, flat and open floodplains that allow for extensive flooding. The floodplains are, instead, quite narrow. This, in combination with the fact that the watercourses in Epsom & Ewell are relatively small and closely managed in their urban locations, results in the risk of fluvial flooding being largely confined to areas immediately adjoined to the river corridors.

160. The probability of fluvial flooding is presented in Appendix C. For an overview of the probability of flooding per character area, see Appendix D. The main risk to property from fluvial flood events is predicted to be in the areas upstream of and between the confluences of Horton Stream and Bonesgate Stream on the Hogsmill and the Ewell Court Stream, which is almost entirely within culverts.

6.4 Surface water and Localised Flood Risk

Surface water and local drainage issues (observed flooding incidents)

161. As discussed in Section 4.2, consultations have been carried out with the Environment Agency and Epsom & Ewell Borough Council to identify known and/or perceived problem areas. These drainage problems may be attributed to inundation due to poor maintenance, culvert and sewer blockages, or increased surface water flow during heavy rainfall. Issues of this nature are often relatively localised, affecting an unpredictable number of properties.

162. Prior to July 2007, there had been no recent, significant, incidences of flooding due to the incapacities of the surface water drainage network and the sewerage systems. On Friday July 20th 2007 the south-east of England was hit by a series of very heavy, localised storms and, in some places, several inches of rain fell within a few hours. Epsom & Ewell was not too badly affected, but there were still incidences of flooding as a result of these storms reported across the Borough.

163. Much of the rain that fell on July 20th 2007could not infiltrate into the ground. This is, in part, due to the fact that infiltration capacity decreases very rapidly during storms, but it is also down to the fact that south-east England had already endured one of the wettest summers on record and local soils would already have been saturated. Similarly, in urban areas, the heavy rainfall could not be accommodated by the surface water sewers. Consequently, much of the rain that fell was transported as surface water flow and this would have followed the natural depressions and surface water flow paths, which are defined by the local topography, until they reached obstacles or depressions.

164. As part of Jacobs' topographical study of Epsom & Ewell, surface water flow paths and depressions were modelled (see Appendix F). Although they do not give a definitive answer to where surface water flooding will occur, they provide a good starting point in the analysis of where surface water problems may arise.

165. It should be noted, though, that the surface water flow path modelling cannot take into account local factors, such as the layout of roads, buildings, walls, fences and other infrastructure. As surface water flow encounters these sorts of obstacles, the course of the flood water is influenced by them significantly at a local level.

166. The Hogsmill IUD identifies that "new developments and the paving over of gardens for car parking increases runoff and could potentially increase flood risk on the surface water flow paths downstream of the development (for example in Epsom High Street). This, in turn, increases inflow to the surface drainage network, which then causes flooding through 'exceedance' and damage to property in its path. Inflow to the main river also increases, thus causing exceedance of watercourse capacity in Kingston".

167. The guidance in PPS25 aims to steer development away form areas of flood risk, but this guidance is largely focussed upon areas of fluvial flood risk (as defined by the PPS25 flood zones). Surface water issues can cause equally damaging and disruptive flooding.

168. It is essential to ensure that future development does not exacerbate existing flooding problems. Flood Risk is a material planning consideration and should be assessed prior to planning permission being granted. Also, strict planning conditions should be placed upon developers to ensure that best practice measures are implemented to mitigate any potential increase in loading upon existing drainage system(s). The Hogsmill IUD Flood Risk tool, when fully available, will prove useful for the assessment of whether planning will be acceptable in terms of the probability of flooding and decision can be made at a pre-planning application stage.

169. The Environment Agency strongly advocates the use of SUDS. A wide variety of SUDS techniques are available (refer Section 7.5.3), potentially providing both water quality and water quantity improvement benefits on a site by site basis throughout Epsom & Ewell. Wherever possible within brownfield areas, the developer should seek to reduce the rate and volumes of runoff from the site to the equivalent greenfield rates (i.e. the rate of runoff generated from the site assuming it were an open grassed area). This is usually within the range of 5 to 9 litres per second per hectare (l/s/ha), depending on site slope and soil porosity. Collectively, the effective application of SUDS as part of all future development has the potential to reduce the risk of flooding within Epsom & Ewell. The guidance developing from the Hogsmill Defra IUD Pilot Study may suggest site based requirements that reduce runoff further as part of strategic measures. Developers should also utilise the guidance within the document 'Rainfall Runoff Management for Developments - Interim National Procedure', which can be seen in Appendix J of this report. The report aims to assist the vision of PPS25, which states that developers and their designers should "…where possible to reduce and certainly not increase flood risk". The document addresses the long-term issue of how to deal with additional volumes of runoff created by the developed area and exceedance design.

Groundwater Flooding

170. Many of the reports of groundwater flooding in Epsom & Ewell have arisen in the areas at the northern foot of the downs, at the junction between the permeable chalk and the less permeable and impermeable strata in the north-west of the Borough. The beds of cretaceous chalk within the downs act as an aquifer and are capable of storing and transporting groundwater flow. During sustained periods of heavy rainfall the chalk aquifers become saturated and springs will occur at the junction between the permeable chalk aquifer and impermeable or less permeable strata.

171. This report has also reviewed the local outputs of the Groundwater Emergence Maps (GEMs). The local outputs of the GEMS broadly follow the junction between the impermeable and permeable strata of Epsom & Ewell. They also enclose all recent, reported, incidences of groundwater flooding. They also report groundwater flood history related to drift gravel deposits.

172. As with surface water flooding, groundwater flooding may not preclude development. However, in accordance with PPS25, future development will require an appropriate Flood Risk Assessment (FRA) at the planning application stage that is commensurate with the level of flood risk posed to the site. The FRA should incorporate a site based assessment of the potential risk of groundwater flooding to the site, confirming the

likelihood and/or severity of this source of flood risk. 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. Safe and dry access would be required. The adopted design will need to ensure that it does not result in any worsening to the risk posed to adjoining properties.

173. Another consideration with respect to groundwater is the effectiveness 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.

6.5 Risk to Life from Flooding (Flood Hazard)

174. As discussed in Section 5.2, the actual flood hazard cannot be fully assessed without two-dimensional modelling at this stage. Flood hazard may arise from all sources of flooding where the combination of depth and velocity are significant. Water flowing out of bank from the main-river, groundwater or rainfall runoff flowing over ground can create flood hazard. For the purpose of the SFRA, wherever flood maps show flooding and wherever surface water flow paths are annotated then hazard should be assumed to exist.

6.6 Topography & Geology

Topography

175. The topography of Epsom & Ewell can be contrasted between the higher ground of the Epsom Downs in the south/south-east of the Borough and the lower and flatter land in the north. The downland ridge represents the boundary between the River Mole catchment to the south, and the Hogsmill River catchment to the north.

Geology

176. The solid geology in Epsom & Ewell is of four separate strata. The higher ground in the south-east of the Borough is made up of cretaceous chalk. The Thanet Sand formation and the Lambeth Group, bands which are both present in the heart of the Borough, border the chalk. London Clay makes up the solid geology of the north-western half Epsom & Ewell. There are drift deposits of gravels within the clay, some of which may be terrace gravels left behind when the River Thames changed its course during an ice-age.

6.7 Summary of Flood Risk by Character Areas

6.7.1 Overview

177. It is essential that both the Council and prospective developers are fully aware of the potential risk that flooding may pose to future development within specific areas of the Borough of Epsom & Ewell. It is equally important that Council and developers have a thorough understanding of the potential impacts that future development may have upon the flooding regime. To this end, the following section provides an overview of the potential risks of flooding posed to the Borough.

178. Due to the fact that the southern half of Epsom & Ewell is largely designated as Metropolitan Greenbelt and the northern half is already urbanised, the scope for development clearly leans towards the regeneration of brownfield sites. Indeed, we are advised that Epsom & Ewell Borough Council will be required to allocate sites for

around 500 dwellings within the next 15 years within their urban areas. Epsom and Ewell do not currently have any specific site allocations for regeneration. At this stage the emphasis has been at a strategic level, outlining the general areas that will accommodate most new development. Epsom and Ewell Borough Council consider Epsom town centre to be a key area for some potential redevelopment and are preparing an Area Action Plan DPD. This report will discuss flood risk within the Borough on a wider scale, looking at each defined character area in turn. The character areas are as follows:

- Epsom North (Cuddington, Ewell Court, Auriol and Stoneleigh wards)
- Epsom West (Ruxley, Court and Stamford wards)
- Ewell (West Ewell and Ewell wards)
- Epsom Town Centre (Town Centre ward)
- Epsom East (Nonsuch and College wards)
- Epsom South (Woodcote ward)

179. The discussion provided below should be read in conjunction with the flood maps accompanying this report. Collectively these will provide an overview of the nature and scale of the potential flood risk posed to the site under consideration. This should inform the scope of the detailed Flood Risk Assessment, highlighting the 'big' local issues that must be considered as part of the site design process. The maps and supporting discussions can be used as tools to inform spatial planning, as can the impending outputs of the Hogsmill IUD Flood Risk Tool. It is essential that site allocations steer development towards areas of lowest risk (as depicted by the flood maps) unless there are exceptional circumstances in which other non-flooding related planning constraints outweigh the risk of flooding.

180. It is important to recognise that the localised flooding incidents listed are only those that have been recorded by Thames Water or notified to Epsom & Ewell Borough Council by the local community. This is not intended to be an all encompassing record of localised flooding problems throughout the Borough. **Prospective developers should contact the following organisations for information: Epsom and Ewell Borough Council, the Environment Agency, Thames Water, Sutton & East Surrey Water and Surrey County Council as part of the detailed Flood Risk Assessment process to confirm whether their site has been affected by localised flooding historically.**

181. Irrespective of the knowledge (or otherwise) of historical flooding, all future development can potentially influence the local flooding regime. It is essential that a 'best practice' approach is adopted in all instances. **Developers should be required to provide a sustainable drainage solution that will ensure that the runoff from the site does not exceed the maximum for Greenfield runoff rates and volumes, with actual rates and volumes to be agreed by the Environment Agency. The site design should also consider the routing of surface water flow when the capacity of the dedicated site drainage system is exceeded.** It is essential that this does not endanger property either within, or outside of, the site boundaries.

6.7.2 Epsom North

182. The character area of Epsom North comprises the area to the north-east of the Hogsmill River, which extends to the Borough boundary and Nonsuch Park. The area is influenced by the right bank of the Hogsmill River and almost the entire length of the Ewell Court Stream.

183. The floodplain of the Hogsmill River, according to the flood modelling, largely lies within

a buffer-strip of green space that has been created either side of the watercourse. This area is known locally as the Hogsmill Open Space. Flood Zone 3b lies entirely within the Hogsmill Open Space. On the north side of the river, though, Flood Zone 3a is much more extensive and would cover a number of properties at Curtis Road, Bridle Close and Huntsmoor Road.

184. The Ewell Court Stream is almost entirely culverted and Flood Zone 3b is only shown to be out of bank in open space and, therefore, is of no risk to property. This suggests that the culvert has at least the capacity to carry a 5% AEP (1in 20) flow. Conversely, Flood Zone 3a impacts extensively on properties in Briarwood Road, Stoneleigh Park Road, Preston Drive and Manor Drive following the path of the stream from Nonsuch Park to the Hogsmill.

185. In terms of surface water flooding, there are four principal surface water flow paths in this area. One route follows Elm Way until it reaches the primary School, a second crosses Ruxley Lane from the Old Haileyburians RFC grounds and flows through the Riverview Road primary School, the third flows along Walsingham Gardens Road until it flows into King George's Auriol Park and the fourth flows North along Kingston Road. See Appendix F.

186. There are two recorded groundwater flood incidences from the 2000 & 2002 events in the north of the area.

187. Other local flooding events have been recorded and there have been 9 reported foul water incident sites and, from the July 2007 flooding, 6 flooded property and 5 no-property flooded incidents recorded.

6.7.3 Epsom West

188. The character area of Epsom West comprises the western area of the Borough. It is bounded by the Bonesgate Stream in the north-west, West Ewell to the north and Epsom town centre to the east.

189. Flooding in the area is influenced by the right bank of the Bonesgate Stream, the Horton Stream and the Green Lanes Stream. The latter two flow through the area for most of their length.

190. Within Epsom West, the areas of Flood Zone 3b and Flood Zone 3a associated with the Bonesgate Stream do not show flooding of any property. However, Flood Zone 2 shows properties in Colne Court and Ash Court, which are upstream of the confluence with the Hogsmill, as being at risk of flooding.

191. No flood risk mapping is available for the Horton Stream up-river of the urban area of West Ewell. As the stream reaches Chessington Road and Chessington Close, properties are shown to be within Flood Zone 3b and, at Scotts Farm Road at the confluence with the Hogsmill, property is shown to be within Flood Zone 2.

192. Flood Zones are not present in the upper reaches of the Green Lanes Stream. Instead, the maps generated by JFLOW have followed the natural valley through Epsom town centre, which is away from the watercourse. Clearly, this information cannot be confused with fluvial flooding as per the PPS25 Flood Zones because no watercourse is present (see Section 4.3). However, the JFLOW modelling that runs through Epsom town centre is a good representation of potential surface water flooding, which the overland flow path map (Appendix F) shows. Therefore, for the purpose of this study, this part of the JFLOW modelling has been redefined as a Critical Drainage Area (CDA), which may be susceptible to pluvial flooding or flooding from sewerage surcharge due to overloading in a heavy rainfall event. Similarly, groundwater emerging from the chalk landscape to the south may also follow this course.

193. The CDA that flows through Epsom town centre indicates that flooding could occur through Epsom General Hospital, Woodcote Road and Rosebery Park at the edge of the town centre. Flooding in 2000 and 2007 has proved that the flowpath through Rosebery Park exists, although never to the extents marked by the CDA.

194. As described above, the principal surface water flowpath and surface water flood risk is via Woodcote to Epsom Town Centre. The flowpath originates on the North Downs and, where flow is unable to infiltrate into the chalk, it will accumulate on this flowpath and, as the Flood Zone maps indicate, there is strong potential for surface water accumulating on this flowpath to cause flooding in Epsom town centre. Two flowpaths pass through urban areas of Ewell, crossing Longmead Road en route to Green Lanes Stream. A series of flowpaths leading to the Horton Stream and West Ewell flow through the hospital complex and the redevelopment sites of West Park and St Ebba's. At this point storm water tanks in the Longmead Industrial & Business Parks attenuate storm water runoff entering Green Lanes Stream.

195. There are no records of groundwater flooding in the Epsom West area.

196. There are 3 reported incidences of foul water flooding and 1 no-property flood incident recorded in Epsom West.

6.7.4 Ewell

197. The Ewell character area is almost entirely urbanised. It comprises the area on the southern (left) bank of the Hogsmill, from its source to its confluence with the Horton Stream. The Ewell character area also extends northwards to Stoneleigh and arches around the north-east sector of Epsom town centre. On the southern boundary are Epsom Town Centre and Epsom West.

198. Upstream of the confluence of the Horton Stream and Hogsmill River, there is no flood risk indicated by the flood risk mapping. From Green Lanes Stream to the source of the Hogsmill River at Ewell Ponds (Bourne Hall), property is at risk from Flood Zones 3b, 3a and 2. On the left bank of the Hogsmill, north of Bourne Hall, property is at risk from Flood Zone 2.

199. The JFLOW modelling also indicates significant property flooding 'upstream' of Bourne Hall and the source of the Hogsmill, all the way to the character area boundary with Epsom East. As explained in Section 4.3, this section of JFLOW modelling has been delineated as a Critical Drainage Area. Therefore, this area may be susceptible to overland flow, surcharging sewers/drains in a heavy rainfall event, or emerging groundwater flooding following the overland flow paths (and, therefore, contributing to surface water and drainage issues).

200. At Scotts Farm Road, at the confluence of the Horton Stream and the Hogsmill River, property could flood in the Climate Change scenario.

201. Within the Ewell character area, the Green Lanes Stream extends from its confluence with the Hogsmill River to just south of the Chessington Road and Longmead Road junction. Property is shown to be within Flood Zone 3a and Flood Zone 2 on Green Lanes and just south of Chessington Road.

202. The principal surface water flowpath rises at St Ebba's and flows through Dane Tree Close and the adjacent school to Horton Stream. A secondary flowpath rises in Heatherside Road, flowing to the Hogsmill River through King George's playing Field.

203. There are two recorded groundwater flood incident sites in the Ewell area.

204. There are 4 reported foul water flooding incidences, 1 flooded property and 3 no-property flooded incidences recorded.

6.7.5 Epsom Town Centre

205. The character area of Epsom Town Centre is entirely urbanised. It comprises the commercial centre and a large industrial area that includes Surrey Business Park. It is bounded by Ewell, Epsom West, Epsom South and Epsom East character areas.

206. There are no watercourses within Epsom Town centre. However, as described earlier,

a significant surface water flowpath draining from the North Downs flows south-north through the town centre. There is potential for pluvial flooding, groundwater flooding emerging from the chalk downs to the south and sewerage surcharge to follow this flow path and cause flooding and disruption within Epsom Town Centre. Indeed, flooding on this flow path has been reported in 2000 and 2007. There are other flowpaths into the south-east sector of the town from Epsom Downs.

207. The JFLOW modelling has followed this overland flow path and, as described in Section 4.3, this section of JFLOW modelling has been delineated as a Critical Drainage Area. Therefore, this area may be susceptible to overland flow, surcharging sewers/drains in a heavy rainfall event, or emerging groundwater flooding following the overland flow paths (and, therefore, contributing to surface water and drainage issues).

208. There are 5 recorded incidences of groundwater flooding in Epsom Town Centre.

209. There are 2 reported foul water flooding incidences, 1 flooded property and 1 no-property flood events.

6.7.6 Epsom East

210. The character area of Epsom East contains the Epsom Downs, farmland, Cuddington Golf Course, Nonsuch Park and the urban areas of south-east Epsom and East Ewell. It is bounded by the Boroughs of Sutton and Reigate and Banstead to the east and all character areas except Epsom West.

211. Like Epsom Town Centre, there are no watercourses within Epsom East. However, the JFLOW modelling has indicated an area susceptible to flooding and this follows a modelled overland flowpath (see Appendix F) draining from East Ewell near the Priest Hill School Sports Centre flows toward the source of the Hogsmill near Bourne Hall. This, therefore, has been delineated as a Critical Drainage Area in accordance with Section 4.3. This area of Ewell may be susceptible to to overland flow, surcharging sewers/drains in a heavy rainfall event, or emerging groundwater flooding following the overland flow paths (and, therefore, contributing to surface water and drainage issues).

212. A significant surface water flowpath, which commences in the Borough of Reigate and Banstead, flows through East Ewell and Nonsuch Park to Ewell Court Stream (Ewell Area) where it has the potential to overwhelm the culverted watercourse in an extreme event.

213. There are no recorded groundwater flood incidences in Epsom East.

214. There have been 3 reported foul water incident sites, 5 flooded property and 6 No-property flooded incidents recorded.

6.7.7 Epsom South

215. The character area of Epsom South is largely made up of open space, with only Langley Vale by Epsom racecourse and the south-west sector of Epsom being urbanised. It is bounded by the Boroughs of Reigate and Banstead and Mole valley on its southern perimeter.

216. Much of the Epsom South overlies the North Downs chalk aquifer. This area suffers little flood risk but contributes most significantly to flood risk in Epsom town.

217. There are no watercourses within Epsom South.

218. A significant surface water flowpath, which commences in the Borough of Reigate and Banstead, flows west then north through Langley Vale toward Epsom via Woodcote.

219. There are no recorded incidences of groundwater flooding in Epsom South.

220. There are 2 reported foul water flooding incidences.

6.8 Impacts of Climate Change upon flood risk

221. Detailed modelling of the impact of climate change throughout Epsom & Ewell is provided by the 1% AEP plus a 20% increase in flows outline shown on the maps. The topography of the Borough is relatively well defined and, therefore, the likely impact of an increase in the peak design flow is unlikely to affect vast areas currently not at risk. **Localised intense storms are likely to occur more frequently and, therefore, events such as that of July 2007 are predicted to occur more often. Because of this, it is important that a site-specific, detailed Flood Risk Assessment (i.e. prepared by the developer at the planning application stage as outlined in Section 7.5) is carried out and that it takes due consideration of climate change**.

222. In the absence of a definitive flood outline, the anticipated extent of the 1% AEP (100 year) flood affected area in 2115 can be approximated by the current 0.1% AEP (1000 year) flood outline, i.e. Zone 2 Medium Probability. Within the river valleys, this indicates an increase in the areas at risk of flooding and, in planning terms, it is essential that Epsom & Ewell Borough Council acknowledge the potential impact that climate change may have within their Borough.

223. By comparing the difference between Zone 3a and Zone 2 and with due consideration to the relatively well defined topography of the area, it is clear that climate change will not markedly increase the extent of river flooding. For this reason, only a few areas that are currently situated outside of Zone 3 High Probability will be at risk of flooding in future years. This is an important conclusion from a spatial planning perspective. Notwithstanding this, those properties (and areas) that are currently at risk of flooding may be susceptible to more frequent and more severe flooding in future years. Therefore, it is essential that the development control process, which should influence the design of future development within the Borough, accounts for the potential impact that climate change may have upon flood risk.

224. The UKCIP climate change model indicates winters may be generally wetter and summers substantially drier for the whole of the UK. The direct effect of climate change on groundwater resources depends upon the change in the volume and distribution of groundwater recharge. If drier, warmer summers lead to the seasonal deficits in the moisture content of soils extending into the autumn, the winter groundwater recharge season may be shortened. This could be compensated, at least to some extent, by an increase in winter rainfall. However, aquifers are recharged more effectively by prolonged steady rain, which continues into the spring, rather than short periods of intense rainfall.

225. Some predictions see overall groundwater recharge reducing by 5% to 15%[17] but there is a high level of uncertainty associated with these values. In the long term, groundwater recharge may reduce but the greater variability in rainfall could mean more frequent and prolonged periods of high or low water levels. The effects of climate change on groundwater in the UK therefore may include:

- a long term decline in groundwater storage
- increased frequency and severity of groundwater droughts
- increased frequency and severity of groundwater-related floods
- mobilisation of pollutants due to seasonally high water tables
- saline intrusion in coastal aquifers, due to sea level rise and resource reduction

226. Overall, groundwater resources are likely to be relatively robust in the face of climate change compared with surface water, due to the buffering effect of groundwater storage. Groundwater, therefore, may have an important role to play in ameliorating the

[17] UKWIR Report 03/CL/04/2 – Effect of Climate Change on River Flows and Groundwater Recharge. UKCIP 02 Scenarios

worst effects of climate change on the water environment, if managed appropriately.

227. The effects of climate change on pluvial flooding are harder to predict. The majority of pluvial flooding in the U.K. occurs from high intensity 'extreme' rainfall events, where urban landscapes cause sewerage and drainage systems and surface watercourses to be completely overwhelmed. Because of the predicted increased storminess that climate change will bring and ongoing urbanisation, the incidence and severity of pluvial flooding, particularly in urban areas, is likely to increase, with more areas seeing flood events such as those of the summer of 2007.

228. The Hogsmill IUD study has highlighted how climate change may affect rainfall runoff in the chalk part of the catchment. In normal intensity rainfall events, the rain can infiltrate into the ground, attenuating flows. However, in very intense rainfall events the rate of rainfall is greater than the grounds infiltration capacity, causing overland flow from an area that does not usually contribute overland flows to the watercourses. It is currently predicted that intense rainfall events may increase in frequency with climate change.

229. For this reason, the development control recommendations set out in Section 7.6 (below) require all floor levels, access routes, drainage systems and flood mitigation measures in new developments in flood risk areas to be designed with an allowance for climate change. This provides a robust and sustainable approach to the potential impacts that climate change may have upon the Borough over the next 100 years. It aims to ensure that future development is considered in light of the possible increases in flood risk over time.

6.9 Residual Risk of Flooding

230. It is essential that the risk of flooding is minimised over the lifetime of the development in all instances. It is important to recognise that flood risk can never be fully mitigated, and there will always be a residual risk of flooding.

231. 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;
- the residual risk of fluvial flooding that exceeds the design return period of a defence;
- general uncertainties inherent in the prediction of flooding.

232. It is important to understand that flood risk cannot be entirely removed; at some point an event greater than those considered occurs or an unforeseeable situation develops that causes flooding. Understanding the flood mechanisms and likely flow paths can enable suitable contingency and emergency plans to be developed to reduce the impact of residual risk to receptors.

233. 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 Borough of Epsom & Ewell are largely based upon the detailed flood mapping within the area. Whilst these provide a good depiction of flood risk for specific modelled conditions, all detailed modelling requires the making of core assumptions and the use of empirical estimations relating to (for example) rainfall distribution and catchment response.

234. Taking a conservative approach for planning purposes, the Environment Agency advises that finished floor levels are raised to a minimum of 300mm above the peak

design flood level (including climate change) when advising developers.

7 Sustainable Management of Flood Risk

7.1 Overview

235. 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 is sustainable development within flood affected areas.

236. The significant flood events that have occurred in the summer of 2007 have 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 to make space for water. However, it is recognised that it is not easy to achieve whilst maintaining an effective community. For this reason, after the sequential test has been applied, 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 while still at risk. These measures should address the flood risk to and from the development and not only in the short term, but throughout the lifetime of the proposed development. This is a requirement of PPS25.

237. Responsibility for flood risk management resides with all tiers of government and, indeed, individual landowners, as outlined below.

7.2 Responsibility for Flood Risk Management

238. There is no statutory requirement for the Government to protect property against the risk of flooding. Aside from this fact, the Government recognises 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.

239. The Regional Assembly should consider flood risk when reviewing strategic planning decisions including (for example) the provision of future housing and transport infrastructure.

240. The Environment Agency has a statutory but permissive responsibility for flood management and defence in England. They are a statutory consultee body for the planning and development control process through the provision of information and advice regarding flood risk and flooding related issues. The Environment Agency also has flood forecasting and warning responsibilities.

241. The Local Planning Authority is responsible for carrying out a Strategic Flood Risk Assessment. The SFRA should consider the risk of flooding throughout the Borough 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.

242. Landowners & Developers[18] have the right to protect their property from flooding and their land from erosion. However, in most cases this will require prior approval from the Environment Agency and/or Epsom and Ewell Borough Council. Any proposed works must not adversely impact upon flood risk on-site or elsewhere. They are also responsible for managing the drainage of their land such that they do not adversely impact upon flood risk on-site or elsewhere. For further responsibilities of the Developer, please refer to paragraph 22 of PPS25. Also, riparian (river side) owners have certain rights and responsibilities. Please see the Environment Agency

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

publication 'Living on the Edge' for more information.

243. Thames Water & Sutton & East Surry Water are responsible for the maintenance of their surface water drainage network.

7.3 Strategic Flood Risk Management - The Environment Agency

7.3.1 Overview

244. 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. Needless to say, construction of such walls can result in the redistribution of floodwater, inadvertently increasing the risk of flooding elsewhere. Therefore, this approach to flood risk management in the modern era should only follow a thorough assessment of the risks that could be created elsewhere in the catchment and these are considered acceptable.

245. The Environment Agency, 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.

7.3.2 Catchment Flood Management Plan (CFMP) – Thames Region

246. "*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*."

247. "*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 coordinated 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.*"

248. *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*."[19]

249. A CFMP is being developed for the non-tidal part of the River Thames catchment and

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

the Hogsmill River is a major tributary of the River Thames. A consultation summary document was provided last year outlining the main messages from the Thames CFMP (January 2007). The outputs of the final CFMP that affect Epsom & Ewell should be integrated into all aspects of the planning process.

250. The Environment Agency has summarised the Thames 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

251. Specific messages have been produced in the Thames CFMP that apply to individual catchment types. The Hogsmill catchment is classified as “Developed flood plain with typically concrete river channels”. For this type of catchment, the draft CFMP states that:

- We need to re-create a river corridor so there is more space for the river to flow and flood naturally.
- Flood risk management planning needs to be linked closely with regeneration and redevelopment so that the location and layout of development can help to reduce flood risk.
- There is a large and increasing residual flood risk in these flood plain areas. PPS25 sets out a range of measures that can reduce the impacts of residual flood risk, such as making buildings resilient to flooding.
- Organisations need to work together to manage all flood sources: fluvial, tidal, surface water and sewer flooding

252. These succinctly reinforce the over-arching objectives of PPS25, i.e. it is important that Local Authorities seek to restrict development within flood affected areas, protecting the natural floodplain wherever possible, and ensuring that development does not exacerbate flooding.

253. 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

254. Further key messages for Epsom & Ewell may also be taken from the CFMP. 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.

255. The Hogsmill catchment has its own 'policy unit' under the Thames CFMP, in which there are catchment-specific messages and policies for the future management of flood risk and consequence within the Hogsmill catchment. This can be seen in Appendix K.

7.3.3 Hogsmill River Flood Risk Management Strategy

256. The Hogsmill River Flood Risk Management (FRM) Strategy is being carried out by Jacobs on behalf of the Environment Agency. The Strategy seeks to identify strategic and sustainable measures to reduce flood risk within the catchment. Measures considered include structural options that involve capital expenditure and engineering and non-structural options that develop planning and organisational approaches. The FRM strategy takes a holistic view of the catchment and the interaction between local authorities -particularly Epsom and Ewell and the Royal Borough of Kingston in conjunction with particular authorities.

257. Structural measures considered include flood storage and raised defences. However, the available storage is not sufficient and raised defences, though economically viable, are a last resort.

258. The most sustainable measures are those which control flow at source to reduce site runoff and manage residual surface water flow to attenuation areas, which double as recreational open space and habitat improvement sites.

7.3.4 Hogsmill Defra Integrated Urban Drainage (IUD) Pilot Study

259. The Hogsmill Defra IUD Pilot Study is a Defra funded research project[20] that is assessing the interactions between fluvial flooding and surface water flooding. This investigation is seeking to establish 'best practice' approaches for sustainable drainage techniques throughout the catchment. There are clear synergies between the Defra study and the Epsom & Ewell SFRA and future revisions of the SFRA process should review the outcomes of this research initiative.

260. The Pilot study is a partnership between the Environment Agency, Epsom and Ewell Borough Council, the Royal Borough of Kingston, Surrey County Council, Thames Water and Sutton and East Surrey Water. The pilot has enabled closer working with partners to develop an understanding of flood risk at more extreme events than usual and seeks to develop an Integrated Urban Drainage plan that the partners will implement in the near future.

261. The study outputs have a strong planning element which should influence future SFRAs. It is also likely to provide additional information and toolkits that will help inform planning decisions.

262. A GIS web-based tool has been produced that holds the update to date & existing information on all flood risk within the Hogsmill Catchment (www.floodrisktool.org). This system allows the user to produce a site by site report on all potential flood risks that may be encountered.

[20] Being carried out by Jacobs

7.4 Surrey County Council Flooding Task Group

263. Surrey County Council set aside £1.2 million of the 2007-08 budget to deal with some of the major flooding problems around the county. A Flooding Task Group was set up to oversee this work and identify the problem areas or 'wetspots' in the county that are most vulnerable to flooding. Gathering information provided by borough and district councils, parish councils and members of the public, the council has drawn up a prioritised schedule of work.

264. In addition to the scheduled drainage works, the council is keen to explore a more holistic approach to the problems of flooding and drainage in Surrey, which is complicated by the fact that responsibility is shared by a number of different organisations. Therefore the Flooding Task Group involves representatives from the Environment Agency, Highways Agency, Thames Water and borough and district councils. Together they will investigate possible joint approaches to preventing flooding in key wetspots in Surrey in the future.

7.5 Application of PPS25 within Epsom & Ewell

7.5.1 Planning Solutions to Flood Risk Management

The Sequential Test

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

266. 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.

267. The fundamental part of this sequential approach is referred to as the Sequential Test. The process for this test is indicated in Figure 3.1 (Application of the Sequential Test) in the practice guide companion to PPS25.

268. It is important to highlight that the SFRA does not attempt and, indeed, cannot fully address the requirements of the PPS25 Sequential Test. As highlighted in the flow chart above, 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).

269. Table D.2 within PPS25 classifies the vulnerability of different development types to flood risk. This considers the likely vulnerability of the proposed development to damage (and indeed the risk to the lives of the site tenants) should a flood occur.

270. The Sequential Test should be applied to development within Flood Zones 2 and 3. Where there are no reasonably available alternative sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed, the flood risk vulnerability should be checked for compatibility with the Flood Zone using Table D.3 in PPS25. Where indicated in table D.3 of PPS25, the Exception Test should be applied. Any development that passes the Sequential Test, and where necessary the Exception Test, must meet the requirements within table D.1 of PPS25.

A sequential approach should be used in areas known to be at risk from other sources of flooding. 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. This is discussed further in Sections 7.4.3 to 7.4.6, below.

The Exception Test

271. It is recognised that only a relatively small proportion of Epsom & Ewell is situated within Zone 3a High Probability. Prohibiting future residential development in this zone is unlikely to have a detrimental impact upon the economic and social welfare of the existing community. However, there may be pressing planning 'needs' that may warrant further consideration of areas for development. Should this be the case, the Council and potential future developers are required to work through the Exception Test (PPS25 Appendix D) where applicable, but only after previously doing the sequential test. 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
- a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall."

272. 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.

273. With regard to the 3rd bullet point, above, it will be the responsibility of the developer (in all instances within Zone 3 and 2) to first resolve the Sequential Test with the Council prior to undertaking a site-specific FRA. This helps to avoid unnecessary expenditure, as well as wasted time on discussing FRAs for sites that would not pass the Sequential Test. If the proposed development passes the Sequential Test, it is then for the developer to put forward a detailed Flood Risk Assessment that can demonstrate that (where appropriate) that the risk of flooding has been adequately addressed in accordance with PPS25 as part of the Exception Test.

274. The SFRA has provided specific recommendations that ultimately should be adopted as planning conditions 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.

275. Specific planning and development control recommendations for future development within Epsom & Ewell are presented below.

276. An overview of flood risk throughout Epsom & Ewell has been provided in Section 6. Future planning decisions should consider the spatial variation in flood risk across Epsom & Ewell, as defined by the delineated flood zone that applies at the specified site location; and apply the recommendations provided below accordingly. PPS25 advocates this approach, which applies equally to both allocating sites within emerging LDF and taking development control decisions on future windfall sites.

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

277. 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 Borough. It is strongly recommended that this principle be adopted as the underlying 'goal' for developers and Council development control teams within Epsom & Ewell.

278. Developers should be encouraged to demonstrate that their proposal will deliver a positive reduction in flood risk to the Borough, 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.

279. It should be an aim to change the character of the urban floodplain through re-development. This should reduce the consequences of flooding whilst supporting the regeneration, modernisation and growth of communities. The consequences of flooding can be reduced by re-establishing river corridors so that urban areas can better accommodate flooding through being set back from the river (location and layout) and the buildings are more resilient to flooding (through design). In the long-term, this should be achievable through re-development. It must be recognised that this is a long-term objective.

280. Possible risk reduction measures for consideration may include the following:

- The integration of SUDS to reduce the runoff rate and volume from the site;
- A change in land use to reduce the vulnerability of the proposed development;
- A reduction in the building platform area and intensity of use. This is to prevent intensification through the addition of storeys (or other conversion) within the same footprint;
- The raising of internal floor levels and flood proofing (within existing buildings) to reduce potential flood damage. The Environment Agency advises that finished floor levels are raised to a minimum of 300mm above the peak design flood level (including climate change);
- The rearrangement of buildings within the site to remove obstructions to surface water flow paths;
- The placement of buildings to higher areas within the site to limit the risk of flood damage.

281. It is recommended that a clear statement be required within each and every detailed FRA that concisely summarises how a reduction in flood risk has been achieved within the proposed (re)development.

7.5.3 Future Development within Zone 3b Functional Floodplain

Planning Recommendations – Allocation of Land for Future Development

282. Areas of Functional Floodplain should be protected for flood storage and conveyance purposes. Future development should be restricted to water-compatible uses and essential infrastructure that has to be there (in accordance with PPS25). Careful consideration should be given to the respective Council's emergency response in times of flood to ensure that public safety is not compromised.

Development Control Recommendations – Minimum Requirements

283. Future development, with the exception of water compatible uses and essential infrastructure, should not be permitted. The frequency and severity of flooding within these areas are such that no engineered mitigation measures could be implemented to safely and effectively minimise the risk to life and property over the lifetime of the development.

284. It is important to recognise that, in accordance with PPS25, the Exception Test must be satisfied if essential infrastructure is proposed within Flood Zone 3b Functional Floodplain. This will require the submission of a detailed Flood Risk Assessment. Minor developments in Flood Zone 3b, such as extensions, will be judged on a case-by-case basis.

7.5.4 Future Development within Zone 3a High Probability

Planning Recommendations – Allocation of Land for Future Development

285. All development in Flood Zone 3a should be steered towards zones of lower flood risk (where possible). Where there are no available alternative sites, less vulnerable types of development, in accordance with PPS25 (Appendix D) Table D2, should generally be acceptable. More vulnerable development will only be acceptable if the Exception Test is passed. Highly vulnerable development is not considered appropriate.

286. Where non-flood risk related planning matters dictate that 'more vulnerable' development (see Table D.2 of PPS25) should be considered further, it will be necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that "the development provides wider sustainability benefits to the community that outweigh flood risk", and that "the development is on developable previously developed land, or that there are no reasonable alternative sites on previously developed land."

287. To satisfy the remaining criteria of the Exception Test, all development within Flood Zone 3a should be planned and designed in accordance with the development control recommendations below:

Development Control Recommendations – Minimum Requirements

288. All proposed future development within Zone 3a will require a detailed Flood Risk Assessment (FRA).

289. Within Zone 3a High Probability, floor levels must be situated above the 1% (100 year) predicted maximum flood level plus climate change, incorporating an allowance for freeboard. Taking a conservative approach for planning purposes, the Environment Agency advises that finished floor levels are raised to a minimum of 300mm above the peak design flood level (including climate change) when advising developers.

290. To ensure the safety of residents and employees during a flood, access and egress routes must be designed to meet Environment Agency defined criteria, as set out in Appendix I. It is essential to ensure that the nominated evacuation route does not divert evacuees onto a 'dry island' upon which essential supplies (i.e. food, shelter and medical treatment) will not be available for the duration of the flood event.

291. Within Zone 3a High Probability, basements that do not have internal access to higher floors (situated above the 1% (100 year) predicted maximum river flood level including climate change) within the building should not be permitted. Basements that do have internal access to higher floors within the building may be permitted, however sleeping accommodation should not be provided at basement level. All basements should be flood-proofed, and it must be shown that the basement does not increase the potential risk of groundwater flooding within adjoining properties.

292. Implement SUDS to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates and volumes. Any SUDS design must take due account of a number of factors including; groundwater; geological condition; slope; and contaminated soil. (SUDS) should be designed to ensure all storage operates when watercourses, groundwater or other source of flooding is at a level that has an annual probability of 1% with an allowance for climate change. SUDS designs should also be developed in accordance with the guidance provided within the document 'Rainfall Runoff Management for Developments - Interim National Procedure' (see Appendix J), which sets out how additional runoff volumes, rates and exceedance design should be approached, as well as providing design advice for drainage systems.

293. Ensure that the proposed development does not result in an increase in any flood levels within adjoining properties. This may be achieved by ensuring (for example) that the existing building footprint is not increased and/or compensatory flood storage is provided within the site (and would only be acceptable off-site if it can be clearly demonstrated that the works would adequately mitigate any loss of storage)[21]. Compensatory flood storage must be on a level for level, volume for volume basis, up to and including the 1% with an allowance for the potential impacts of climate change flood water level. Further guidance can be found in CIRIA C624.

294. A minimum 8m buffer zone must be provided to 'top of bank' within sites immediately adjoining waterway and culvert corridors. This requirement may be negotiated with the Environment Agency in heavily constrained locations. The buffer zone is required so that future maintenance and operations can be carried out unimpeded and plant can access the site safely. Also, the buffer zone ensures that no development interferes with the watercourse or defences, ensuring their future integrity. The buffer zone is also relevant to the Land Allocations Development Plan Document for zone definition and should be taken into account.

295. The main messages of the Thames CFMP also support the purpose of the buffer zone. The CFMP promotes naturalising the river where practical by removing culverts, trash screens, artificial channel and bank lining where possible. This will contribute to reducing the maintenance burden in the future by removing unnecessary structures and improving the river environment.

7.5.5 Future Development within Zone 2 Medium Probability

Planning Recommendations – Allocation of Land for Future Development

296. All development in Flood Zone 2 should be steered towards Flood Zone 1 (where possible). Where there are no available alternative sites, water compatible; less vulnerable; more vulnerable (including most residential development), or essential infrastructure should generally be acceptable (in accordance with PPS25 [Appendix D] Table D.2).

297. Where non-flood risk related planning matters dictate that 'highly vulnerable' development should be considered further, it will be necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that "the development provides wider sustainability benefits to the community that outweigh flood risk", and that "the development is on developable previously developed land, or that there are no reasonable alternative sites on previously developed land."

298. To satisfy the remaining criteria of the Exception Test, all development within Flood Zone 2 Medium Probability should be planned and designed in accordance with the development control recommendations below.

[21] Compensatory flood storage should be located as close as practically possible to the proposed development. The Environment Agency can provide further advice in this regard

Development Control Recommendations – Minimum Requirements

299. All proposed future development within Zone 2 Medium Probability will require a site-specific Flood Risk Assessment (FRA) that is commensurate with the risk posed to the proposed development;

300. Floor levels must be situated above the 1% (100 year) predicted maximum flood level plus climate change, incorporating an allowance for freeboard (normally a minimum of 300mm);

301. To ensure the safety of residents and employees during a flood, access and egress routes must be designed to meet Environment Agency defined criteria, as set out in Appendix I. It is essential to ensure that the nominated evacuation route does not divert evacuees onto a 'dry island' upon which essential supplies (i.e. food, shelter and medical treatment) will not be available for the duration of the flood event;

302. Implement SUDS to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates and volumes. Any SUDS design must take due account of a number of factors including; groundwater; geological condition; slope; and contaminated soil. (SUDS) should be designed to ensure all storage operates when watercourses, groundwater or other source of flooding is at a level that has an annual probability of 1% with an allowance for climate change. SUDS designs should also be developed in accordance with the guidance provided within the document 'Rainfall Runoff Management for Developments - Interim National Procedure' (see Appendix J), which sets out how additional runoff volumes, rates and exceedance design should be approached, as well as providing design advice for drainage systems.

303. In seeking to reduce flood risk, developers should also attempt to meet the specific CFMP objectives relevant to the site, as well as Epsom and Ewell's flood risk policy and sustainability objectives.

7.5.6 Future Development within Zone 1 Low Probability

Planning Recommendations – Allocation of Land for Future Development

304. All uses of land are appropriate within Flood Zone 1 low probability (in accordance with PPS25), however it is important to recognise that future development within this zone may adversely impact upon the existing flooding regime if not carefully managed. Flooding related issues of a localised nature, such as surface water flooding and groundwater flooding, may also occur within Zone 1 Low Probability (as highlighted in Section 5.3). For this reason, all development should be carried out in accordance with the development control recommendation below.

Development Control Recommendations – Minimum Requirements

305. A site-specific Flood Risk Assessment will be required in compliance with PPS25 and current guidance and policy. This will involve the introduction of SUDS techniques to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates and volumes. Any SUDS design must take due account of a number of factors including; groundwater; geological condition; slope; and contaminated soil. Safe access and egress should also be checked because, although a site may be in Flood Zone 1, access and egress may be cut off during flood events.

306. In seeking to reduce flood risk, developers should also attempt to meet the specific CFMP objectives relevant to the site, as well as Epsom and Ewell's flood risk policy and sustainability objectives.

7.6 Detailed Flood Risk Assessment (FRA) – what is required from the Developer

7.6.1 Scope of the Detailed Flood Risk Assessment

307. As highlighted in Section 2, the SFRA is a strategic document that provides an overview of flood risk throughout the area. **A site-specific Flood Risk Assessment (FRA) must be carried out by the developer for all proposed developments and this should be submitted as an integral part of the planning application.**

308. 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 and outside any other sources of flooding), 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.

309. It is highlighted that the description of flood risk provided in the Character Area discussions (Section 6.7) place emphasis upon the primary source of flood risk (i.e. river flooding). In all areas, a localised risk of flooding may also occur, typically associated with local catchment runoff following intense rainfall passing directly over the Borough. This localised risk of flooding must also be considered as an integral part of the detailed Flood Risk Assessment.

310. Any sites that sit within the study area of the Hogsmill Flood Risk Tool should make use of its outputs. The Flood Risk Tool will advise on SUDS techniques throughout the catchment and will have a strong planning element which will provide additional information and toolkits that will help inform planning decisions.

311. Developers should also reference the Environment Agency's standing advice on development and flood risk, which is currently available online at www.pipernetworking.com/floodrisk and will be moved to the Environment Agency website (www.environment-agency.gov.uk) after June 2008.

312. The Sequential Test should also be applied internally on large sites to ensure that the most vulnerable land uses are directed towards areas of least risk. This is particularly applicable to mixed-use sites that cover areas with varying flood probabilities.

Proposed Development within Zone 3a High Probability

313. All FRAs supporting proposed development within Zone 3a High Probability should include an assessment of the following:

- 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 consulting the SFRA mapping then 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 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

and the effect of the new development on depth and speed of flooding to adjacent and surrounding property. This will require a detailed assessment, which is to be carried out by a suitably qualified engineer.

- 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 defences, flood resistant and resilient design, escape/evacuation, effective flood warning and emergency planning.
- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum.
- 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 Borough.

Proposed Development within Zone 2 Medium Probability

314. For all sites within Zone 2 Medium Probability, a high level FRA should be prepared based upon readily available existing flooding information, which can be sourced from the Environment Agency. 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 (refer Section 6.6.2) and the provision of a planned evacuation route.

315. The risk of alternative sources of flooding (e.g. urban drainage and/or groundwater) must be considered, and SUDS must be employed to ensure no worsening to existing flooding problems elsewhere within the area.

Proposed Development within Zone 1 Low Probability

316. Within all areas of the Borough, the risk of alternative sources of flooding (e.g. urban drainage and/or groundwater) must be considered and SUDS must be employed to ensure no worsening to existing flooding problems elsewhere within the area.

7.6.2 Raised Floor Levels & Basements (Freeboard)

317. The raising of floor levels above the 1% AEP (100 year) fluvial flood level will ensure that 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.

318. Wherever possible, 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 Zone 3a 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 flood proofing to that height).

319. The use of basements within flood affected areas should be discouraged. Where basement uses are permitted, 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.

7.6.3 Sustainable Drainage Systems (SUDS)

320. SUDS are the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment. The management of rainfall (and then surface water) is considered an essential element of reducing future flood risk to both the site and its surroundings. Indeed, reducing the rate and volume of discharge from urban sites to greenfield conditions or less is one of the most effective ways of reducing and managing flood risk within an area. The integration of SUDS into a site design can also provide broader benefits, including an improvement in the water 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 green space areas offering habitat, recreation and/or aesthetic benefits.

321. SUDS may improve the sustainable management of water for a site by[22]:

- 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.

322. 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.

323. Rainwater harvesting provides attenuation and rainwater management, by reducing storm-water runoff and controlling the flow-rate off site. A rainwater harvesting system simply collects the rain which fall onto roofs, then stores it in a tank until required for use. When required, the water is then pumped to the point of use, thus displacing what would otherwise be a demand for mains-water. In the process, a volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks. More recently, water demand has started to exceed supply, and localised flooding has become an issue. Industry experts are now recognising the important role that rainwater harvesting (also known as rainwater recycling) has to play in alleviating both these problems.

324. 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[23]. 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) as well as the local groundwater regime. Careful consideration of the site characteristics must be assured to ensure the future sustainability of the adopted drainage system. Adopting an approved maintenance scheme is also essential for the future efficiency of the chosen SUDS system.

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

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.
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

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

- Draft Planning Policy Statement 25, Annex F, Office of the Deputy Prime Minister, 2005
- Interim Code of Practice for Sustainable Drainage Systems, National SUDS Working Group (2004)
- Building Regulations (Part H)
- C697 *The SUDS manual* (Woods Ballard B; Kellagher R et al, 2007 – freely available from the CIRIA bookshop www.ciria.org)
- *Preliminary rainfall runoff management for developments* (R & D Technical Report W5-074/A Revision D, Environment Agency and Kellagher R, 2005 – Free download from the Environment Agency web site www.environment-agency.gov.uk)
- *Interim code of practice for sustainable drainage* (National SUDS Working Group, 2004) - Free download from CIRIA web site www.ciria.org or Environment Agency web site www.environment-agency.gov.uk)
- C644 *Building greener. Guidance on the use of green roofs, green walls and complementary features on buildings* (Early P; Gedge D; Newton J; Wilson S, 2007- available from the CIRIA bookshop www.ciria.org)
- C635 *Designing for exceedance in urban drainage – good practice* (C Digman, D Balmforth, R Kellagher, D Butler, available from the CIRIA bookshop www.ciria.org)
- C625 *Model agreements for sustainable drainage systems* (Shaffer et al, 2004 - available from the CIRIA bookshop www.ciria.org)
- Report 156 *Infiltration drainage – manual of good practice* (Bettess R, 1996 - available from the CIRIA bookshop www.ciria.org)
- W12 *Sustainable water management in schools* (Duggin & Reed, 2006 – Free download from CIRIA web site www.ciria.org)
- *Harvesting rainwater for domestic uses: an information guide* (Environment

Agency, 2003 - Free download from Environment Agency web site www.environment-agency.gov.uk)

326. 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 with interceptors - over-sized pipes/tanks - storms cells	✔	✔	

327. It should be acknowledged that SUDS should be fully effective for the lifetime of the development that they are draining, taking into account not only climate change, but also the issue of how the paving of gardens and extensions may increase run-off. Full adoption of the SUDS is also imperative so that regular maintenance can be carried out.

328. All SUDS need to consider the requirements in the document 'Rainfall Runoff Management for Development Sites - Interim National Procedure' (see Appendix J), including those for controlling the peak rates, additional volume and exceedance design.

7.7 Emergency Planning

329. Emergency planning is a critical element of any sustainable flood risk management solution. Liaison with both the Environment Agency and emergency services is essential.

330. The Council is designated as a Category 1 Responder under the Civil Contingencies Act 2004. All Category 1 responders have the same duties under the Civil Contingencies Act. The duties of the Act fall on each Category 1 responder individually. Under Section 2(1) of the Act, each Category 1 responder has a duty to:

- Assess the risk of an emergency occurring in the LRF area (and publish some or all of this assessment in a Community Risk Register);
- Maintain business continuity plans to ensure that they can continue to perform their functions in the event of an emergency;
- Develop and maintain emergency plans for preventing, mitigating the effects of and responding to emergencies;
- Maintain arrangements for warning and informing the public and;

- Share information and co-operate with each other to achieve effective emergency arrangements.

331. As all these duties fall equally on each category 1 responder, they should use the Local Resilience Forum to agree how to share this work out amongst the member organisations to avoid duplication of effort. An example of this is where different agencies will take the lead and co-ordinate the risk assessment for particular hazards or co-ordinate the arrangements for warning and informing the public.

332. Emergency planners can consider the impact of flood risk to vulnerable sites by considering routes that may be closed to emergency services during a flood event in advance.

333. The Environment Agency monitors river levels using telemetered river level gauges. The Environment Agency uses this data in conjunction with weather forecasts, groundwater information, rainfall data (amount, distribution, intensity and timing) and details on response of river systems (e.g. topography, soil types and land-use) to monitor and forecast the expected response of rivers level and timing of level rise.

334. Where these predicted water levels are expected to result in water level rising above the river bank[24], the Environment Agency will issue a series of flood warnings within defined flood warning areas, encouraging residents to take action to avoid damage to property in the first instance.

335. As water levels rise and begin to pose a risk to life and/or livelihood, it is the responsibility of the Council to coordinate the evacuation of residents. This evacuation will be supported and facilitated by the emergency services. It is essential that a robust plan is in place that clearly sets out (as a minimum):

- roles and responsibilities;
- paths of communication;
- evacuation routes;
- community centres to house evacuated residents;
- contingency plans in case of loss of power and/or communication.

336. Safe, dry access (i.e. above flood level) should be sought wherever possible to ensure that all residents can be safely evacuated in times of flood. Safe, dry access must be achieved to land completely out of the floodplain (i.e. not to a 'dry island'). The reason for this is that, during a flood, residents trying to leave a site would be at considerable danger from the floodwater itself and also from various other hazards such as underwater drops and waterborne debris. Those venturing out on foot in areas where flooding exceeds 100mm or so would be at risk from a wide range of hazards, including (for example) unmarked drops, or access chambers where the cover had been swept away. Such hazards would be hidden by the inevitably murky and often fast flowing floodwater. Therefore there would be some hazard to anyone attempting to leave a site on foot. Equally, journeys by small boat would also entail dangers, particularly near floodwater flow routes.

337. See Appendix I for a summary of the Environment Agency's safe access and egress design requirements. As part of their long term strategy for road maintenance and improvement, the Council progressively should seek to raise critical evacuation routes above the greater of the 1% AEP + 20% flow (i.e. climate change) flood level. As an absolute minimum, 'safe' access must be assured during the 1% AEP (100 year) fluvial flood level, defined with due consideration to the emerging Defra research presented in "Flood Risk to People" (FD2320 and FD2321). It is highlighted that road raising must

[24] Restricted to those urban areas situated within Environment Agency flood warning zones

not have a detrimental impact upon flow routes and/or the effectiveness of floodplain storage.

338. Category 1 responders work together to coordinate a flood response. The Environment Agency provides Flood Warnings and forecast information to the public, Cat. 1 and Cat. 2 responders, Local Authorities and the Emergency Services, who use this information to try and ensure the safety of residents during times of flood. Some areas within Epsom & Ewell are at risk of river flooding (as indicated by the shaded PPS25 flood zones in the attached maps) that occurs after relatively long duration rainfall events. The Environment Agency will endeavour to issue a Flood Warning 2 hours prior to flooding. However, the Hogsmill is a fast-reacting catchment and this might not always be possible.

339. In contrast, areas suffering from localised flooding issues will tend to be at greater risk. These areas are susceptible to 'flash' flooding, associated with storm cells that pass over the Borough resulting in high intensity, often relatively localised, rainfall. It is anticipated that events of this nature will occur more often as a result of possible climate change over the coming decades. Events of this nature are difficult to predict accurately, and the rapid runoff that follows will often result in flooding that cannot be sensibly forewarned.

340. All urbanised areas are potentially at some degree of risk of localised flooding due to heavy rainfall. The blockage of gullies and culverts as a result of litter and/or leaves is commonplace, and this will inevitably lead to localised problems that can only realistically be addressed by reactive maintenance. **It is recommended that all owners/maintainers of culverts, gullies and drains produce a pro-active maintenance schedule to ensure that they are clear and fully functioning prior to flood events**.

341. The vulnerability map (Appendix G), indicates the relative positions of vulnerable sites to Emergency services and Hospitals. The Emergency plan should make contingency arrangements where key routes may be flooded e.g. under railway bridges.

342. The Environment Agency recommends that all communities at risk of flooding consider producing their own Flood Plans. The Environment Agency has produced a template for the community Flood Plans, which can be adapted to suit each individual community's needs and procedures.

343. It is recommended that the Council's Emergency Response Plan is reviewed in light of the findings and recommendations of the SFRA to ensure that safe access can be provided during a major flooding event.

7.8 Insurance

344. Many residents and business owners perceive insurance to be a final safeguard should damage be sustained as a result of a natural disaster such as flooding. Considerable media interest followed the widespread flooding of 2000 when it became clear that the insurance industry were rigorously reviewing their approach to providing insurance protection to homes and businesses situated within flood affected areas. Not surprisingly, the recent widespread flooding of July 2007 has further exacerbated the discussion surrounding the future of insurance for householders and business owners situated within flood affected areas.

345. The following quotations are an extract from the Association of British Insurers (ABI) website, dated August 2007:

"The UK is unique in offering flood cover as a standard feature of household and most business policies. Unlike much of Europe and worldwide, cover is widely available to the UK's 23.5 million householders.

In the long term, this situation could worsen, unless we take action to reduce flood risk to people and property. Climate change will increase winter rainfall, the frequency of

heavy rainfall, and sea levels and storm surge heights. With no change in Government policies or spending, climate change could increase the number of properties at risk of flooding to 3.5 million. Furthermore, continued pressure on land could mean even more new developments being situated in floodplains.

By spreading the risk across policy holders, insurance enables householders and businesses to minimize the financial cost of damage from flooding. In the modern competitive insurance market, premiums reflect the risks that customers face. This enables insurance to be offered at very competitive prices to customers living in low flood risk areas.

In 2003 ABI members agreed to extend their commitment to provide flood insurance to the vast majority of UK customers. The result of discussions between Government and insurers was a Statement of Principles, which aims to provide reassurance to the overwhelming majority of insurance customers living in the floodplain about the continued availability of insurance in future.

Individual property owners can do much to increase the resistance and resilience of their properties to flood damage - further information is available. ABI has issued a factsheet for property owners on a range of measures that could be taken by a homeowner to improve the resilience of their property to flood damage."

346. In summary, for the time being, residents and business owners can be assured that insurance will be available to assist in recovery following a flood event. However, it would appear fair to say that the future availability of flood insurance within the UK will be heavily dependant upon commitment from the government to reduce the risk of flooding over time, particularly given the anticipated impacts of climate change. Investment is required in flood defence and improving the capacity of sewage and drainage infrastructure. It is also essential to ensure that spatial planning decisions do not place property within areas at risk of flooding.

8 Conclusion & Recommendations

347. A small percentage of total properties (1135, which equates to just 4.7% of the total) within Epsom and Ewell are at risk of flooding from rivers. However, the urbanised areas, steep topography and potential rainfall runoff from the Epsom Downs introduces a relatively high susceptibility to surface water, groundwater and localised flooding in certain parts of the Borough. The risk of flooding posed to properties arises from a number of sources including river flooding, surface water, localised runoff and sewer flooding. However, the most significant of these is surface water runoff.

348. Planning policy needs to be informed about the risk posed by flooding. A collation of potential sources of flood risk has been carried out in accordance with PPS25 and developed in close consultation with both Epsom and Ewell Borough Council and the Environment Agency. Epsom and Ewell Borough area has been broken down into zones of 'high', 'medium' and 'low' probability of flooding in accordance with PPS25, providing the basis for the application of the PPS25 Sequential Test.

349. 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. Redevelopment and regeneration offer a crucial opportunity to reduce flood risk.

350. Where other planning considerations must guide the allocation of sites and the PPS25 Sequential Test cannot be satisfied, specific recommendations have been provided to assist the Council and the developer to meet the Exception Test. These should be incorporated in development control policy guidance for all future development.

351. Planning policy is essential to ensure that the development control recommendations can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within Epsom and Ewell with respect to flood risk management.

352. It is recommended that:

- Land is safeguarded that can provide multiple benefits to communities by reducing flood risk as well as providing amenity and habitat improvement. This can provide both local and strategic benefits.
- Planning should encourage use of pervious surfaces and other infiltrating SUDS, wherever practicable (and no contamination risk exists) to improve infiltration to the aquifer this is to be strongly encouraged.
- Infrastructure is planned and managed to accommodate more surface water flows. This needs to commence now with new developments and/or redevelopments and also the upgrading or refurbishment of roads and other physical infrastructure.

353. It is essential to ensure that future development does not exacerbate existing flooding problems. Strict planning conditions should be placed upon developers, which must be resolved prior to the granting of planning permission, to ensure that best practice measures are implemented to mitigate any potential increase in loading upon existing drainage system(s).

354. The Environment Agency strongly advocates the use of Sustainable Drainage Systems (SUDS). A wide variety of SUDS techniques are available (refer Section 7.6.3), potentially providing both water quality and water quantity improvement benefits on a site by site basis throughout Epsom & Ewell. Collectively, the effective application of SUDS as part of all future development has the potential to reduce the risk of flooding within Epsom & Ewell.

355. Developers should be required to provide a sustainable drainage solution that will ensure that the runoff from the site does not exceed the maximum for Greenfield runoff rates and volumes, with actual rates and volumes to be agreed by Epsom and Ewell Borough Council and/or the Environment Agency. The site design should also consider

the routing of surface water flow when the capacity of the dedicated site drainage system is exceeded

356. A site-specific Flood Risk Assessment (FRA) must be carried out by the developer for all proposed developments and this should be submitted as an integral part of the planning application. It is recommended that a clear statement be required within each and every detailed FRA that concisely summarises how a reduction in flood risk has been achieved within the proposed (re)development.

357. It is recommended that all owners/maintainers of culverts, gullies and drains produce a pro-active maintenance schedule to ensure that they are clear and fully functioning prior to flood events.

358. Wherever possible within brownfield areas, where it is not feasible to dispose of all of the runoff via infiltration, the developer should seek to reduce the volume and rate of runoff from the site to the equivalent greenfield runoff conditions (i.e. the volume and rate of runoff generated from the site assuming it were an open grassed area). This is usually within the range of 5 to 9 litres per second per hectare (l/s/ha), depending on site slope and soil porosity.

359. A more complete understanding of surface water and drainage-related flooding should be gained, so that any future improvements are part of a wider strategy for addressing these sources of flooding. A Surface Water Management Plan (SWMP) or Integrated Urban Drainage Plan (IUDP) should define the future approach. This is important in this policy unit because of both the existing and future risk. Joined-up working between the organisations who influence drainage in the catchment should be promoted.

360. As with surface water flooding, groundwater flooding may not preclude development. However, in accordance with PPS25, future development will require an appropriate Flood Risk Assessment (FRA) at the planning application stage that is commensurate with the level of flood risk posed to the site. The FRA should incorporate a site based assessment of the potential risk of groundwater flooding to the site, confirming the likelihood and/or severity of this source of flood risk.

361. The Flood Risk tool should be rigorously used to evaluate planning applications. Planners should also encourage local developers to use the tool when considering land purchases.

362. Surface water management plans need to be produced for known hot spots. These plans should include possible solutions/mitigation methods to reduce the impact of surface water flooding.

363. It is important that prospective developers contact the Council, the Environment Agency, Thames Water and Surrey County Council as part of the detailed Flood Risk Assessment process to confirm whether their site has been affected by localised flooding historically.

364. 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. Safe and dry access would be required. The adopted design will need to ensure that it does not result in any worsening to the risk posed to adjoining properties.

365. Emergency planning is crucial for the minimisation to the risk to life posed by flooding within the Borough. It is recommended that Epsom and Ewell Council review their adopted flood risk response plan in light of the findings and recommendations of the SFRA with due consideration of the vulnerability map.

A Living Document

366. The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. A rolling programme of detailed flood risk mapping within the Thames 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 Borough and may marginally alter predicted flood extents within Epsom & Ewell. 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 Epsom & Ewell SFRA is advised.

367. The following key questions should be addressed as part of the SFRA review process:

Question 1

Has any flooding been observed within the Borough 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 Borough?). This will be decided by the Environment Agency in conjunction with data supplied by the Met Office.
- 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, on average, once in every 100 years 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? (refer Section 5.2)
- Does the revision to the policy guidance alter the decision making process required to satisfy the Sequential Test? (refer Section 6.4.1)
- Does the revision to the policy guidance alter the application of the Exception Test? (refer Section 6.4.1)
- 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? The Council should contact The Environment Agency to determine if any changes have/are going to happen. If they have:

- Has any further detailed flood risk mapping been completed within the Borough, 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? (refer Section 5.6) If yes, then a review of the impacts that climate change may have upon the Borough is required.
- Do the development control recommendations provided in Section 6.4 of the SFRA in any way contradict emerging Environment Agency 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 Environment Agency is required to ensure an agreed suite of development control requirements are in place.

It is highlighted that the Environment Agency reviews the Flood Zone Map on a quarterly basis. If this has been revised within the Borough, 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?