



**FLOOD RISK REGULATIONS 2009
PRELIMINARY FLOOD RISK ASSESSMENT REPORT
FOR BRACKNELL FOREST COUNCIL**

**VERSION 2
July 2011**

VERSION CONTROL

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ABBREVIATIONS

AStSWF	Areas Susceptible to Surface Water Flooding
BFC	Bracknell Forest Council
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FMfSW	Flood Map for Surface Water
FWMA	Flood & Water Management Act 2010
LLFA	Lead Local Flood Authority
PPS25	Planning and Policy Statement 25: Development and Flood Risk
PFRA	Preliminary Flood Risk Assessment
SAB	SuDS Approving Body
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TW	Thames Water

EXECUTIVE SUMMARY

This report has been prepared to assist Bracknell Forest Council meet their duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations (2009). Bracknell Forest Council, defined as a Lead Local Flood Authority (LLFA) under the Regulations, is one of six unitary authorities in Berkshire. The PFRA, comprising this document, the supporting spreadsheet, checklist and GIS layer represents the first stage of the requirements of the Regulations.

The PFRA process is aimed at providing a high level overview of local flood risk.

As a LLFA BFC must submit this PFRA to the Environment Agency for review by the 22nd June 2011 (the deadline has been extended until 19th August 2011). The methodology for producing this PFRA has been based on the Environment Agency's Final PFRA Guidance and Defra's Guidance on selecting Flood Risk Areas, both published in March 2011.

The PFRA is a high level screening exercise which involves collecting information on historic flooding events and the potential consequences of future floods, and to identify Flood Risk Areas. These are areas where the risk of flooding is significant and therefore requires further examination through the production of maps and management plans.

The Environment Agency has used a national methodology, which has been set out by Defra, to identify indicative Flood Risk Areas across England. Of the ten indicative Flood Risk Areas that have been identified nationally, none are located within BFC or within adjacent neighbouring areas.

Within an identified indicative Flood Risk Area, the Regulations require two subsequent key stages:

- Development of flood hazard maps and flood risk maps; and
- Flood risk management plans.

As BFC does not fall within an indicative Flood Risk Area the subsequent stages will not have to be undertaken. The PFRA requires review on a 6 yearly cycle.

In order to commence the process and achieve a clearer understanding of flood risk within the Borough it was necessary to attempt to collect historic local flood risk information from a variety of sources. However comprehensive details were sketchy and inconsistent. Given the reliability and incompleteness of the data it was decided to concentrate on three 'event years' during which storm events across parts of the Borough had caused some limited and extremely short lived surface water flooding.

Based on the evidence collected no past events are considered to have had 'significant harmful consequences' as detailed in the criteria within the national guidance and are therefore not required to be included into the spreadsheets for formal reporting to the EU. However as a good practice exercise and for future PFRA review cycles the 3 event year details have been captured on the spreadsheet for information.

CHAPTER 1 INTRODUCTION

1.1 Scope

The Preliminary Flood Risk Assessment is an initial high level screening exercise that aims to review historical and future (potential) flood risk and determine Flood Risk Areas. The exercise reviews pre existing data and does not require any additional modeling to be undertaken.

This report assesses local flood risk within the Borough, due to data limitations this report focuses on surface water flooding. The report brings together existing and available information to determine the level of surface water flood risk throughout the Borough.

1.2 Objectives

The chief drivers behind this research and preparation of the PFRA report are two new pieces of legislation: the Flood Risk Regulations which came into force on the 10th December 2009, and the Flood & Water Management Act (FWMA) which gained Royal Assent on the 8th April 2010. Under these pieces of legislation, all Unitary Authorities, and in two-tier systems, all County Councils, are designated a Local Lead Flood Authority (LLFA) and have formally been allocated a number of key responsibilities with respect to local flood risk management. A full description of these responsibilities is detailed Chapter 2.

The purpose of the Flood Risk Regulations was to transpose the EC Floods Directive into domestic law in England and Wales and to implement its provisions. In particular it places duties on the Environment Agency and LLFAs to prepare a number of documents including:

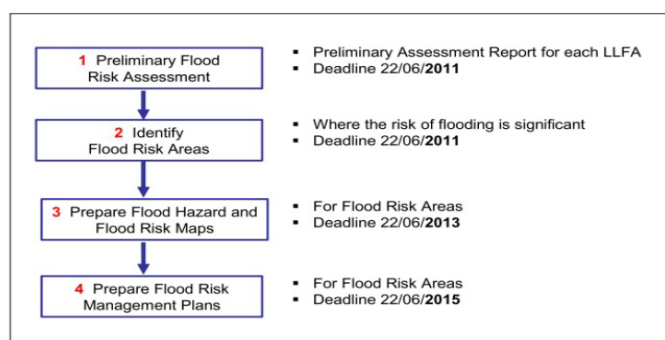
- Preliminary Flood Risk Assessments;
- Flood hazard and flood risk maps;
- Flood Risk Management Plans.

BFC, as LLFA, has a duty to prepare a PFRA under the Flood Risk Regulations within a 6 year period. The assessment is a vital and critical step in understanding the flood risk in BFC and will be the foundation for future local flood risk management strategy.

The Preliminary Flood Risk Assessment involves an assessment of local flood risk, the preparation of a Preliminary Assessment Report and the identification of any Flood Risk Areas (areas where the risk of flooding is significant).

However, there are no Flood Risk Areas identified in BFC or neighbouring authorities and therefore the subsequent stages of flood hazard maps and flood risk management plans are not required.

Table 1 Flood Risk Regulations 2009



The key objectives of this PFRA are summarised below:

- Describe the arrangements for partnerships and collaboration for the ongoing assessment of flood risk, data collection and means of public engagement.
- Summarise the methodology used for the PFRA and the scrutiny and review procedures.
- Assess historic flood events within BFC from local sources and the consequences of these events.
- Establish an evidence base of historic surface water flood risk information which can be used to support and inform the preparation of BFC's future local flood risk strategy.
- Assess the potential harmful consequences of future flood events within BFC.
- Review the indicative Flood Risk Areas provided by the Environment Agency and identify locally significant flood risk areas

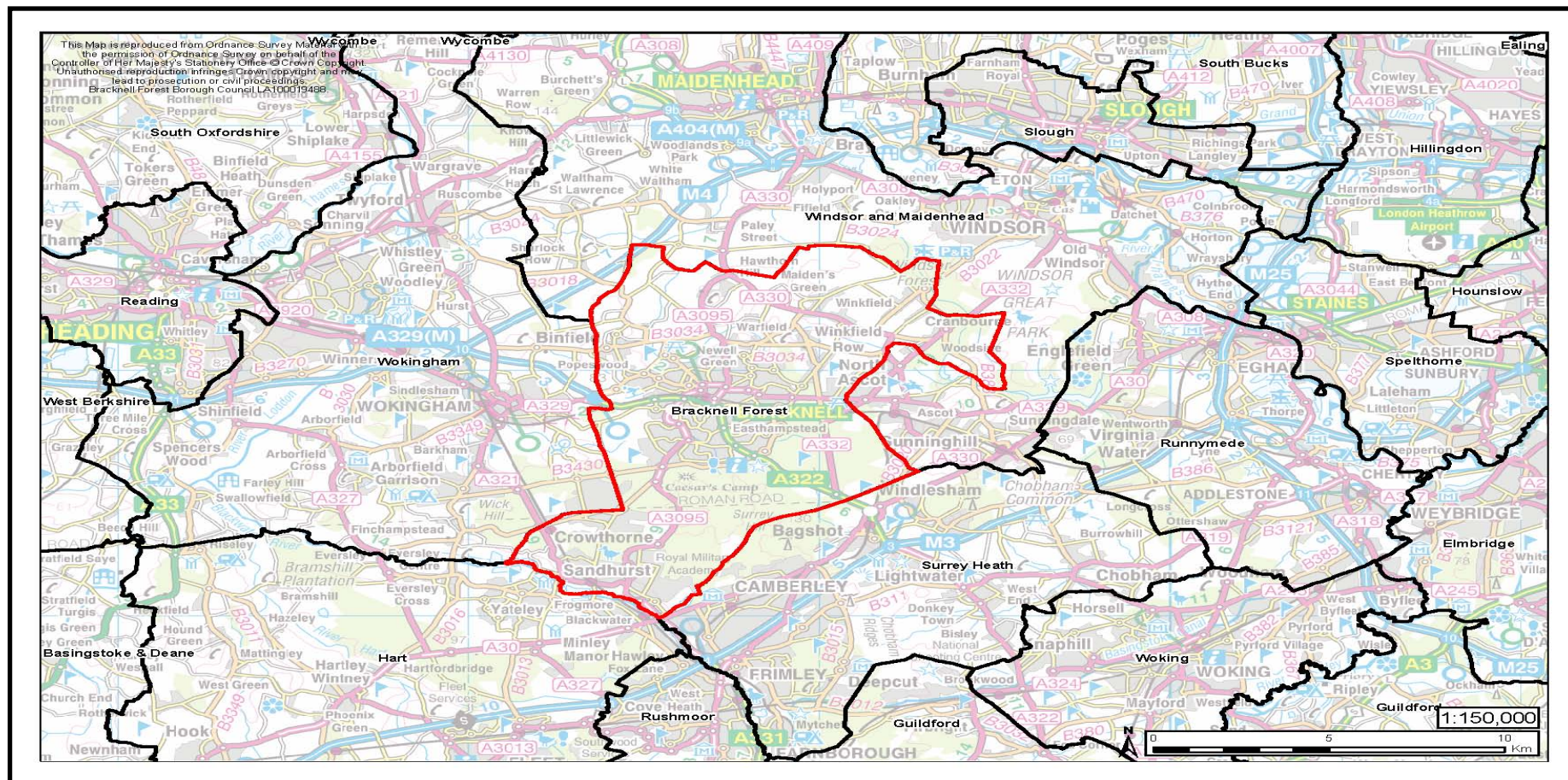
1.3 Study Area

The study area for this PFRA is defined as the administrative area of BFC. Bracknell Forest lies 28 miles west of London, at the heart of the Thames Valley and within the county of Berkshire. The Borough's population is 115,100 (2009 estimate). The area covers approximately 109 km² which includes the parishes of Binfield, Bracknell Town, Crowthorne, Sandhurst, Warfield and Winkfield. BFC contains three main towns. The largest is Bracknell itself which lies in the centre of the Borough. To the south of the Borough are Crowthorne and Sandhurst. Outside the towns, the south of the Borough is forested whilst the north of the Borough is rural, agricultural land with small pockets of woodland and some small villages and hamlets.

The study area falls into the Thames River Basin District and is served by the EA West Thames area office. The main rivers in BFC are The Cut and the River Blackwater. The Cut and its tributaries flow through the north of the Borough. The River Blackwater flows along the southern border of the Borough.

Thames Water is the water company that serves the BFC area. BFC is bordered by Wokingham BC, The Royal Borough of Windsor and Maidenhead, Hart and Surrey Heath.

Figure 1 Bracknell Forest Council Administrative Area



CHAPTER 2

LEAD LOCAL FLOOD AUTHORITY RESPONSIBILITIES

2.1 Flood Risk Management Governance Arrangements

One of the direct actions resulting from the Pitt Review into the summer 2007 flooding was that the role of local authorities should be enhanced so that they take on responsibility for leading the coordination of flood risk management in their areas. Designated as a LLFA BFC are therefore responsible for leading local flood risk management across the Borough.

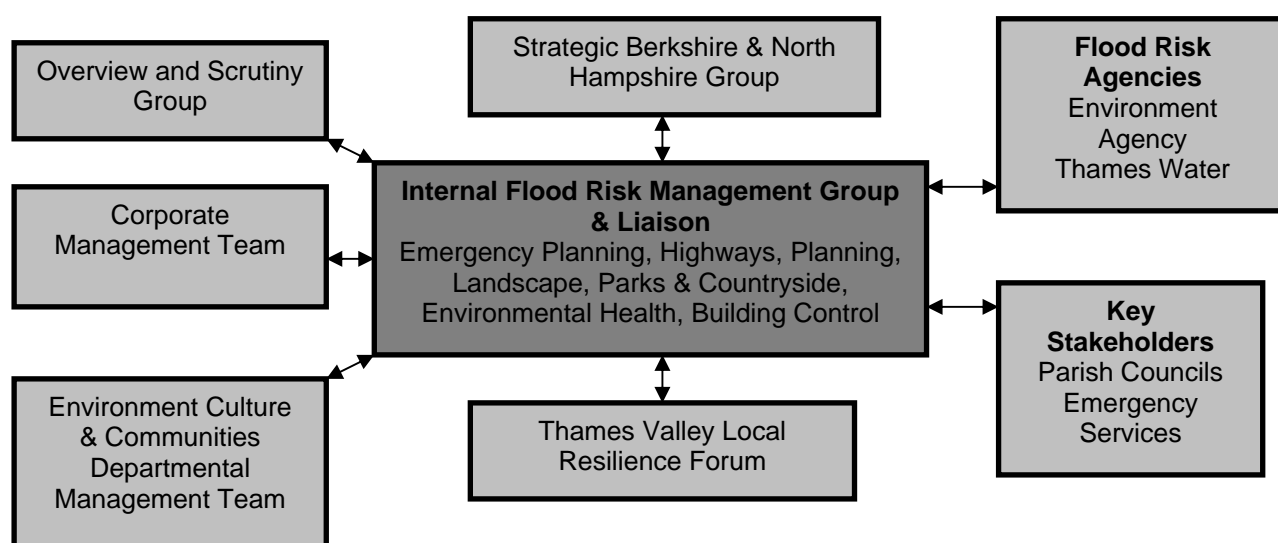
As LLFA BFC have the ultimate responsibility for coordinating effective partnerships with other stakeholders who have an interest in flood risk management.

An internal flood risk management group has been established for approximately two years. This is an officer led group which was initially set up to achieve the reporting requirements of National Indicator 189 (flood and coastal risk management). Although this NI is no longer in place the group still exists to oversee the requirements of the FWMA. There is good representation from across service areas, including Emergency Planning, Highways, Engineering and Planning. The EA are also well represented on the group although it has not been possible to engage a water company representative and historically BFC have found engagement somewhat challenging.

Management of flood risk within BFC is currently being assessed at a strategic level which will mean that all the requirements of the FWMA are managed in a more consistent and coordinated manner.

In order to ensure that flood risk management issues are considered at a strategic level a Berkshire and North Hampshire Director / Chief Office led group is under development.

Figure 2 Bracknell Forest Council Flood Group Structure



A decision was made early on in the process to concentrate on historical information and data relating to three significant event years. For the purposes of compiling information for this PFRA the Met Office were approached and provided event rainfall data and other partners such as Parish Councils and Royal Berkshire Fire & Rescue Service were also asked to provide any relevant contributions and historical information if available. Upon request Thames Water also provided information in the form of a DG5 register.

The scrutiny and review procedures for the PFRA are set out by the European Commission to ensure that the appropriate information has been used to determine flood risk and the most significant flood risk areas are identified. The review procedure comprises two parts. The first part of the review is through internal Environment Culture & Communities Departmental Management Team (July 2011) to ensure the PFRA meets the required quality standard before it is submitted to the Environment Agency.

The Environment Agency will then undertake a technical review and ensure that the guidance has been applied consistently. The PFRA will then be submitted to the relevant Regional Flood Defence Committee (RFDC). Once the RFDC has approved the PFRA, the Environment Agency Regional Director will collate, publish and submit all the PRFAs to the European Commission.

2.2 LLFA Responsibilities

The FWMA requires the Environment Agency to produce a national strategy for Flood and Coastal Erosion Risk Management (FCERM) and the LLFA to produce Local Flood Risk Management strategies. As the LLFA, BFC will be required to develop and implement a strategy for local flood risk management within Bracknell Forest and the strategy will be based on an assessment of risk and will incorporate evidence from the PFRA process.

In conjunction with leading and coordinating flood risk management the FWMA also places a number of other key duties on the LLFA, with the exception of the SuDS Approving Body these responsibilities are now enacted.

- **Investigating flood incidents** – LLFAs have a duty to investigate and record details of significant flood events within their area.
- **Asset Register** – LLFAs have a duty to maintain a register of structures or features which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection.
- **SuDS Approving Body** – LLFAs are designated the SuDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SuDS) within their area.
- **Works powers** – LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area.
- **Designation powers** – LLFAs, as well as the Environment Agency have powers to designate structures and features that affect flooding in order to safeguard assets that are relied upon for flood risk management.

CHAPTER 3 METHODOLOGY AND DATA REVIEW

3.1 Approach and Methodology

The PFRA is a high level screening exercise used to identify historic flood risk and areas at risk of significant future potential flooding. This PFRA has been prepared by BFC in consultation with its partners. The approach taken has been to collate record of historical flood risk. No new analysis or modeling has been undertaken although storm analysis event data has been purchased from the Met Office.

The core aim has been to derive an understanding of local flood risk by identifying existing and readily available local data. Records of past flood events are sketchy and inconsistent. The information provided did not accurately contain complete details of the consequences of past flood which made it impossible to assess consequences of historic flooding. This has highlighted the need to carefully define how future data is collected.

3.2 Data Sources and Assessment of Historic and Future Flood Risk

In order to complete the PFRA it was necessary to request and compile data from a number of sources. Existing datasets and anecdotal information from stakeholders were collated to try to identify details of past flood events (refer to table 2). Given that the historic information was generally sketch the main source of data came from the internal Confirm database. This system is used to record all Highways related drainage issues with records commencing from October 2000 to date. A decision was made early on in the PFRA process to focus on three known event years which had caused repeatable flooding across some very localised areas.

Table 2 Sources of Flooding Information and Datasets

Dataset	Description
Environment Agency	
Areas Susceptible to Surface Water Flooding	The first generation national mapping, outlining areas of risk from surface water flooding across the country with three susceptibility bandings (less, intermediate and more).
Flood Map for Surface Water	The updated (second generation) national surface water flood mapping which was released at the end of 2010. This dataset includes two flood events (with a 1 in 30 and 1 in 200 chance of occurring) and two depth bandings (greater than 0.1m and greater than 0.3m).
Flood Map (Rivers and the Sea)	Shows the extent of flooding from rivers with a catchment of more than 3km ² and from the sea.
Areas Susceptible to Groundwater Flooding	Coarse scale national mapping showing areas which are susceptible to groundwater.
Indicative Flood Risk Areas	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by Defra.
Historic Flood Map	Attributed spatial flood extent data for flooding from all sources.
Bracknell Forest Council	
Strategic Flood Risk Assessment July 2010	Assessment of flood risk for spatial planning purposes.
Historical Flooding Records from Confirm Database	Historical reports of predominantly highways flooding issues.
Parish Councils	
Anecdotal information from Parish Councils	Anecdotal information on local surface water flood history and flooding hotspots.
Met Office	
Storm event data	Storm event data for 3 event years.
Thames Water	
DG5 Register	DG5 Register logs and records of sewer flooding incidents in the Borough.
Royal Berkshire Fire & Rescue Service	
Historical flooding records of flooding related call outs	Information provided.

No data was collected from the public as part of this process.

The identification of Flood Risk Areas through the PFRA takes into account future floods, defined as any flooding that could potential occur in the future. This definition includes predicted floods extrapolated from current conditions with an allowance for climate change. The assessment of future flood risk relies on a review of the Environment Agency's FMfSW which was recently circulated to Lead Local Flood Authorities. The FMfSW predicts the extent of surface water flood risk from two events (1 in 30 annual chance and 1 in 200 annual chance)

Nationally significant indicative flood risk areas have been determined via the impact flooding will have on human health, economic activity, cultural heritage and the environment.

Table 3 Key Flood Risk Indicators

Impact of flooding on:	Flood Risk Indicators
Human Health	Number of residential properties Critical services (Hospitals, police/ fire/ ambulance stations schools, nursing homes, electricity substations etc)
Economic Activity	Number of non-residential buildings Length of road or rail Area of agricultural land
Cultural Heritage	Cultural heritage sites, schedule monuments, listed buildings
Environment	Designated SSSI's, SPA, SAC, Ramsar sites, Nature reserves

The flood risk indicators above have been selected by Defra and the Environment Agency in order to identify areas that exceed a pre-determined threshold. The areas that have been identified using this methodology are in excess of 30,000 people at risk and these have been identified as Flood Risk Areas. Further information is contained in Chapter 6.

3.3 Data Limitations

During the data collection process a number of issues arose, including inconsistent and sketchy methods of recording historical data across BFC. The quality of data cannot be confirmed as 100% accurate, some information has been recorded from knowledge and experience. The data sets provided by Thames Water in the form of the DG5 register are postcode specific to the first four letters / numbers therefore do not provide localised information, there was no date relationship on the data and indeed some data was provided for postcodes not within the Borough boundary. Data provided by Royal Berkshire Fire & Rescue Service did appear to correlate with information held by the Council but was provided too late in the process to enable detailed analysis. Consequently the datasets collated are extremely limited both in terms of flooding source and consequence (internal or external flooding) and very unlikely to accurately represent the flood risk issues in particular areas.

Much of the data was derived from vast experience and local knowledge of the Borough and this was invaluable when reviewing ten years of data that had been collected and recorded on the Confirm database system. This knowledge and experience was used to sift the initial drainage / flood records (> 400) to provide data relating to the three storm event years. (The accuracy and relevance of some of these records is questionable in a lot of cases, for example flooding issues may have

been reported as surface water flooding but were actually attributable to burst pipes etc.)

3.4 Data Storage and Restrictions

Data relating to these three event years (2002, 2006, 2007) along with all relevant GIS layers provided by the EA Geostore database are recorded on the Councils new GIS application system known as LocalViewFusion (Navigator).

This PFRA will become a publically available document and in order to ensure data sensitivity and confidentiality the historic information to determine previously flooded areas has been recorded via street basis rather than on an individual household.

CHAPTER 4

HISTORIC FLOOD RISK

4.1 Overview of Historic Flood Risk within BFC

Historical flood records have been captured as three event years within the Borough. These flood events were caused by surface water flooding which can be directly attributed to rainfall storm events which occurred over all or some parts of the Borough. A summary map highlighting historical flood events is contained in Annex1.

4.2 Surface Water Flooding

The most recent and significant surface water flooding to affect the Borough was on the 20th July 2007. The flooding occurred as a result of extremely heavy rainfall experienced during the storm event. Heavy rainfall over previous weeks had caused a degree of saturation resulting in less water being infiltrated through the soil and this caused much higher than normal rates of surface water run off in a very short time period. The whole Borough experienced heavy rainfall with a lot of minor flash flooding on roads across the Borough although this was relatively short lived.

Records also indicate similar issues albeit to a lesser extent during storm events in 2002 and 2006. Again details of the consequences are unreliable. Table 5 below details the storm analysis information provided by the Met Office.

The rainfall data provides evidence that there is always likely to be significant variability in rain in a thundery storm situation across parts of the Borough.

The most significant surface water flooding in the last 10 years was that experience in July 2007 with a 1 in 33 chance of occurring. However it is also interesting to note that event rainfall events of very low return periods can have an impact.

Table 4 Flood Event Information

Date	Flood location	Estimated no. of properties affected (Internal)	Source
7 th – 8 th May 2000	Localised across Borough	Unknown	Surface water
8 th August 2002	Localised across Borough	Unknown	Surface water
17 th November 2006	Localised across Borough	Unknown	Surface water
20 th July 2007	Localised across Borough	< 10	Surface water

Table 5 Met Office Storm Analysis Information

Rainfall measurements in mm Table represents daily 24hr totals from 0.900GMT on the date shown

7 th – 8 th May 2000 (not included within context of PFRA as no historical records available on Confirm although info detailed for information).							
Rainfall Stations	Distance	(km) &	06/05/00	07/05/00	08/05/00	Most significant amount estimated	Return period
Ascot, Whitmoor	2.3	ESE	0.0	31.7	0.3	28.7mm in one hour	14 years 1 in 14 chance of occurring (BUT see comments)
Bracknell, Sewage Works	3.2	NNW	0.0	1.4	0.0		
Bracknell, Beaufort Park	3.5	SW	0.0	54.6	0.2		
Chenies Rainfall Radar	-	-	N/A	N/A	N/A		
Comments - Based on rain timings provided by the hourly totals at Ascot an estimated 1 hour fall of 28.7mm was obtained, this has a return period of 14 yrs . The variability of heavy rain in a thundery situation is shown by the daily totals at the other two stations. Data provided shows a return period of 78 yrs at Beaufort Park.							
8 th August 2002							
Rainfall Stations	Distance	(km) &	07/08/02	08/08/02	09/08/02	Most significant amount estimated	Return period
Bracknell, Beaufort Park	3.5	SW	31.2	6.4	1.2	17.8mm in two hour	1 year 1 in 1 chance of occurring (BUT see comments)
Broadmoor	5.2	SSW	85.8	8.9	3.8		
Bagshot, Lutines Farm	6.9	SE	53.1	15.8	0.8		
Chenies Rainfall Radar	-	-	N/A	N/A	N/A		
Comments - Beaufort Park recorded a 24hr total of 31.2mm. The localised nature can be seen by totals recoded at Broadmoor (85.8mm) and Bagshot (53.1mm). Hourly totals at Beaufort Park show there were two periods of rain which made up the total of 31.2mm (a 2 hour total of 17.8mm and a 3 hour total of 13.4mm). Beaufort Park provided a return period of 1 year (1 in 1 chance of occurring) (17.8mm in 2 hours). The Broadmoor and Bagshot stations however confirm far heavier rain in place with a return period of 134 yrs (1 in 134 chance of occurring) at Broadmoor and 13 yrs (1 in 13 chance of occurring) at Bagshot.							
17 th November 2006							
Rainfall Stations	Distance	(km) &	17/11/06	18/11/06	19/11/06	Most significant amount estimated	Return period
Bracknell, Sewage Works	3.2	NNW	23.6	0.0	6.7	27.1mm in two hours	2 years 1 in 2 chance of occurring (BUT see comments)
Broadmoor	5.2	SSW	32.5	0.0	12.2		
Bagshot, Lutines Farm	6.9	SE	23.2	0.0	6.7		
Chenies Rainfall Radar	-	-	49.4	0.0	9.1		
Comments – The radar identified a 2 hr total of 31.4mm. For comparison radar data was also obtained for the sewage works and provided data of 35.6mm compared to recorded totals of 23.6mm. This shows the radar over estimated and based on this comparison an adjustment was made to reducing from 49.9mm to 32.7mm.							

20 th July 2007								
Rainfall Stations	Distance	(km)	&	19/07/07	20/07/07	21/07/07	Most significant amount estimated	Return period
Bracknell, Sewage Works	3.2	NNW		26.3	37.7	4.8	57.3 mm in six hours	31 years 1 in 31 chance of occurring
Bagshot, Lutines Farm	6.9	SE		29.2	49.8	14.8		
Wokingham, Emmbrook	7.2	W		24.5	39.2	4.1		
Chenies Rainfall Radar	-	-		23.5	37.5	5.0		
Comments – Hourly total from the Radar provided an estimated 10 hr total of 60.5mm, within this period some heavy rain of 57.3mm in a 6 hr total from 0600.								

4.3 Other Sources of Flooding

For the purposes of this PFRA there are no other sources of flooding that have had significant consequences.

Sewer flooding is often caused by excess surface water entering the drainage network. Given the heavily urbanised character of some parts of the Borough it is inevitable that localised flooding problems can arise when the capacities of existing systems are reached. Thames Water have supplied details of their DG5 register which provides number of properties currently on their flooding register. The DG5 register provides course data which made it difficult to undertake meaningful analysis but of the 61 properties listed by postcode area, excluding the final two letters, the greatest proportion are in the GU47 8 (Sandhurst), RG12 7 (Bracknell Town) and RG45 7 (Crowthorne) areas.

This PFRA does not consider main river flooding and the groundwater emergence maps indicate a low risk of groundwater flooding. Flooding from ordinary water courses was not considered as part of the initial data assessment.

4.4 Consequences of Historic Flooding

Insufficient data is available to draw definitive conclusions but only a small number (less than 10) of properties within the Borough have been reported to the Council as having experienced internal property flooding.

Given that the criteria in Table 3 relates to the impact in terms of human health, economic activity, cultural heritage and environment and records of internal property flooding are less than 10 it would therefore be reasonable to assume that there are no significant surface water flooding problems with the Borough.

Although not fulfilling the criteria of nationally or locally significant and therefore not requiring reporting to the EU the three flood event years will be recorded in Annex 1 of the Preliminary Assessment Spreadsheet as part of a future evidence base. This can then be utilised along with any future flood event records to support the required local risk management strategy as well as inform future PFRA cycles.

A selection of photos have been included in Annex 1. They highlight the fact that there have been some flood related issues in the Borough despite none having significant harmful consequences based on the information available and criteria set.

CHAPTER 5

FUTURE FLOOD RISK

5.1 Overview of Future Flood Risk within BFC

This section summarises all information on future flood risk in Bracknell Forest. Prior to the production of this PFRA there has been no detailed information on the risk of future flooding within the Borough, consideration has therefore been given to the national datasets on future risk of surface water flooding produced by the Environment Agency, including

- Areas Susceptible to Surface Water Flooding (AStSWF)
- Flood Map for Surface Water (FMfSW) and
- Areas Susceptible to Groundwater Flooding (AStGWF)

The AStSWF indicates a larger area at risk of surface water flooding than the FMfSW. A comparison of the two maps has been undertaken and the conclusion is that the FMfSW best represents the risks in Bracknell Forest, using the AStSWF maps and historic flooding hotspots as supporting evidence. The types of locations where AStSWF might better represent the surface water risk than FMfSW are where local sewer capacity is able to drain less than 6mm/hr. It is anticipated that the sewer capacity within Bracknell Forest is able to drain more than 6mm/hr due to the urbanised nature of the borough and hence FMfSW has been chosen.

There is limited information with regards to historical flooding within Bracknell Forest, therefore it has been difficult to make a comparison between the historical flooding and the predicted flooding on the AStSWF and FMfSW maps.

Review of the FMfSW indicates a larger number of properties at risk of future flooding and greater extents of future flooding than have been identified in the historical flooding records. Bracknell Forest has not experienced large amounts of flooding in the past, which on initial inspection appears to be in contradiction with the FMfSW.

The topography of Bracknell Forest is of a mostly flat catchment with heavily urbanised centres. Whilst the AStSWF map is identified as more suitable for flatter catchments, such as Bracknell Forest, the FMfSW has been chosen as it better represents the overall risk of flooding within the borough due to the location of the urban centres.

The difference in the historical flooding and the predicted flooding could be attributed to the unique topography of the borough and the topography of the areas surrounding it. Additionally, Bracknell Forest has a history of building low order, regional attenuation ponds. These tend to have the capacity for attenuating surface water runoff for events with approximately a 1 in 33 chance of occurring. This may reduce the amount of flooding experiences, particularly in smaller storm events. Whilst there is potential for large areas of flooding due to the flatter nature of the borough, the areas that are flat are served well by existing drainage systems that have sufficient capacity and hence limited flooding has been experienced in the past. The FMfSW provides a more accurate representation of the limited flooding that has been experienced than the AStSWF and hence has been chosen as the most appropriate dataset for the borough. However, the modelling methodology is still crude and does not fully represent the risk of surface water flooding in Bracknell Forest.

5.2 Locally Agreed Surface Water Information

As there is no additional local information on future flooding available, the 'locally agreed surface water information' has been chosen in conjunction with the Environment Agency and has been chosen as the FMfSW dataset, which gives an overview of the future flood risk from surface water across Bracknell Forest and is considered to be the most appropriate source of information. This dataset is illustrated in Annex 2.

5.3 Surface Water Flooding

The FMfSW is represented in Annex 2. The number of properties at risk of surface water flooding was estimated based on these maps. The FMfSW has been modelled for events with 1 in 30 chance of occurring and a 1 in 200 chance of occurring, within each event two bands of depth have been identified, greater than 0.1m and greater than 0.3m.

5.4 Other Sources of Flooding

There are no Environment Agency products that deal solely with flooding from ordinary watercourses, however there are several that contain relevant information.

The Environment Agency's PFRA guidance states "The Environment Agency's national datasets showing surface water flooding do not explicitly cover flooding from ordinary watercourses. However, because the extent of flooding is often topographically defined (i.e. dependent on the height of the land), we can make assumptions about the extent of flooding from surface runoff and small ordinary watercourses, which is likely to be similar in many cases. In most places, the 'locally agreed surface water information' will therefore cover the same areas as would be expected to flood from ordinary watercourses."

No further information exists on a local level with regards to future flooding from ordinary watercourses and hence this source of flooding has been reviewed as part of the review of the FMfSW.

There is no local information available which provides evidence on future groundwater flood risk across Bracknell Forest and groundwater flooding is not believed to be a major issue in the Borough. Therefore the future groundwater flood risk in Bracknell Forest has been based on the AStGWF mapping. The groundwater flood risk is based on the following risk bands:

< 25%;
>= 25% <50%;
>= 50% <75% and
>= 75%.

This dataset is illustrated in Annex 2 and areas at high risk from groundwater flooding are identified.

The 1km square count in Bracknell Forest within each risk band are given in Table 6 below. The majority of the grid squares are within the <25% band and hence the overall risk to the Borough from groundwater flooding has not been considered as significant.

Table 6 Number of 1km Squares in Bracknell Forest within each AStGWF Risk Band

AStGWF risk band	Number of 1km squares
< 25%;	53
>= 25% <50%	16
>= 50% <75%	2
>= 75%	1

5.5 Potential Consequences of Future Flooding

The Environment Agency has used the FMfSW and the National Receptors Database to identify a number of properties within each of the LLFA areas that are at risk of surface water flooding. The results for Bracknell Forest have been included in the Preliminary Assessment Spreadsheet in Annex 2 and are presented in the table below.

Table 7 Consequences of Future Flooding in Bracknell Forest

Area	Dataset used	Number of properties at risk of surface water flooding	Number of residential properties at risk of surface water flooding	Number of non-residential properties at risk of surface water flooding
Bracknell Forest	Flood Map for Surface Water (FMfSW) - 1 in 200 chance of occurring - Flooding greater than 0.1m depth	16,000	13,500	2,500
Bracknell Forest	Flood Map for Surface Water (FMfSW) - 1 in 200 chance of occurring - Flooding greater than 0.3m depth	6,100	5,200	900

In addition to the property count, the Environment Agency have undertaken a count of the number of environmental sites, and cultural heritage sites at risk of surface water flooding, based on the FMfSW, but in addition to this, the fluvial flood zones were overlaid in order to identify the extents only at risk from surface water. The results of this count for Bracknell Forest are shown in the table below.

Table 8 Other Sites at Risk of Flooding

	Number of sites identified at risk of surface water flooding based on FMfSW
Environmental Sites	
RAMSAR	0
SAC (Special Area of Conservation)	1
SPA (Special Protection Area)	1
SSSI (Site of Special Scientific Interest)	9
Parks and Gardens	1 (partially within Bracknell Forest)
World Heritage Sites	0

Of the sites identified in the table above, the most adverse implication in terms of surface water has been considered to be Windsor Great Park, which lies partially within Bracknell Forest. This is because the park is identified as being at risk in both the SAC and SSSI categories, in addition to being ranked 1st in England and Wales in terms of the parks and gardens at risk, with a total area of 12,463ha at risk of surface water flooding, which represents 5.5% of the total area of Windsor Great Park. However, as the majority of the Great Park is within the Royal Borough of Windsor & Maidenhead boundary, this has been included in the Royal Borough of Windsor & Maidenhead PFRA and as such is not considered to be locally adverse for Bracknell Forest.

It has therefore been considered that there is no adverse consequence to cultural heritage and the environment from surface water flooding. This is identified in the Preliminary Assessment Spreadsheet in Annex 2.

5.6 Effect of Climate Change

There is clear scientific evidence that global climate change is happening and it cannot be ignored. Over the past century around the UK sea levels have risen and more winter rain is falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts have changed little in the last 50 years. Some of these changes might reflect natural variation; however the broad trends are in line with projections from climate change models.

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.

There is enough confidence in large scale climate models to suggest that changes must be planned for. There is more uncertainty at a local scale but model results can still assist in planning to adapt. For example rain storms are likely to become more intense, even if it is not known exactly where or when. By the 2080s, the latest UK

climate projections (UKCP09) suggest 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%.

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%.

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

Wetter winters and more of rain falling in wet spells may increase river flooding in both rural and heavily urbanised catchments. More intense rainfall causes more surface runoff, increasing localised 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.

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.

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.

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

Past emission means some climate change is inevitable. It is essential the response includes planning ahead. Preparations can be made by understanding 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 and sustainable benefits.

Although the broad climate change picture is clear, local decisions have to be made against deeper uncertainty. So it is therefore necessary to consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that vulnerability to flooding is not increased.

Although the effects of climate change not fully understood, it is anticipated that the due to the higher intensity of rainfall events, the infiltration capacity will be superseded quickly and more water will leave the area as overland run off. This increase in volume increases the risk that surface water flooding occurs downstream.

5.7 Effect on Long Term Developments

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.

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."

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 which are "significant" (in terms of the Government's criteria).

The Council originally produced evidence on strategic flood risk (Bracknell Forest Strategic Flood Risk Assessment, Entec, 2006) which supported the production, consideration and adoption of the Core Strategy Development Plan Document (DPD). The Core Strategy sets out the Council's development needs for 20 years to 2026.

Since then, PPS25 has been published and the Council therefore needed to update its SFRA which was completed in 2010, Strategic Flood Risk Assessment – Halcrow, August 2010. This work supports a further planning document called the Site Allocations DPD which will allocate land to accommodate the level of development set out in the Core Strategy. This SFRA has been therefore used in assessing the flood risk of potential sites.

In more detail, the SFRA is a living document which is used as a tool by a local planning authority (LPA) to assess flood risk for spatial planning, determine planning applications, produce development briefs, set constraints, inform sustainability appraisals, identify locations of emergency planning measures and indicate requirements for site specific flood risk assessments. The SFRA is used to ensure future development is sustainable in terms of flood risk, and in particular aims to reduce overall flood risk where possible. The SFRA is not intended to be applied in isolation, but to ensure flood risk is considered as one of the constraints within the planning process. The SFRA must take into account other national and regional planning policies in relation to flood risk.

The outputs presented in the SFRA will be used as part of the evidence base for the Council in carrying out their spatial allocation of development in the SADPD. In particular, eight options for site development 'broad areas' have been subjected to a preliminary assessment of flood risk. It should be noted that this assessment gives only an overview of flood risk and does not preclude the requirement for site developers to carry out a Flood Risk Assessment (FRA). A number of recommendations have been produced for the purpose of initiating this process.

The SFRA also includes chapters providing guidance for the preparation of FRAs, guidance on the application of the Sequential Test, and information on the use of Sustainable Drainage Systems (SUDS).

CHAPTER 6

REVIEW OF INDICATIVE FLOOD RISK AREAS AND IDENTIFICATION OF FLOOD RISK AREAS

6.1 Indicative Flood Risk Areas in Bracknell Forest

No Indicative Flood Risk Areas have been identified in Bracknell Forest and hence no action is required.

6.2 Identification of Flood Risk Areas

In order to ensure a consistent national approach, Defra have undertaken a national selection and review of Flood Risk Areas using significance criteria and thresholds. Guidance on applying these thresholds has been released in Defra's document "Selecting and reviewing Flood Risk Areas for local sources of flooding". In this guidance document, Defra have set out agreed key risk indicators and threshold values which must be used to determine Flood Risk Areas.

The methodology is based on using national information to identify 1km squares where local flood risk exceeds the defined threshold set out below (refer to Drawing Number BS13 in Annex 3):

- Number of people >200
- Number of critical services >1
- Number of non-residential properties >20

Where a group of 5 or more of these identified grid squares was identified, within a 3km square this was classified as a 'cluster' (refer to Drawing Number C3 in Annex 3). The clusters were then ranked in order of the number of people affected and where this was above 30,000, the cluster was identified as an Indicative Flood Risk Area.

The Environment Agency has undertaken a national assessment and to select 10 Indicative Flood Risk Areas across the country (refer to Drawing Number IFRA_EE in Annex 3). No areas within Bracknell Forest have been identified as an indicative Flood Risk Area.

The Indicative Flood Risk Areas map provided in Annex 3 indicates the identified areas, as well as the grid squares identified as being above the thresholds set out above.

As well as reviewing the Borough as a whole, the Environment Agency has also used the FMfSW and the National Receptors Database to identify a number of areas across the country that exceed a given threshold.

Within Bracknell Forest, the areas identified as being above the thresholds set by the Environment Agency are set out in the table below.

Table 9 Consequences for Clusters within Bracknell Forest based on FMfSW

Cluster	Human Health Impact			Economic Impact – non-residential properties
	Residential properties	Number of people	Critical Services	
Bracknell	3215	7523	17	481

No areas within Bracknell Forest have been identified as an Indicative Flood Risk Area. However, a cluster has been identified for the Bracknell town area of the Borough. This cluster has been ranked as number 45 within the country. The total number of people at risk within that cluster is 7,523 and hence it is below the threshold of 30,000 to be classified as an Indicative Flood Risk Area.

The data gathered as part of this PFRA indicates that this is correct; there are no areas within Bracknell considered to be at nationally significant risk of surface water flooding and hence no further action is required with regards to reviewing of amending these areas.

SECTION 7

NEXT STEPS

7.1 PFRA Cycle

No indicative Flood Risk Areas have been identified within Bracknell Forest; consequently there is no requirement for BFC as the LLFA to prepare a Flood Hazard or a Flood Risk Management Plan as outlined within the Flood Risk Regulations. However, there is still a requirement under the FWMA to undertake a Local Flood Risk Management Strategy, which will be informed by this PFRA.

The Flood Risk Regulations require BFC to review the PFRA every 6 years. Any work that is undertaken on flood risk management within this 6 year cycle will need to be included in the updated PFRA. Any other relevant data that will be generated over the next 6 years needs to be reviewed and included in the updated PFRA.

7.2 Future Data Management and Partnership Arrangements

In order to comply with its duties under the FWMA, BFC are required to investigate any future flood events and ensure continued collection, analysis and publication of flood risk data and information.

As part of the PFRA process, a GIS platform has been set up to record the historical sources of flooding. This platform which is still under development will form the basis of an information sharing database for the future and assist BFC in fulfilling their duties under the Flood Risk Regulations and the Floods and Water Management Act. It is anticipated that any future incidents of flooding will be recorded in the same way, and include collating the following information on any particular incident:

- Unique reference Number;
- Date of Flooding;
- Description of location;
- Postcode;
- Grid reference;
- Source of flooding (where known);
- Description of what affected by flooding (consequences);
- Summary of flooding incident;
- Additional Comments;
- Photographs/images of incident; and
- Source of information regarding incident.

It is anticipated that this information would be obtained at the point of recording a flood incident, either by the officer investigating the incident or obtained at the point when the incident is identified, i.e. from a member of the public. There is a duty under the Floods and Water Management Act for the LLFA to investigate and record all flooding incidents to an extent that it considers necessary or appropriate. It is anticipated that the format recommended for recording the incidents will meet these requirements.

Once the database is complete, the information can be stored as a GIS database information table as well as used to create graphical plans of flooding that has occurred and provided for public review either on the Bracknell Forest website or within the Council offices. It also enables the public to review information in a simple

plain English manner without having to review technical reports relating to the specific incident.

The internal flood risk management group will continue and all efforts will be made as the LLFA to strengthen existing partnership arrangements.

7.3 Scrutiny and Review Processes

The European Commission sets out the scrutiny and review procedures to be adopted when producing a PFRA.

The two stages of the PFRA review process are outlined below.

Local Authority Review – BFC undertook an internal review of this PFRA in order to ensure that it meets the required quality standards, before submission to the Environment Agency. The Bracknell Forest PFRA was reviewed internally and agreed by the Environment Culture and Communities Departmental Management Team.

Environment Agency Review - The Flood Risk Regulations has given the Environment Agency the role of reviewing, collating and publishing all of the submitted PFRAs.

The Bracknell Forest PFRA has been submitted to the Environment Agency who will undertake a technical review. As no amendment of the Flood Risk Areas have been undertaken in Bracknell Forest a review of these areas will not be necessary. Once satisfied, the Environment Agency will recommend submission to the relevant Regional Flood Defence Committee (RFDC) for endorsement.

When the PFRA has been endorsed by the RFDCs the relevant Environment Agency Regional Director will sign it off, before all PFRAs are collated, published and submitted to the European Commission.

The second review cycle of the PFRA by Bracknell Forest must be submitted to the Environment Agency by the 22nd of June 2017. The Environment Agency must then submit it to the European Commission by the 22nd of December 2017 using the same review procedure described above.

REFERENCES

Environment Agency Preliminary Flood Risk Assessment (PFRA) Final guidance Report – GEHO1210BTGH-E-E (Dec 2010)
https://knowledgehub.local.gov.uk/c/document_library/get_file?uuid=8600eda9-7490-4533-b2f0-e1e6856dab00&groupId=5919398

Defra / WAG (2010) Selecting and reviewing Flood Risk Areas for local sources of flooding – Guidance to Lead Local Flood Authorities.
<http://archive.defra.gov.uk/environment/flooding/documents/interim2/flood-risk-method.pdf>

Met Office Storm Analysis Data

Bracknell Forest Strategic Flood Risk Assessment, Halcrow, 2010

ANNEX1 – RECORDS OF PAST FLOODS AND THEIR SIGNIFICANT CONSEQUENCES

REFER TO PRELIMINARY ASSESSMENT SPREADSHEET – ANNEX 1

HISTORICAL FLOODING WITHIN BRACKNELL FOREST

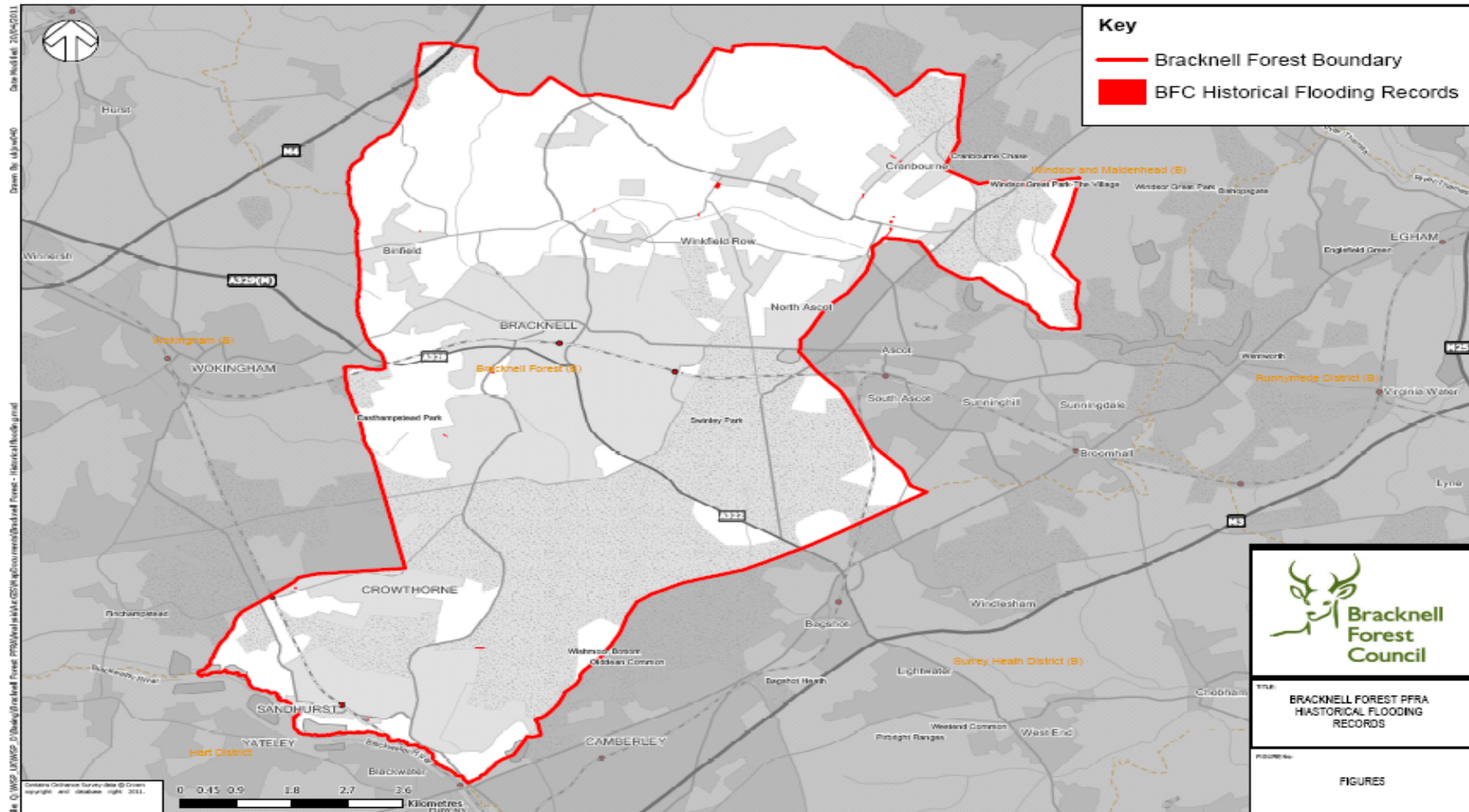


PHOTO EXAMPLES OF SURFACE WATER FLOODING



These two photos are flooding around the Cut River as a result of the July 2007 flooding event. The photos show the road and bridge are impassable as a result.



These four photos show flooding as a result of the Mill Pond reservoir over topping in July 2007. This infrastructure around Mill Pond flooded as it was designed to do but these photos give some illustration of the amount of water resulting from a flash storm event.





These three photos show surface water flooding in the RG42 6L area. Under the water is a 'B' and a residential cul de sac.





Properties at RG45 6D
postcode, experienced
internal property
flooding in July 2007.



ANNEX 2 – RECORDS OF FUTURE FLOODS AND THEIR CONSEQUENCES

REFER TO PRELIMINARY ASSESSMENT SPREADSHEET – ANNEX 2

Key

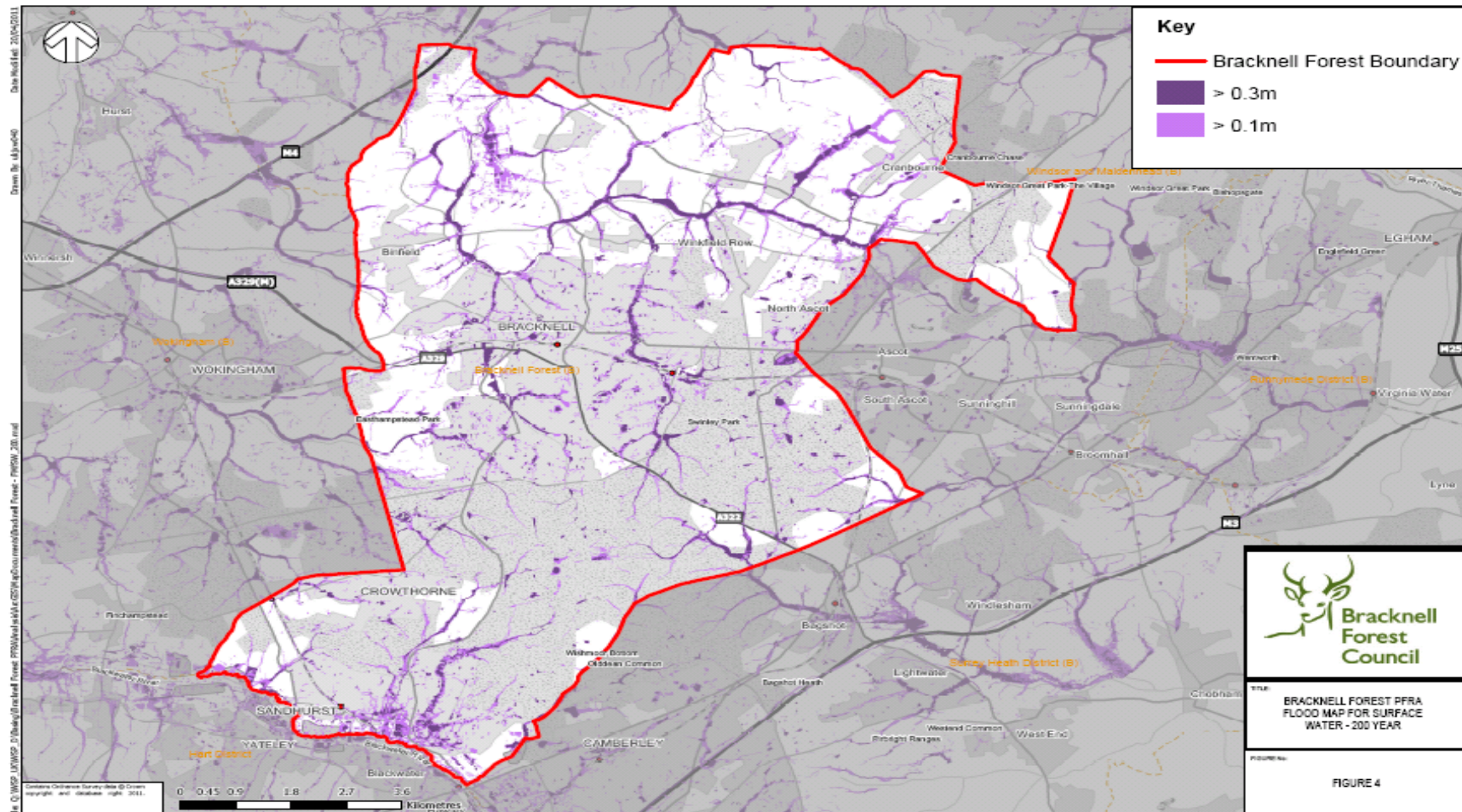
- Bracknell Forest Boundary
- > 0.3m
- > 0.1m

Bracknell Forest Council

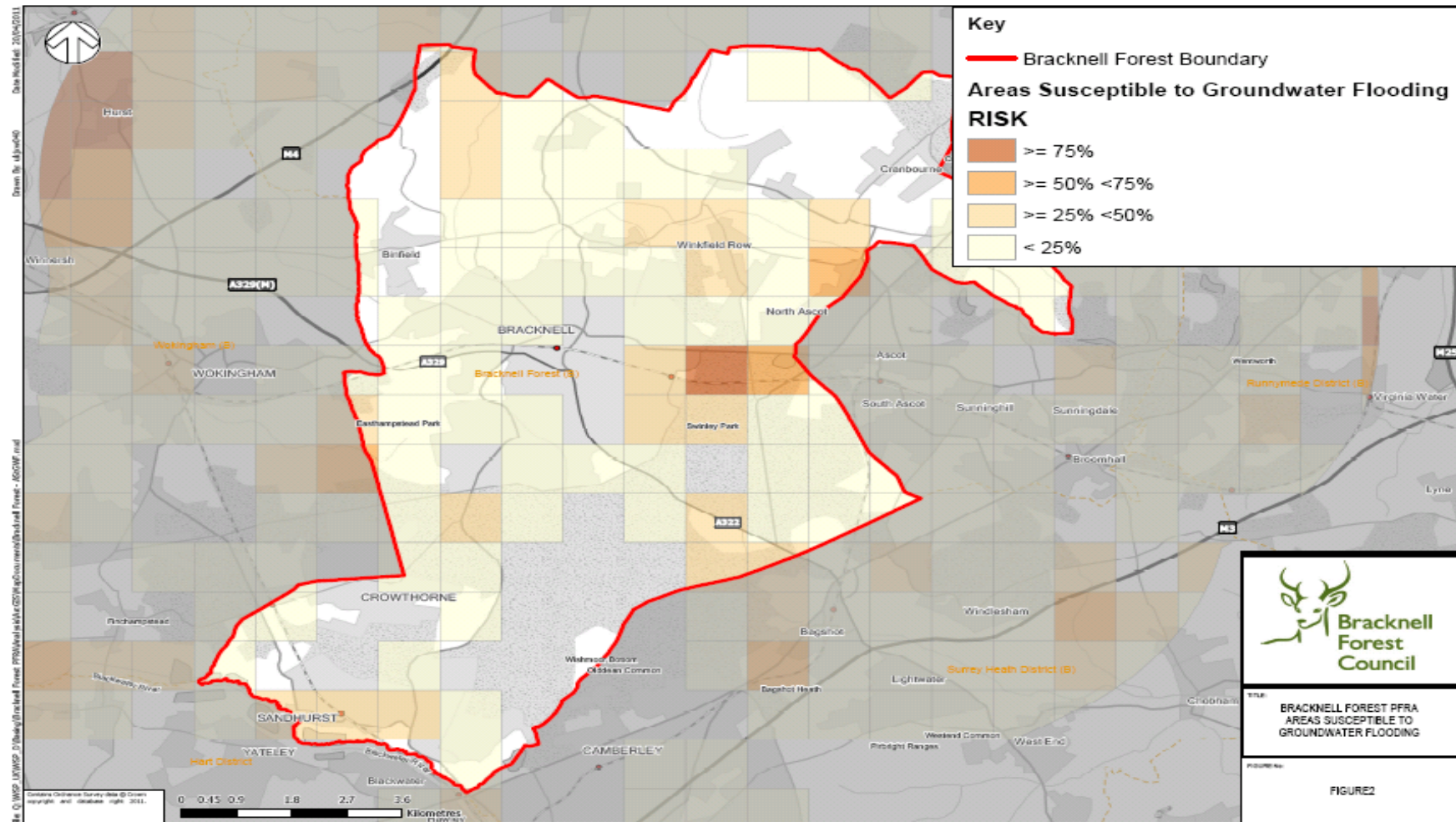
BRACKNELL FOREST PFRA FLOOD MAP FOR SURFACE WATER - 30 YEAR

FIGURE 3

FLOOD MAP FOR SURFACE WATER – 1 IN 200 CHANCE OF OCCURRING



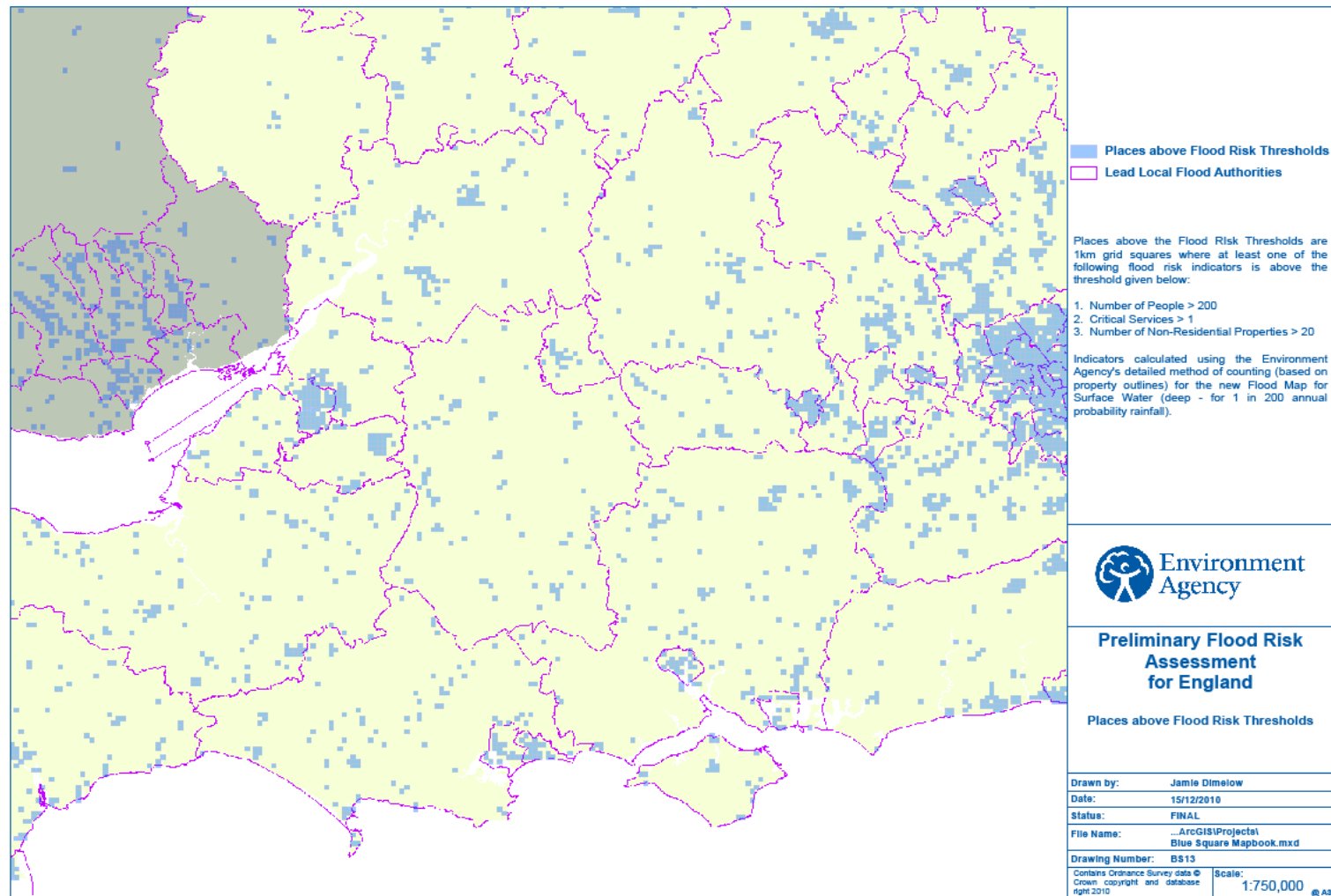
AREAS SUSCEPTIBLE TO GROUNDWATER FLOODING



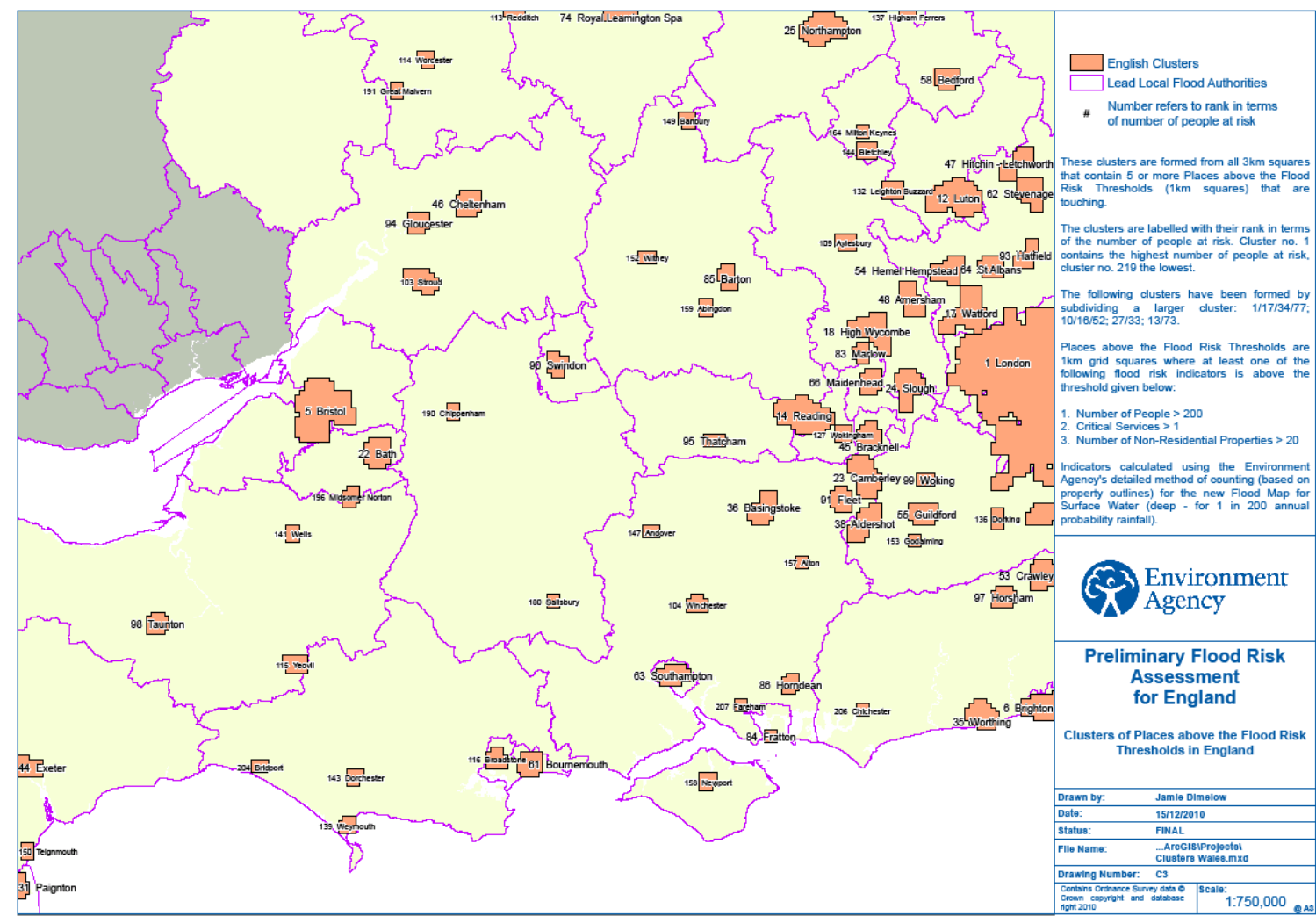
ANNEX 3 – RECORDS OF FLOOD RISK AREAS AND THEIR RATIONALE

REFER TO PRELIMINARY ASSESSMENT SPREADSHEET – ANNEX 3

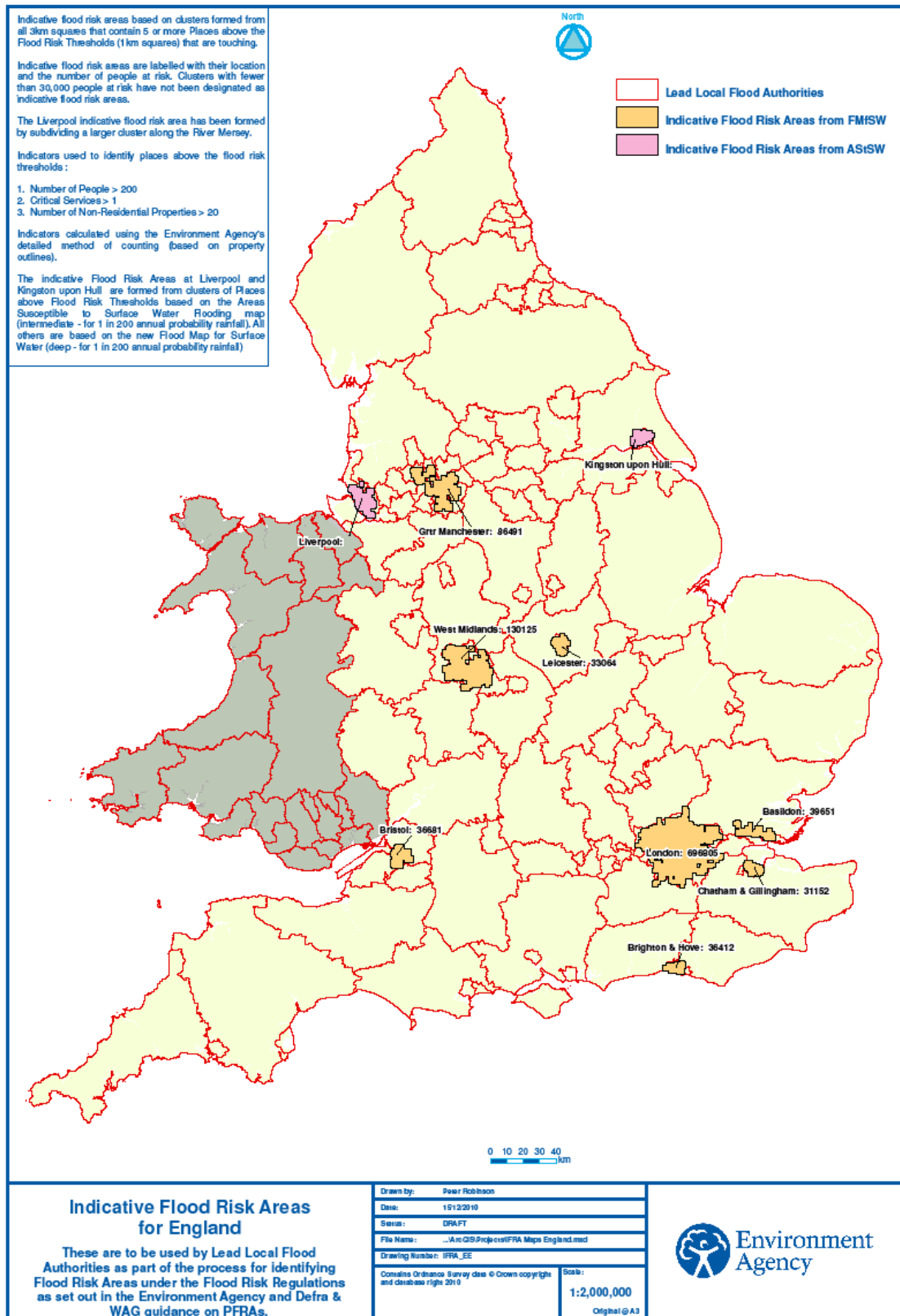
DRAWING NUMBER BS13 – PLACES ABOVE FLOOD RISK THRESHOLDS



DRAWING NO C3 – CLUSTERS OF PLACES ABOVE THE FLOOD RISK THRESHOLDS IN ENGLAND



DRAWING NO IFRA_EE – INDICATIVE FLOOD RISK AREAS MAP



ANNEX 4 – REFER TO PFRA CHECKLIST