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# Preliminary Flood Risk Assessment

June 2011

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**Preliminary Flood Risk Assessment**

**Surrey County Council**

**June 2011**

# Executive Summary

This report has been prepared to help Surrey County Council meet their duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations 2009. Surrey County Council, defined as a Lead Local Flood Authority (LLFA) under the Regulations, is a large two-tier authority with eleven district and borough councils. The Preliminary Flood Risk Assessment (PFRA), comprising of this document, the supporting spreadsheet and GIS layer represents the first stage of the requirements of the Regulations.

The PFRA process is aimed at providing a national high-level overview of flood risk from local flood sources, including surface water, groundwater, ordinary watercourses and canals. As an LLFA, Surrey County Council must submit their PFRA to the Environment Agency (EA) for review by 22nd June 2011. The methodology for producing this PFRA has been based on guidance documents from both Defra and the EA, published in December 2010.

The EA has used a national methodology, which was set out by Defra, to identify Indicative Flood Risk Areas (IFRA) across England. Of the ten IFRAs that have been identified nationally, only one affects part of the County Council's administrative area – The London IFRA. Within this Flood Risk Area, the Regulations require Surrey County Council to carry out two subsequent key stages:

- Produce flood hazard maps and flood risk maps; and
- Produce flood risk management plans.

The London IFRA extends into the north of Surrey and covers parts of Tandridge, Reigate and Banstead, Elmbridge, Epsom and Ewell and Mole Valley.

In order to develop a clear overall understanding of the flood risk across Surrey, flood risk data and records of historic flooding were collected from both local and national sources including the eleven district and borough councils, the Environment Agency, water companies, emergency services and other risk management authorities.

Information relating to four particular flood events, caused by flooding from local sources, was collected and analysed. Although, it was considered relatively good data, the elements relating to the consequences of these events, wasn't of sufficient quality to complete the sections required by the Annex 1 of the PFRA.

Analysis of the national surface water modelling maps, indicate there is considerable risk of flooding from surface water across Surrey, particularly in the North, where the London IFRA extends. Based on figures from the Environment Agency, approximately 46,500 properties are estimated to be at risk from flooding to a depth of 0.3m during a rainfall event with a 1 in 200 annual chance of occurring.

Having compared flood risk information with locally observed flooding, this report proposes two minor extensions of the London IFRA. These extensions will include areas in both Banstead and Leatherhead, where substantial flooding has been recorded, including the internal flooding of properties.

# Glossary of Terms

| Term | Definition |
|---|---|
| ALC | Agricultural Land Classification |
| AStSWF | Areas Susceptible to Surface Water Flooding |
| CFMP | Catchment Flood Management Plan |
| Defra | Department for Environment, Food and Rural Affairs |
| DG5 | A document produced by water companies that indicate recorded sewer flooding events in postcode areas |
| EA | Environment Agency |
| EC | European Commission |
| FMfSW | Flood Map for Surface Water<br>*Deep = 0.3m deep flooding*<br>*Shallow = 0.1m deep flooding* |
| FWMA | Flood & Water Management Act 2010 |
| GIS | Geographic Information Systems |
| IDB | Internal Drainage Board |
| LLFA | Lead Local Flood Authority |
| LPA | Local Planning Authority |
| NRD | National Receptor Dataset |
| PFRA | Preliminary Flood Risk Assessment |
| PPS25 | Planning and Policy Statement 25: Development and Flood Risk |
| RBD | River Basin District |
| Regulations | Flood Risk Regulations 2009 |
| SAC | Special Areas of Conservation |
| SCC | Surrey County Council |
| SFRA | Strategic Flood Risk Assessment |
| Significant | An event or item that is important at a national level |
| SPA | Special Protected Area |
| SSSI | Sites of Special Scientific Interest |
| SuDS | Sustainable Drainage Systems |
| SW | Southern Water |
| SWMP | Surface Water Management Plan |
| TW | Thames Water |
| WAG | Welsh Assembly Government |

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# 1 Introduction

## 1.1 Background and Scope

1.1.1 This Preliminary Flood Risk Assessment has been prepared by Surrey County Council in response to the Flood Risk Regulations 2009, which require all unitary and county councils, (where two tier systems exist) to become Lead Local Flood Authorities. The Flood Risk Regulations tasks Lead Local Flood Authorities, in conjunction with the Environment Agency, with producing three tracts of work;

- Preliminary Flood Risk Assessments,
- Flood Hazard and Risk Maps
- Flood Risk Management Plans.

1.1.2 The Flood Risk Regulations transpose the EU Floods Directive into UK law. These confirm the LLFA role and require specific tasks to be undertaken by these authorities. The Regulations set in motion a six yearly assessment, mapping and planning cycle that begins with the Preliminary Flood Risk Assessment.

1.1.3 The Directive needs to be implemented in coordination with the Water Framework Directive by aligning flood risk management plans with river basin management plans and by consulting with the public on the content of the flood risk management plans.

| Task | Organisation | Completion |
|---|---|---|
| Preliminary Flood Risk Assessment Report | SCC | 22 June 2011 |
| Review Preliminary Flood Risk Assessment Report and publish | EA | 22 December 2011 |
| Produce Flood Risk and Flood Hazard Maps | SCC | 22 June 2013 |
| Review Flood Risk and Flood Hazard Maps and publish | EA | 22 December 2013 |
| Flood Risk Management Plans | SCC | 22 June 2015 |
| Review Flood Risk Management plans and publish | EA | 22 December 2015 |

Table 1-1: Risk Regulation Timetable

## 1.2 Aims and Objectives

1.2.1 The aim of the PFRA is to provide a broad overview of flooding over the administrative area of Surrey so that along with information from other unitary and county councils, a national picture of flooding can be developed by the Environment Agency.

1.2.2 The objectives are:

- Assess past flooding through a data gathering and mapping exercise.
- Identify and map possible future flooding sites
- Produce a PFRA report
- Identify future steps to be taken with respect to the future management of flooding

1.2.3 Both the Flood Risk Regulations and the Flood and Water Management Act work in tandem and apply to all sources of Flooding. The Flood and Water Management Act 2010 gives Local Authorities a new role to manage local flood risk in their area, which includes surface water flooding, groundwater flooding, flooding from ordinary

watercourses and canal flooding. River flooding still lies within the remit of the Environment Agency.

- Surface water flooding generally relates to rainfall running off surfaces before it enters a drainage system or a watercourse
- Groundwater flooding occurs when the water table below ground level rises and breaks through onto the surface
- Ordinary watercourses are any watercourse (including ditches and streams) that are not identified as Main Rivers on the Defra register.

## 1.3 PFRA Administrative Boundary

1.3.1 The County of Surrey has 11 boroughs and districts. These are Elmbridge, Epsom and Ewell, Guildford, Runnymede, Reigate & Banstead, Waverley and Woking Borough Councils and Mole Valley and Tandridge District Councils.

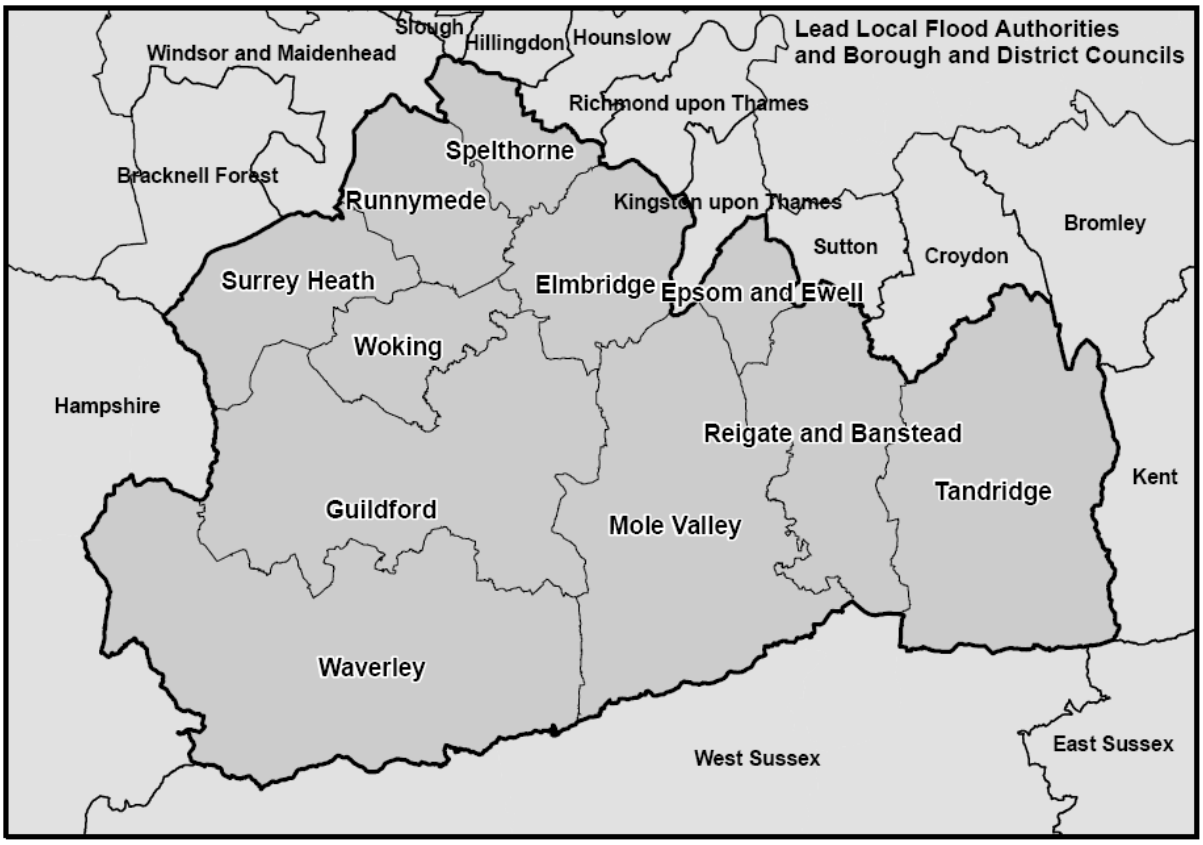


Figure 1-1: Surrey Boundary

1.3.2 Surrey shares its boarder with Hampshire, West Sussex, East Sussex and Kent County authorities; Bracknell Forest, Windsor and Maidenhead and Slough unitary authorities and the London Boroughs of Hillingdon, Hounslow, Richmond Upon Thames, Kingston Upon Thames, Sutton, Croydon and Bromley.

## 1.4 Topography and geology

1.4.1 The principal topographical features in the county are the North Downs, which run through the centre of the county from east to west. To the north of the Downs, the relief gives way to the flood plain of the River Thames.

1.4.2 In the northwest, a spur off the Downs runs northwards to the border with Berkshire, commonly referred to as Chobham Ridges. To the south of the North Downs, the topography generally drops shallowly away toward Sussex and the Weald Valley.

1.4.3 However areas of the competent rocks within the Lower Greensand geological strata just south of the Downs give rise to high relief structures such as Box Hill and Leith Hill in the centre of the county and Gibbet Hill to the south west, on the border with Hampshire.

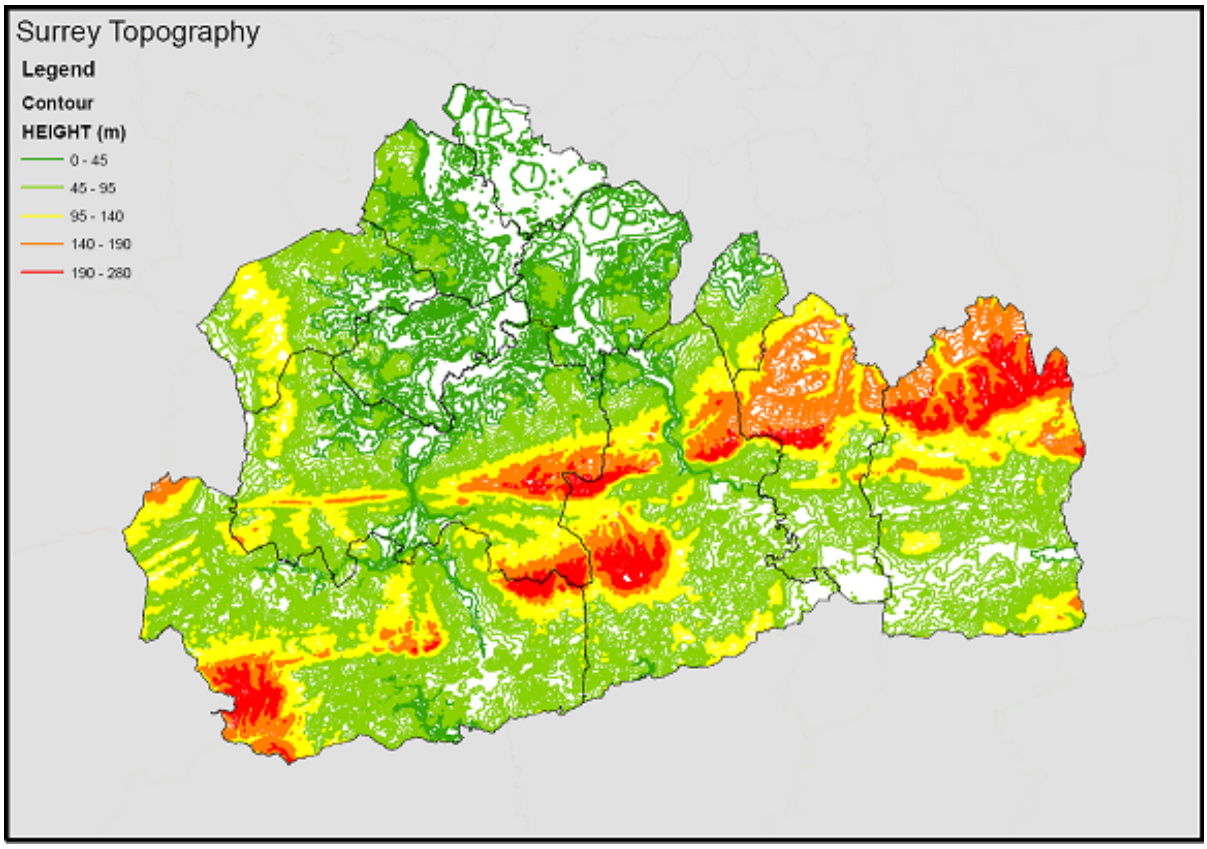


Figure 1-2: Surrey Topography

1.4.4 The geology of the area is mixed. The Downs are part of the Weald–Artois anticline (a big fold in the rocks), which created a competent chalk layer, which forms the majority of the high ground. The northern lowlands comprise clay, sandy clays & silty sands and extensive gravel in the Thames flood plain.

1.4.5 The southern lowlands comprise clays and silty sands.

1.4.6 Overall, in general terms of flooding, the lowlands are prone to river type flooding whereas along the base of the Downs and the Lower Greensand hills, flash flooding from surface water is a major concern.

# 2 LLFA Responsibilities

## 2.1 Governance and Partnerships

2.1.1 In order to gather the data to take the process forward, it was necessary to work with all organisations which either affect or are effected by the flooding within or adjacent to the county boundary. The Regulations states, under Section 35, *"Any relevant authority must co-operate with any other relevant authority which is exercising any functions under the regulations"*. Also in the Regulations, under Section 36 (2), it states that *"The Environment Agency and an authority listed in paragraph (3) must comply with a request of a lead local flood authority to provide information reasonably required in connection with the lead local flood authority's functions under these regulations."*

2.1.2 Through the work carried out by the SCC Flooding Task Group, (described in 3.1) Surrey County Council had already implemented extensive partnership arrangements with stakeholders, especially with the Borough and District Council's drainage/engineering sections which meet through several different forums and ultimately work to prioritise the Counties capital drainage programme.

2.1.3 In addition the County's Highways section, working with the County's Emergency Planning Unit, have established relationships with the emergency services and utilities companies through the Surrey Resilience Forum working on the multi agency flood plan.

## 2.2 Surrey Flood Risk Partnership Board

2.2.1 The Surrey Flood Risk Partnership Board is currently being developed. It is likely to include representatives from the Environment Agency, boroughs and districts, utility companies and emergency services.

2.2.2 The Board will take on the role of developing flood strategies within the County. In addition to looking at technical processes, the board will also develop funding strategies with Districts and Boroughs and other asset holders to ensure that drainage assets are maintained and local flooding strategies brought to fruition.

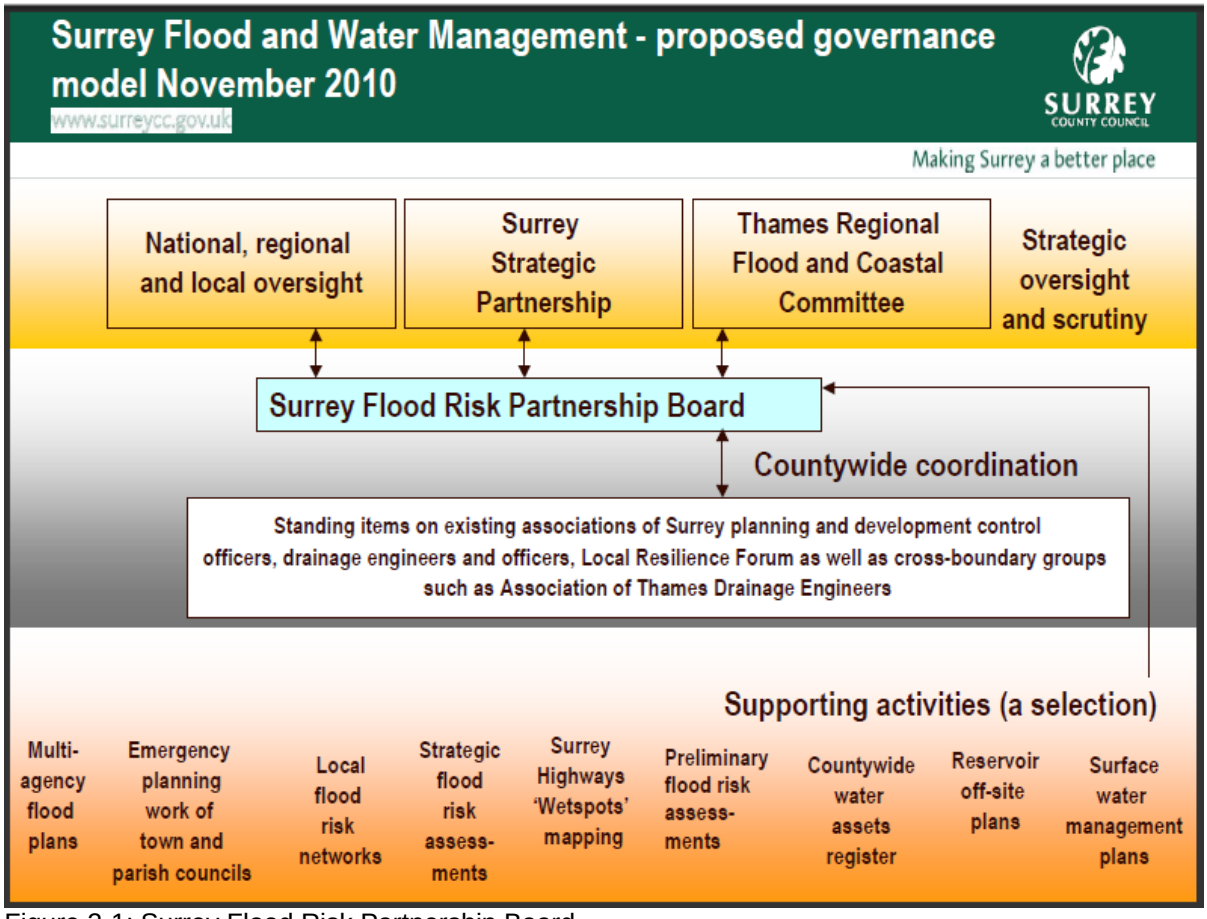

Figure 2-1: Surrey Flood Risk Partnership Board

# 3 Methodology and Data Review

## 3.1 Availability and limitations of gathered data

3.1.1 In 2007, Surrey County Council members formed a Flooding Task Group to review the implications of flooding in the county and to identify short, medium and long term solutions. Information requests were sent to all districts and boroughs, all parishes and all councillors. All information returned to the Flooding Task Group was recorded in the wet spot flooding database. The database is annually reviewed and updated. In light of the recent flooding legislation, the last database review was particularly robust.

3.1.2 As such, the wet spot flooding database has proven to be an invaluable tool in both reviewing past flood events, and validating assessments on future flood risk.

3.1.3 In addition web pages have been created on the county's website to enable the public to provide information on historic flooding.

3.1.4 External flooding information, such as the Strategic Flood Risk Assessment documents and various GIS datasets from the Environment Agency were readily available. However, specific details of historic flooding areas required face-to-face meetings with the engineers from each of the districts and boroughs within Surrey.

3.1.5 The National Receptors Dataset provided by the Environment Agency contains the property points layer for Surrey and the surrounding areas. These property points contain information on residential properties, critical services and non-residential properties. An issue with the non-residential properties in this dataset was that it included significant number of records relating to non-building locations such as ponds. 17759 non-building locations were identified from the "OS Class" field and removed from the dataset before any GIS analysis was performed. The following table shows the various organisations contacted for flooding information relevant to the PFRA, along with a breakdown of the individual datasets received.

| Dataset | Description |
|---|---|
| **Surrey County Council** | |
| Wet Spot Flooding Database | The Wet Spot database has been developed and is continually being updated with current information to produce a comprehensive map and records of all the identified Wet spot in Surrey.<br>The Wet Spot database was used to highlight significant flood events and to determine which of the Flood Maps provided by the Environment Agency best represented flooding in Surrey. |
| Surrey GIS layers | A selection of GIS layers that include specific critical infrastructure within Surrey and geographical strata.<br>This data was used to understand the likelihood of groundwater flooding to affect areas of Surrey. |
| CONFIRM database | CONFIRM is a database of calls from stakeholders within Surrey including data from Surrey Police. The specific area of CONFIRM used for this report were the calls specific to flooding, both highway and property.<br>This data was used to determine consequences of historic flood events. |

| | |
|---|---|
| **Environment Agency** | |
| Areas Susceptible to Surface Water Flooding | The AStSWF maps show outlined areas at risk from surface water flooding and are based on our understanding of surface water flooding at the time of the original publication in 2008. The three bandings are less, intermediate and more.<br>These maps have been used to determine areas at risk of flooding in England and Wales. |
| Flood Map for Surface Water | The next step from the AStSWF maps. These maps indicate a more defined flow and are split into four bandings. Shallow and Deep flooding for 1 in 30yr and 1 in 200yr events.<br>These maps have also been used to determine areas at risk of flooding. Both these maps and AStSWF maps have been compared to historic event locations to determine which map is more representative of flooding in Surrey. |
| Flood Map | Shows the extent of flooding from rivers with catchments of more than $3km^2$ ($1.2\ Miles^2$).<br>This map was used to determine which flood events may be partly due to flooding of main rivers, which are not to be included in this report. |
| Areas Susceptible to Groundwater Flooding | Course grids indicating areas that may be susceptible to groundwater flooding and may require further investigation.<br>This map was used in a broad analysis of future flood risk with other flood maps. |
| National Receptors Dataset | NRD is a spatial dataset which contains a number of GIS layers categorised into themes of information including buildings, environment, heritage, transport, utilities.<br>This dataset was used when analysing the IFRAs provided by the Environment Agency. |
| Indicative Flood Risk Areas | Indicative flood risk areas based on clusters formed from all $3km^2$ squares that contain 5 or more Places above the Flood Risk Thresholds ($1km^2$ squares) that are touching.<br>This map has been used to determine whether there are any IFRAs within the Surrey boundary. |
| Historic Flood Map | The Historic Flood Map shows the combined extents of known flooding from rivers, the sea, and groundwater.<br>Recorded historic events have been compared to this map. |
| Thames, Medway and Arun Catchment Flood Management Plan (CFMP) | CFMPs consider all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea. They also take into account the likely impacts of climate change, the effects of how the land is used and managed, and how areas could be developed to meet our present day needs.<br>These reports have been used as part of the process to determine areas at risk of flooding but also to compare areas within Surrey to areas located outside of the county. |
| **District and Borough Councils** | |
| Strategic Flood Risk Assessment (SFRA) | Strategic Flood Risk Assessments have been completed for all Boroughs and Districts and include information on historic flooding from all types of flooding.<br>Most of the historic events within these reports are already part of the Wet Spot database held by SCC. GIS layers provided with the reports were compared to the Wet Spot data and included if data was not duplicated. |
| Historical flooding records | Historical records of flooding events collected by the local council.<br>This data was compared to other historic data and included in the analysis |
| Anecdotal information relating to local flood history and flood risk areas | Anecdotal information from different council employees including Engineers and Planning Officers.<br>This data was compared to other historic data and included in the analysis |
| **National Trust** | |
| Flood History of the River Wey Navigation | No Information Available - We were informed that the Environment Agency kept records of flood events along the Wey Navigation. |

| | |
|---|---|
| **Basingstoke Canal Authority** | |
| Anecdotal information relating to flood history along the Basingstoke Canal | Anecdotal information from Basingstoke Canal Authority representatives indicating areas that have flooding, works that have been taken out to reduce likelihood of repeat flooding, and areas most likely to flood. Unfortunately, all events provided have had work completed to reduce the risk of further flooding so no extra data could be included in the report |
| **Wey and Arun Canal Trust** | |
| Records of flood events in the Surrey section of the Wey and Arun Canal | No Information Readily Available at time of publishing |
| **Upper Medway Internal Drainage Board** | |
| Records of flood events in the Surrey section of the Medway Catchment | Information held by Environment Agency |
| Anecdotal Information related to flooding of ordinary watercourses in the Medway Catchment | Anecdotal information from Upper Medway Internal Drainage Board representatives, indicating areas within their boundary affected by flooding of ordinary watercourses<br>This data was compared to other historic data and included in the analysis |
| **Thames & Southern Water** | |
| DG5 Register for Thames Water | DG5 Register logs and records sewer-flooding incidents in postcodes for the last 10 years.<br>The data was allocated to a postcode shapefile to display the data for historic flooding. As is represented in postcodes, the lack of accuracy of the data reduces its use. |
| DG5 Register for Southern Water | No Information Readily Available at time of publish |
| **Surrey Fire and Rescue Service** | |
| Records of historic flood events with Surrey | No Information Readily Available at time of publish |
| **Highways Agency** | |
| Records of flooding involving highways within Surrey | Information on past floods was received and used to verify the surface water flooding models. |
| **Network Rail** | |
| Records of flooding involving railways within Surrey | Information on assets within the modelled river flood areas. Unfortunately, as the information is based river flooding, the information could not be used in this report. |
| **Natural England** | |
| GIS layers indicating Environmentally important sites within Surrey | GIS layers indicating the locations of Sites of Special Scientific Interest (SSSI), Special Protected Areas (SPAs), Special Areas of Conservation (SAC), and Ramsar Sites as well as the Agricultural Land Classification (ALC)<br>These GIS layers have been used to determine where there are possible environmental impacts from flooding. |
| Historic Data on Flooded SSSIs and their consequences | No Information Readily Available at time of publish |

Table 3-1: Preliminary Flood Risk Assessment Sources

3.1.6 The quality and coverage of the data does vary. The main factors being the amount of local knowledge and experience available, the historical records, and the resources available. (See section 4.3 for more information on the limitations of historic flooding data)

3.1.7 For example, in the borough of Epsom & Ewell the flooding information is fairly limited. However, a Surface Water Management Plan is currently underway in this borough, and the outputs of this project will include much more detailed information on past floods, future flood risk and possible flood risk mitigation options. As a significant portion of Epsom & Ewell lies with the London Indicative Flood Risk Area, this information will be extremely useful in the development of the Flood Risk and Hazard maps required by the EU flood directive in 2013.

### 3.2 Future Data Storage

3.2.1 Currently, the wet spots flooding database serves as the master database for all types of flooding reported to Surrey County Council. The diverse nature of this data, such as different sources of flooding and the varying methods of reporting, can cause complications when combined into a single dataset. Therefore, a review of the way that observed flooding is recorded and stored will need to be undertaken by the Surrey Flood Risk Partnership Board, along with proposals for new systems that will allow specific information to be shared with the relevant partners.

### 3.3 Flooding Information: Security, Licensing and Restrictions

3.2.2 All received flooding information was transferred onto the internal servers, where only the relevant personnel have access. Some data is freely available to the public, and therefore has no restrictions regarding publication. Other data, from sources such as the water companies and some of the datasets from the Environment Agency were provided with specific licenses, which restrict the use of their data. All of these restrictions must be followed closely when referencing the data in this report, whether in the form of quoted figures, or information displayed on a map or plan.

## 4 Historic Flood Data

### 4.1 Overview of Historic Flooding in Surrey

4.1.1 Data collected directly by Surrey County Council is held in a wet spots flooding database. The wet spots flooding database also includes sites that have had remedial work carried out. These sites have been excluded from this report. Data provided by borough and district authorities has been consolidated into the wet spots flooding database.

4.1.2 Data was also collected from other stakeholders. For more information on the variety and the collection of data, see section 3.1.

### 4.2 Significant Harmful Consequences

4.2.1 The Preliminary Flood Risk Assessment is based on using existing information to produce readily derivable information.

4.2.2 The data required to assess the consequences for past flooding is stipulated as human health, the economy, the environment and cultural heritage. The indicators for consideration are given below:

| Impacts of Flooding on: | Flood Risk Indicators |
|---|---|
| Human Health | • Number of people (based on residential properties)<br>• Number of critical infrastructure (schools, hospitals, nursing homes, police / fire / ambulance stations etc) |
| Economic Activity | • Number of non-residential properties (e.g. shops, offices and churches)<br>• Length of road or rail<br>• Areas of agricultural land |
| Environment | • Designated sites (SSSIs, SACs, SPAs, etc) and BAP habitats |
| Cultural Heritage | • World Heritage Sites |

Table 4-1: Flood Risk Indicators

## 4.3 Quality of Historic Flooding in Surrey

4.3.1 The main problem with the data gathered is with the exception of the 4 identified events; much of the data does not have a date or time allocation. Therefore, it was not possible to determine which of these floods were attributed to any flood event in particular. In addition, the lack of homogeneity in the data means that comparison of flood data between areas is unlikely to provide reliable results.

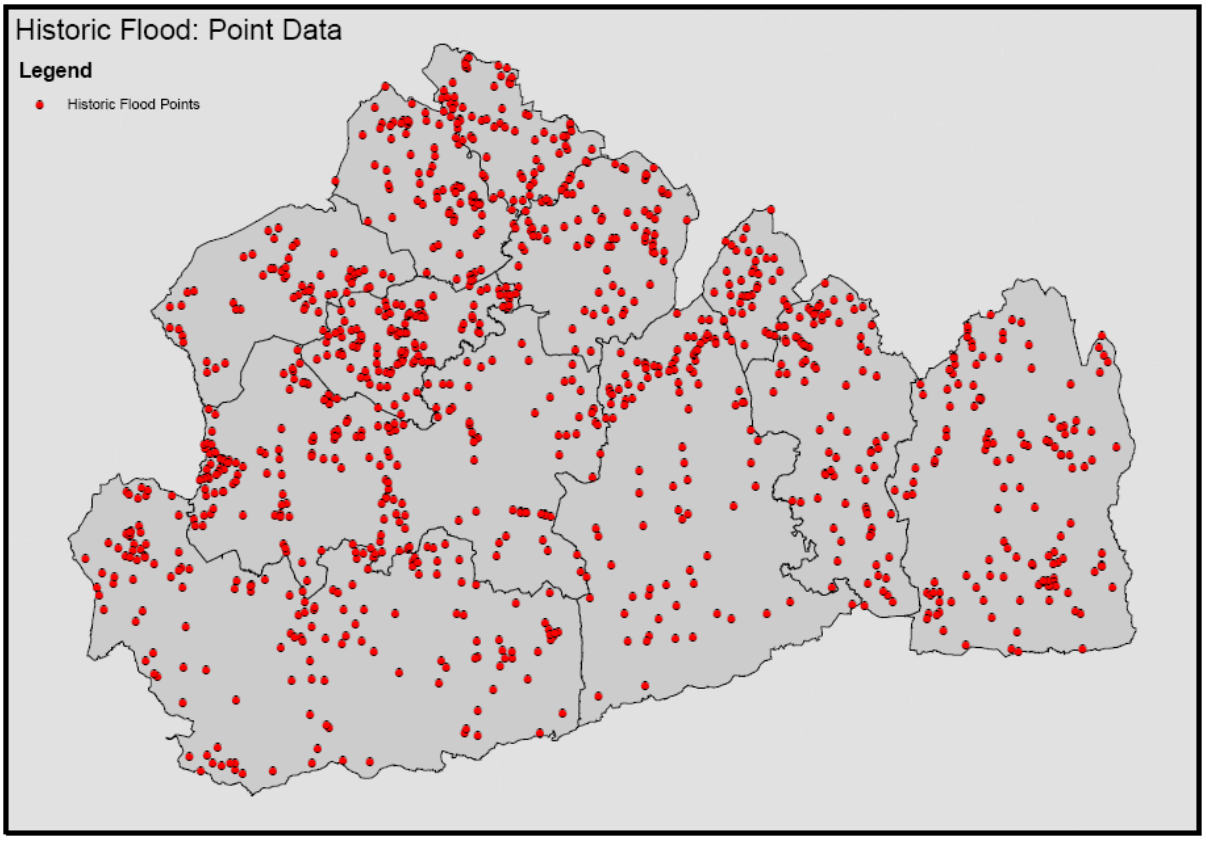


Figure 4-1: Point Data for Historic Floods

4.3.2 The variety of data can be attributed to the ways different organisations and individuals hold their flooding data. For example, records held for the flood events witnessed by the Borough and District authorities vary, The range of data varies from one authority that has recorded floods back to July 2000, and some who have limited or no records of flooding at all within their boundary. Another issue with the data collected was the validity of the records. Some boroughs have computer-based records of flood events, some information was delivered to Surrey County Council as a GIS layer. Other data was collected from the memories of employees of the council authorities

4.3.3 Thames Water data, referred to as DG5 data, is held in postcode format. Comparison of Figure 4-1 and Figure 4-2 shows clearly the difference in the different methods in storing the data.

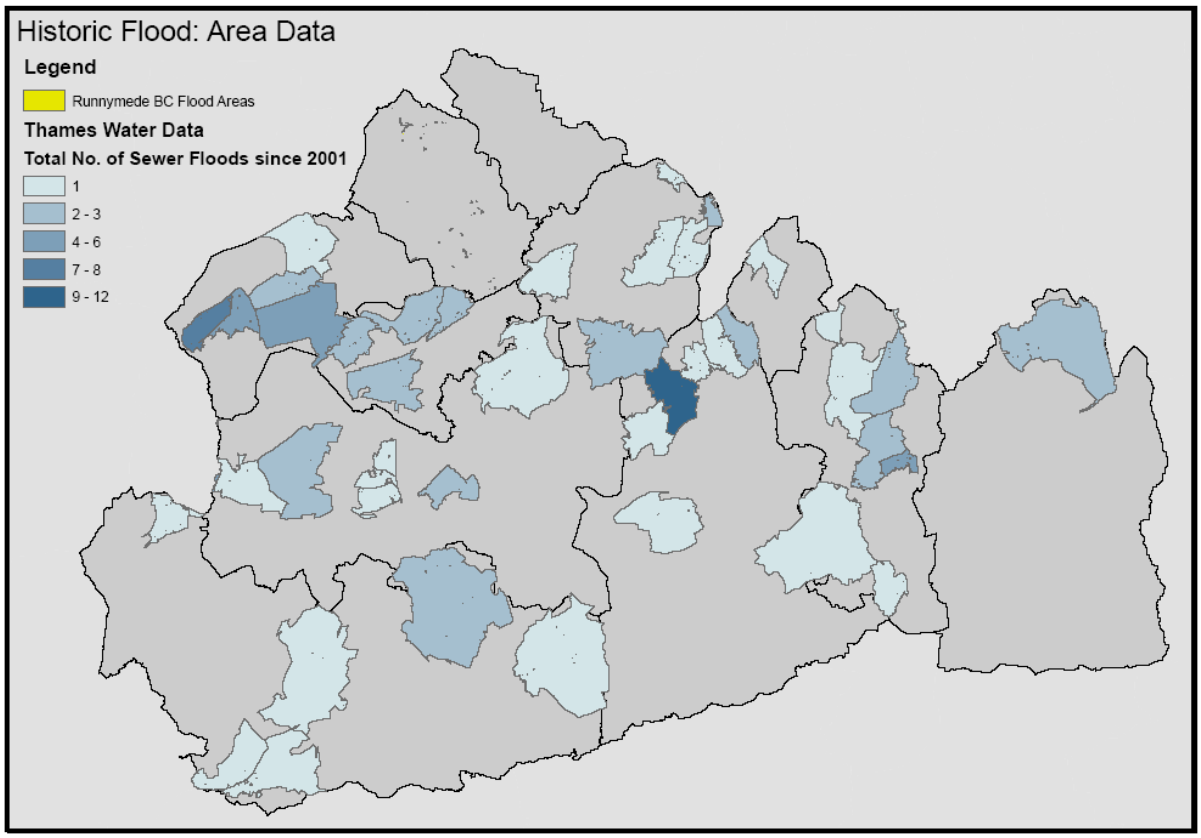


Figure 4-2: Area Data for Historic Flood Events

## 4.4 Consequences of Historic Flooding

| Flood | Information | Consequences | Source |
|---|---|---|---|
| **Autumn 1968** | Little accurate data | Not enough data | Anecdotal newspaper articles from archives |
| **Autumn 2000** | 1 in 300yr storm<br>"Wettest Autumn since records began" (in 234 yrs) | 500+ properties flooded, 260 residents evacuated<br>Flooding closed M25<br>Flooding incidents occurred outside floodplain due to infrastructure deficiencies | Surrey County Council "Highway Management of Flooding and Drainage"<br>Doc No. 3499/doc/02 |
| **Winter 2002-3** | Flooding in Runnymede and Spelthorne during December 2002 was due to river flooding and is not applicable to this report. | 11 property floods reported to Council | Surrey County Council 2007: "Highway Management of Flooding and Drainage". SCC CONFIRM system |

| Flood | Information | Consequences | Source |
|---|---|---|---|
| **August 2006** | Two months of rainfall (85mm) fell in the space of 6 hours over North West Surrey.<br>Flooding was experienced in Aldershot, Ash, Ash Vale, Windlesham, Lightwater, Chobham, West End and Addlestone. | 190 properties flooded internally.<br>325 properties flooded externally.<br>Estimated 57 roads were affected.<br>Surrey Police set up and controlled temporary road closures following reports of flooding.<br>Surrey Fire Brigade received 395 calls, 80 were within their capability to answer. Hampshire Fire and Rescue Service carried more out.<br>No data was collected on the disturbances to transportation within Surrey.<br>These consequences do not cover those required for a flood to be considered significant. | Environmental Agency Flood Event Report – Report into the river flooding on 13 and 14 August 2006 in North West Surrey and North East Hampshire Published by Environment Agency |
| **July 2007** | Rainfall in July: *actual (percentage of usual)*<br>Byfleet = 141mm(255%)<br>Guildford = 151.6mm(342%)<br>660 calls from Residents during and between the two heavy rainfalls | Surrey County Council was informed of 61 property floods. | http://www.environment-agency.gov.uk/static/documents/Research/rainfall_1897354.pdf (07/04/2011)<br>Surrey County Council Confirm System |

Table 4-2: Information and Consequences on Past Floods

4.4.1 Early guidance on the figure to use for significant harmful consequences affecting the population was indicated to be 3,000 people being affected. This is one magnitude lower than the 30,000 people figure used for Indicative Flood Risk Areas and can be considered as a relative progression based on a national scale. Therefore, for the purpose of this report, the figure of 3,000 people has been used to assess past flooding. The new Surrey Flood and Risk Management Board may want to review this figure in the future.

4.4.2 Areas in Surrey which don't reach this national based figure, but under go 'regular serious flooding incidents', will be addressed in Local Flood Risk Reduction Plans that will be introduced by the Surrey Flood Risk Partnership Board.

4.4.3 Surrey has no international or nationally acknowledged Cultural Heritage sites.

4.4.4 Surrey currently has 62 Sites of Specific Scientific Interest (SSSIs). Of these, there are also a number of Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Ramsar sites. At present, it is not known how these sites would individually react to flooding.

4.4.5 The Autumn 2000 flood event is considered the worst flood event for which records are held. Between 500 and 600 properties were recorded as flooding in Surrey. This is equivalent to approximately 0.1% of the total number of properties in Surrey and significantly below the 3000 figure.

4.4.6 No historic flood events have been considered for inclusion in Annex 1 of the Preliminary Assessment Spreadsheet. This is because the information available does not indicate that the floods have fulfilled the criteria that is required for an event to be included in the spreadsheet

# 5 Future Flood Risk

## 5.1 Locally agreed surface water flooding information

5.1.1 There are several different flood maps available from the Environment Agency, showing surface water flood risk from different flood events. Whilst not a specific requirement of the Flood Risk Regulations, it is recommended that Lead Local Flood Authorities review the different flood maps and select the one that best describes the local flood conditions observed and recorded thus far. This flood risk map is to be referred to as the "Locally Agreed Surface Water Flooding Information"

5.1.2 Local information on future surface water flood risk is very limited in Surrey, and the only available datasets come from some of the Strategic Flood Risk Assessments conducted by the districts and boroughs (Surrey Heath West and Waverley). These surface water flood risk maps were compared to the surface water flood risk maps provided by the EA. The comparison of these maps with the wet spot flooding database, which are records of actual floods, showed that the EA's modelled flood maps were more accurate. Information on the drainage capacity across the Surrey area is also extremely limited, and it was decided that there was insufficient data for this to feed into the locally agreed surface water information.

5.1.3 The best set of recorded flooding incidents in Surrey is the wet spot flooding database. This dataset was used when comparing the different flood maps, to see which best agrees with the flooding incidents observed to this day.

5.1.4 Based on our reviews, the Flood Map for Surface Water (FMfSW) 1 in 200yr deep (0.3m depth) flood map agreed with the observed wet spots flooding better than the any of the others. (See figure 5.1)

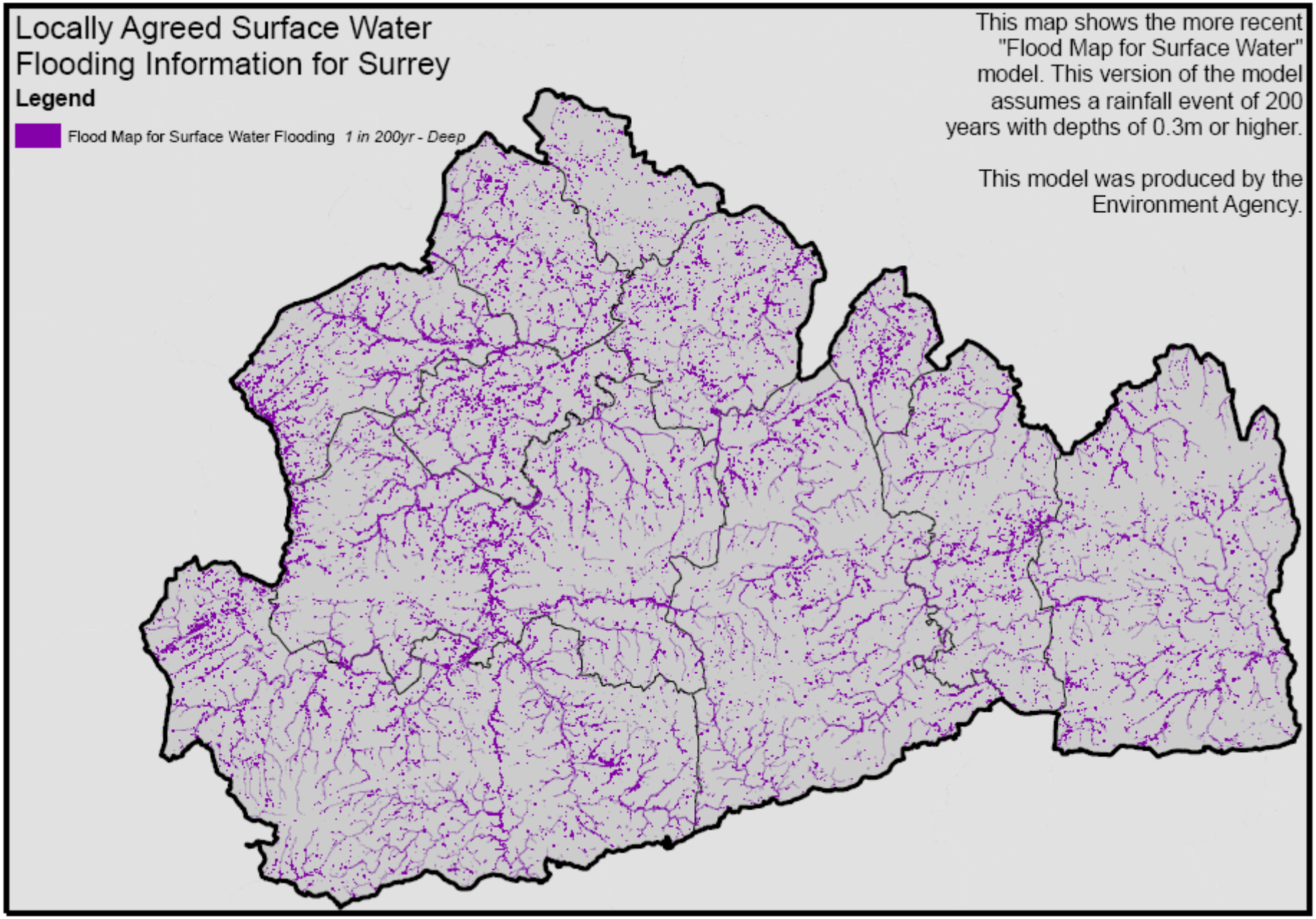


Figure 5-1: Locally Agreed Surface Water Information

5.1.5 Another key point to consider was that the newer Flood Map for Surface Water data has included considerations on surface water entering drainage systems. Whilst this would be a valid assumption for most of the County, some areas on the chalk bedrock rely more on ground infiltration rather than drainage systems that carry the water to watercourses. These areas were inspected in detail, but found that the Flood Map for Surface Water maps still agreed closely with the wet spot data. This too, supported the decision to nominate the FMfSW 1 in 200 yr deep as the "Locally agreed surface water flood information" for Surrey.

5.1.6 The detailed GIS analysis, provided by the Environment Agency, show that 46500 of the property points within the National Receptors Database lie within the FMfSW 1 in 200 yr deep.

## 5.2 Summary table and description of Future Flood Risk in Surrey

5.2.1 An initial assessment of flood risk was carried out by Defra by way of calculating the number of properties at risk of flooding in areas relating to the various cities, towns and villages across the country. These areas were then given a national ranking based upon these property numbers and this list was used to determine which areas would receive funding for local Surface Water Management Plans.

5.2.2 A more detailed national analysis of flood risk was then carried out by Defra, which yielded the "Places above flood risk thresholds" the English Clusters and the Indicative Flood Risk Areas.

5.2.3 The Environment Agency description for the "Places above flood risk thresholds" is given below:

Places above the Flood Risk Thresholds are 1km grid squares where at least one of the following flood risk indicators is above the threshold given below:

- Number of People – 200 or more (based on an average of 2.34 people residing in a property)
- Critical Services – 1 or more
- Number of Non-Residential Properties – 20 or more

5.2.4 Indicators were calculated using the Defra detailed method of counting (based on property outlines) on the FMfSW 1 in 200 yr deep.

5.2.5 The areas of greatest risk from surface water flooding were found by selecting the clusters of 8 or more touching "Places above flood risk thresholds" squares. These areas were designated the "Surrey Clusters".

5.2.6 The Surrey clusters were named based on the major towns they covered. The GIS data for the Places above flood risk thresholds contains the numbers for the different flood risk indicators in the FMfSW 1 in 200 yr deep areas contained in each 1km grid square:

- Number of people refers to the number of residential properties multiplied by 2.34
- Number of critical services refers to the number of properties classified as critical services in the EA PFRA guidance document. These include hospitals,

nursing/care/retirement homes, police/fire/ambulance stations, prisons, sewerage treatment works and electricity installations.

- Number of non-residential properties refers to properties not classified as a residence. Defra believes this gives an indication of the number of properties associated with economic activity.

5.2.7 The number of “Places above flood risk thresholds” simply shows the number of 1km grid squares making up each Surrey Cluster.

5.2.8 The sum of these numbers for all the squares in each Surrey Cluster is shown in the table below.

| Surrey Cluster | No. of People | No. of Critical services | No. of Non-residential properties | No. of Places above flood risk thresholds |
|---|---|---|---|---|
| Reigate & Redhill | 5900 | 14 | 623 | 16 |
| Guildford | 5689 | 15 | 539 | 15 |
| Woking & Byfleet | 5677 | 12 | 394 | 14 |
| Epsom & Ewell | 4070 | 13 | 453 | 10 |
| Camberley | 3988 | 16 | 629 | 12 |
| Caterham & Warlingham | 3085 | 7 | 297 | 8 |
| Leatherhead | 2734 | 12 | 292 | 8 |
| Farnham | 2479 | 21 | 418 | 12 |
| Banstead | 2291 | 6 | 155 | 8 |
| Dorking | 2252 | 8 | 289 | 8 |
| Thames Ditton | 2055 | 10 | 135 | 7 |

Table 5-1: Areas at risk of flooding

5.2.9 There is an obvious correlation between the figures listed, and the number of squares that make up each area. However, the Defra squares were generated by a national level analysis on the FMfSW 1 in 200 yr deep which itself will not take may local factors into account – such as flood defences and new developments. In order to better understand the severity of flood risk consequences without the bias of large numbers of adjacent blue squares, the figures above were divided by the number of blue squares to show the density of flood risk receptors for each area.

5.2.10 As the higher density areas have their flood risk receptors clustered into relatively small areas, even the more localised rainfall events can affect the majority of them and generate considerable risk of surface water flooding. Conversely, a more widespread rainfall event is required to affect a similar number of flood risk receptors in the larger, lower density areas.

| Area | No. of People per 1km square | No. of Critical services per 1km square | No. of Non residential properties per 1km square |
|---|---|---|---|
| Epsom & Ewell | 407 | 1.30 | 45.30 |
| Woking & Byfleet | 405.5 | 0.86 | 28.14 |
| Caterham & Warlingham | 385.63 | 0.88 | 37.13 |
| Guildford | 379.27 | 1.00 | 35.93 |
| Reigate & Redhill | 368.75 | 0.88 | 38.94 |
| Leatherhead | 341.75 | 1.50 | 36.50 |
| Camberley | 332.33 | 1.33 | 52.42 |
| Thames Ditton | 293.57 | 1.43 | 19.29 |
| Banstead | 286.38 | 0.75 | 19.38 |
| Dorking | 281.5 | 1.00 | 36.13 |
| Farnham | 206.58 | 1.75 | 34.83 |

Table 5-2: Alternate List of Areas at Risk of Flooding

5.2.11 These lists stand well with both the local strategy projects that have already been implemented in Woking and Epsom & Ewell, and the indicative flood risk areas that lie within the London cluster.

5.2.12 In terms of defining the significance of each of the Surrey clusters, the Indicative Flood Risk Areas require a total number of people at risk of flooding to be greater than 30,000. Given that the largest figure for number of people at risk of flooding in the Surrey clusters is 5900, this confirms that these areas are well below the threshold for being classified as significant on a national level for this report.

## 5.3 Preliminary Assessment Report Spreadsheet

5.3.1 Many of the fields in the spreadsheet required data that was either provided to the Lead Local Flood Authorities by the Environment Agency, or were easily obtainable using simple GIS analysis.

5.3.2 The key mandatory fields in the spreadsheet require the Lead Local Flood Authorities to decide whether the consequences listed can be deemed “Significant” for each flood event based on a national level assessment, which will be presented to the European Commission.

5.3.3 The guidance states that whilst there are no steadfast rules in terms of determining what is and isn’t significant, the Lead Local Flood Authorities should bear in mind the criteria and thresholds used by Defra in generating the Indicative Flood Risk Areas.

5.3.4 To assist in deciding on a threshold to determine whether the consequences are significant on a national level assessment, it was decided to use the Surrey Indicative Flood Risk Areas as an acceptable point of reference.

5.3.5 Through GIS analysis, the percentage of flood risk receptors that fall within the Indicative flood risk areas was calculated and used as the thresholds for the various flood events.

5.3.6 The same analysis was done for the Surrey County area, for the various flood events and these percentages were compared with the thresholds to use as evidence to support the completion of the mandatory fields for human health and economic consequences.

5.3.7 In terms of the consequences for environment and cultural heritage, section 4.2 highlights the key factors to be considered.

5.3.8 Whilst Surrey currently has 62 Sites of Special Scientific Interests, there is no readily available information on determining which of these would experience harmful consequences because of flooding. There are also no nationally acknowledged cultural heritage sites within Surrey.

5.3.9 Whilst some of the flood events have been identified as having significant consequences on a countywide level and will be dealt with by the local strategy, none of these flood events exceed the threshold criteria to qualify as significant on a national level. Therefore, the flood events in the annex 2 Future Floods spreadsheet have been deemed as not having significant consequences at this strategic level.

## 5.4 River Basin Districts and Climate Change

### The Evidence

5.4.1 There is clear scientific evidence that global climate change is happening now. It cannot be ignored.

5.4.2 Over the past century around the UK we have seen sea level rise and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation, however the broad trends are in line with projections from climate models.

5.4.3 Greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.

5.4.4 We have enough confidence in large scale climate models to say that we must plan for change. There is more uncertainty at a local scale but model results can still help us plan to adapt. For example we understand rainstorms may become more intense, even if we can’t be sure about exactly where or when. By the 2080s, the latest UK climate projections (UKCP09) are that there could be around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

### Key Projections for Thames River Basin District

5.4.5 If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are

- • Winter precipitation increases of around 15% (very likely to be between 2 and 32%)
- • Precipitation on the wettest day in winter up by around 15% (very unlikely to be more than 31%)
- • Relative sea level at Sheerness very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- • Peak river flows in a typical catchment likely to increase between 8 and 18%

### Implications for Flood Risk

5.4.6 Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.

5.4.7 Wetter winters and more of this rain falling in wet spells may increase river flooding in both rural and heavily urbanized catchments. More intense rainfall causes more surface runoff, increasing localized flooding and erosion. In turn, this may increase pressure on

drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected.

5.4.8 Rising sea or river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

5.4.9 There is a risk of flooding from groundwater-bearing chalk and limestone aquifers across the district. Recharge may increase in wetter winters, or decrease in drier summers.

5.4.10 Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

**Adapting to Change**

5.4.11 Past emissions means some climate change is inevitable. It is essential we respond by planning ahead. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term, sustainable benefits.

5.4.12 Although the broad climate change picture is clear, we have to make local decisions against deeper uncertainty. We will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that we do not increase our vulnerability to flooding.

**Long Term Developments**

5.4.13 It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk.

5.4.14 In England, Planning Policy Statement 25 (PPS25) on development and flood risk aims to "ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall."

5.4.15 Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels that are "significant" (in terms of the Government's criteria).

# 6 Review of Indicative Flood Risk Areas

6.0.1 The Indicative Flood Risk Area (IFRA) for London crosses the Surrey administrative border in four separate locations. These areas are relatively small when compared to the total area of the London IFRA, with their combined area making up approximately 5%.

6.0.2 In order to carry out the analysis they have been treated as four individual areas and have been designated as:

1 Elmbridge Section
2 Leatherhead Section
3 Banstead Section
4 Tandridge Section

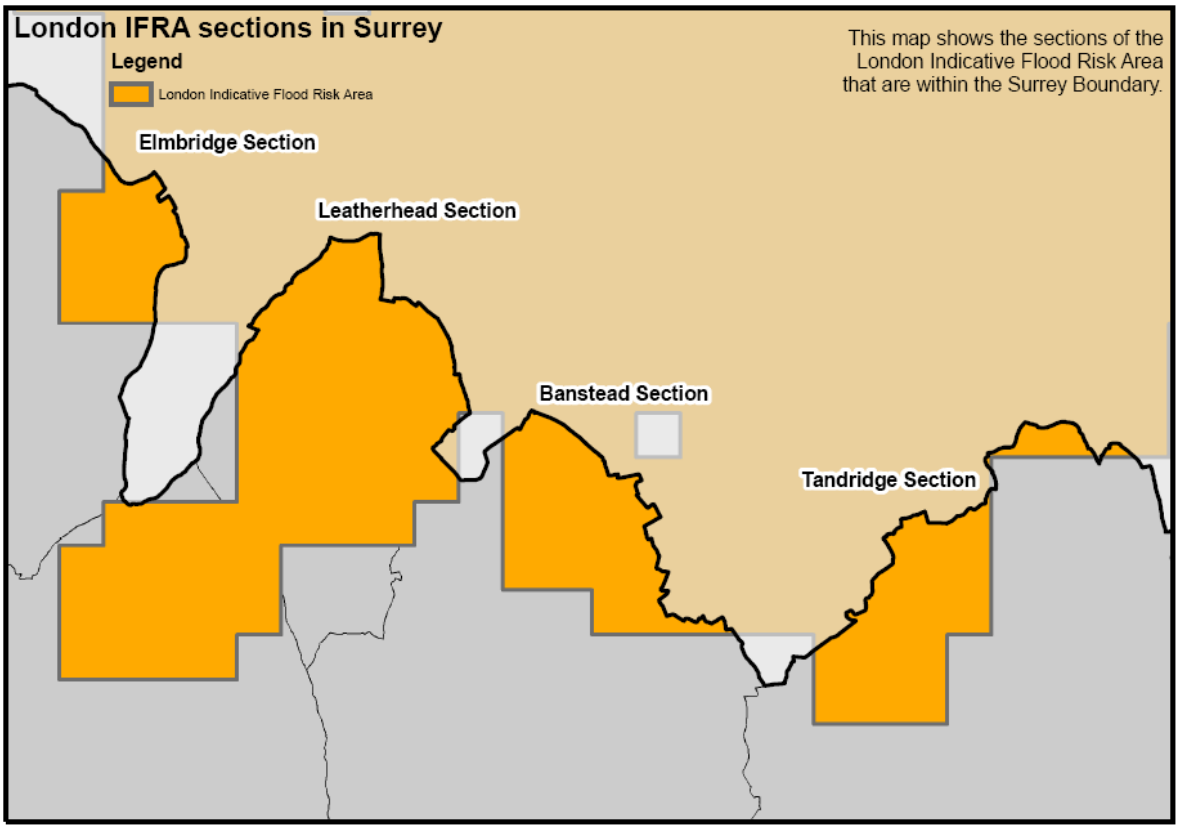


Figure 6-1: London Indicative Flood Risk Area sections in Surrey

6.0.3 The first part of the review process was to evaluate each of these areas against the locally agreed surface water information, which is the FMfSW 1 in 200 yr deep, and any other relevant local information such as the historic flooding information recorded in the wet spots flooding database.

6.0.4 From the analysis, the Surrey sections of the London IFRA contain obvious surface water flow routes leading towards the Greater London area. The only exception to this is the area covering Leatherhead, which shows the surface water routes heading towards the River Mole, rather than into Epsom & Ewell.

6.0.5 In addition, these areas have already been identified as having enough residential or business properties and/or critical services at risk of future flooding, as shown by the blue squares provided by the Defra.

6.0.6 Finally, these areas were compared with the wet spot flooding database, and this comparison confirms that significant local flooding had been observed in all of these areas.

6.0.7 Therefore, this review agrees that considerable risk exists in the Surrey sections of the London IFRA proposed by Defra.

6.0.8 The next stage of the review involved analysis of the areas immediately surrounding the Surrey sections of the IFRA to assess whether any amendments based on local historic information should be proposed.

6.0.9 It was decided to limit the proposed extensions to 1km grid squares, so as to maintain consistency with Defra's method.

6.0.10 The main features that were looked for in these surrounding areas, was the existence of wet spots showing that internal property floods had been observed. Where these were identified, the information contained in the wet spots flooding database was analysed to confirm that the likely cause of the flooding was from overwhelmed drainage systems (as opposed to maintenance issues).

6.0.11 Finally, these identified areas were compared against the locally agreed surface water information to both confirm that the source of flooding is surface water, and that the surface water flow routes do lead into the London IFRA.

A summary of the individual areas is given below:

**Elmbridge section of London IFRA -** This area covers around 7.5 $km^2$ (2.9 square miles) in the Thames Ditton Area. The area is centred on the Rythe, a tributary of the Thames.

The area contains 8 recorded locations that have experienced flooding in the past, with one known property flood. No other types of flooding have been recorded.

**Leatherhead section of London IFRA -** This area is the largest of the 4 and covers 45$km^2$ (17.4 square miles). The area covers Leatherhead town and most of the Epsom & Ewell borough.

The area contains 63 recorded locations that have experiences flooding in the past, with 3 known property floods. A further 3 have experienced foul water sewer flooding.

**Banstead section of London IFRA -** This area covers roughly 11$km^2$ (4.2 square miles). The area covers the east section of Banstead and Woodmansterne.

The area contains 12 recorded locations that have experienced flooding in the past, with 3 known property floods, one of which included foul water sewer flooding.

**Tandridge section of London IFRA -** This area covers roughly 15$km^2$ (5.8 square miles). The area covers the section of Caterham and the west and centre section of Warlingham.

This area contains 17 recorded locations that have experienced flooding in the past, with 4 known property floods, one of which is affected by foul water sewer flooding.

# 7 Amendments to London Indicative Flood Risk Area

7.0.1 While carrying out the review for section 6, it became apparent that it was necessary to consider the area surrounding Leatherhead and make a decision as to whether it should remain part of the London IFRA. The primary reason for this is that when it was reviewed against the locally agreed surface water flooding information, it was revealed that the area of Leatherhead contains surface water flow routes that run towards the River Mole, and it is therefore not directly hydraulically linked to the rest of the London IFRA.

7.0.2 After considering all relevant flooding information for area, it was decided that it would be of greater benefit to keep Leatherhead as part of the London IFRA, and include it in the next stage of the process.

7.0.3 Despite the fact that it is not directly hydraulically linked to Greater London, a large number of significant historic flood events have occurred which include internal property flooding. As it is also a highly urbanised area, the future flood risk is considerable, as shown by the “Places above flood risk thresholds”, identified by Defra.

7.0.4 Following the review of the areas surrounding the London IFRA, two minor amendments are proposed.

7.0.5 Given that the Leatherhead section of the London IFRA remains in effect, it is proposed that the region around Leatherhead be extended to include the areas shown in figure 7.1, and the Banstead section be extended as shown in figure 7.2

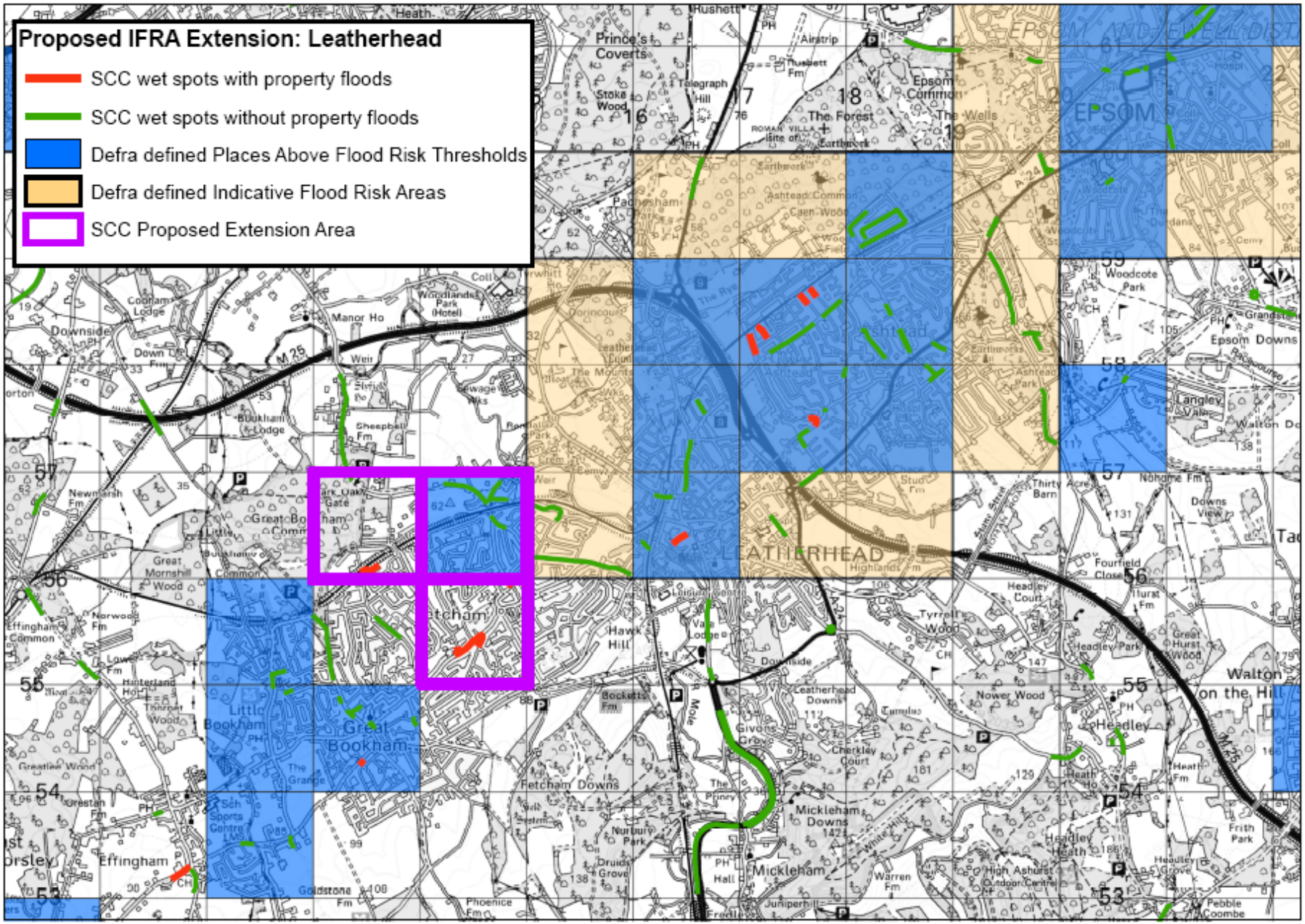


Figure 7-1: Proposed IFRA extension: Leatherhead area

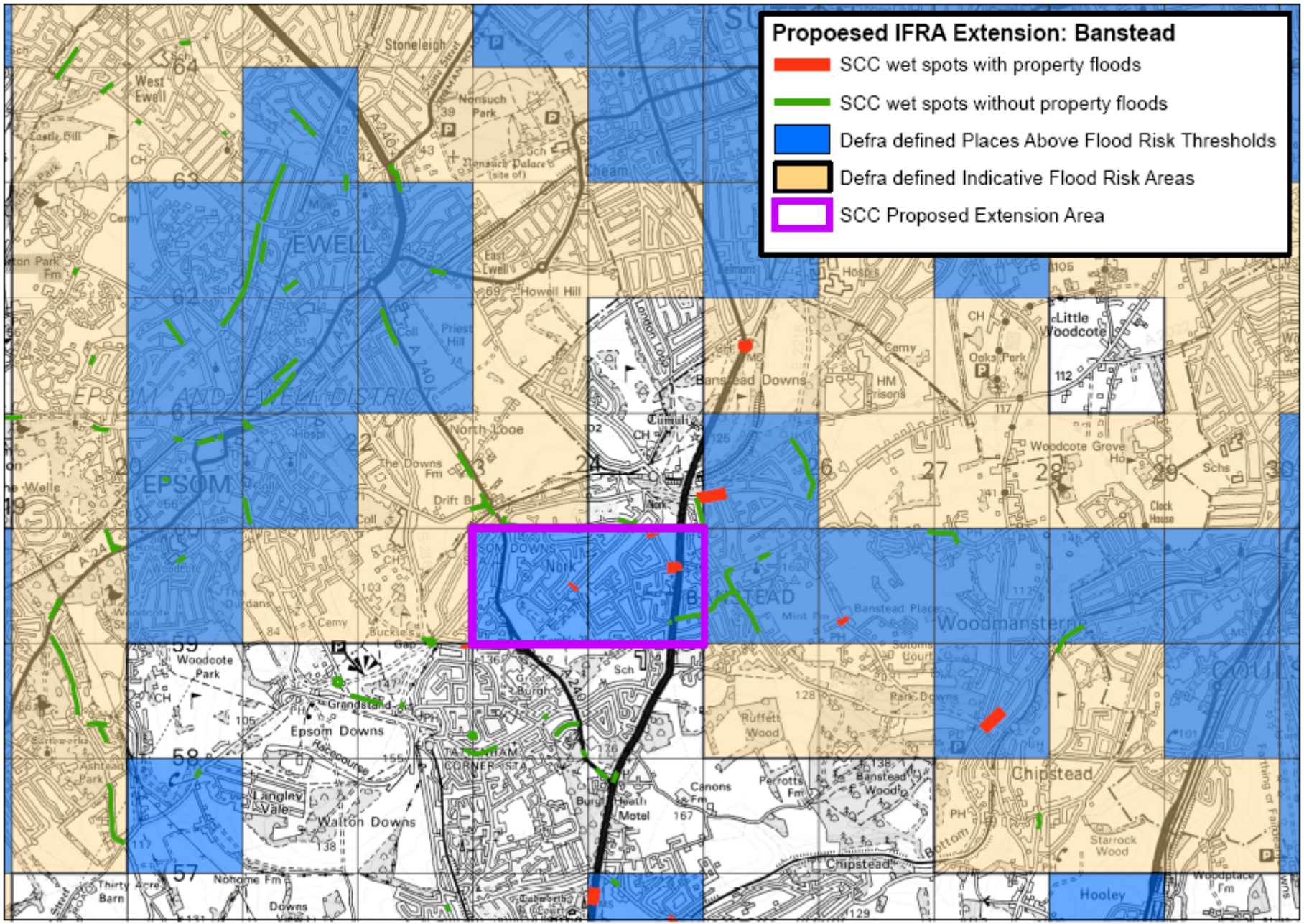


Figure 7-2: Proposed IFRA extension: Banstead area

7.0.6 The main factors for both these proposals are that the wet spots show significant local flooding (Including internal property floods) has been observed and also that the “Places above flood risk thresholds” highlight significant future flood risk in these areas.

7.0.7 The surface water flow routes from the locally agreed surface water information confirm that the flooding in these areas are directly connected to the areas that have already been identified as part of the London IFRA.

7.0.8 In order to propose any new flood risk areas, it would be necessary to identify a large area of flood risk that exceeds the threshold of 30,000 people at risk of flooding. Given that the number of people is determined by the number of residential properties x 2.34, this threshold effectively means that the flood risk area must include at least 12,800 residential properties within the FMfSW 1 in 200 yr deep areas.

7.0.9 Using the information on number of people at risk from surface water flooding in the Surrey Clusters (see table 5.1), none of these areas are close to the 30,000 threshold and therefore, no new flood risk areas are proposed.

# 8 Next Steps

8.0.1 The next step for the County is the imminent formation of the Surrey Flood Risk Partnership Board, see figure 2-1, which will take responsibility for developing the County’s flood risk management strategy.

8.0.2 The PFRA process, which requires review every 6 years, will ensure that data continues to be gathered so that the Board can monitor the changes in flood risk across the county and adapt the strategy as necessary.

8.0.3 The County have, for the past 3 years, gathered information from the Districts and Boroughs. In addition localised flood events have been monitored using the County’s highway CONFIRM software. This is currently being replaced by a new system called MG Connect. The software is still being developed, but once the core system becomes operational a specific flood recording system will be developed covering groundwater, ordinary watercourses and canals.

8.0.4 Geographic Information Systems (GIS) have proved invaluable during the initial Preliminary Flood Risk Assessment process and the County intends to increase its capabilities in this area so that more detailed analysis can be carried out. In addition, GIS will enable the county to exchange flood information with other authorities and publish data to the public.

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# Annex 1 - Records of past floods and their significant consequences (preliminary assessment report spreadsheet)

As discussed in Chapter 4.4, due to the lack of data that was available regarding the consequences of past flooding, no flood events have been considered to have ‘significant harmful consequences’ on a national scale. Due to this, the relevant spreadsheet will not be included in this report.

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# Annex 2 - Records of future floods and their consequences (preliminary assessment report spreadsheet)

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# Annex 3 - Records of Flood Risk Areas and their rationale (preliminary assessment report spreadsheet)

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# Annex 4 - Review checklist

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# Annex 5 - GIS layer of flood risk area(s) if one/any exist