



FLASH FLOODS  
AND PLUVIAL  
FLOODING



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Istituto Superiore per la Protezione  
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REGIONE AUTONOMA  
DELLA SARDEGNA



MINISTERO DELL'AMBIENTE  
E DELLA TUTELA DEL TERRITORIO E DEL MARE

Working Group F Thematic Workshop

Exploring the potential for pluvial flood  
warnings with professional responders  
and the public in England and Wales

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26<sup>th</sup>-28<sup>th</sup> May 2010, Cagliari, Italy

**fhrc**  
Flood Hazard  
Research Centre



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## Pluvial/SW Flood Warning Scoping Project

- Environment Agency funded Science Research Project
- Flood Hazard Research Centre and HR Wallingford Ltd
- Completed in February 2010
- Second phase piloting recommended options is due later in 2010

The project has two main aims:

- *To assess existing and recent initiatives to provide pluvial flood warning.*
- *To scope the potential for the Environment Agency to develop a pluvial flood warnings service.*



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## Background

- Flood warning systems well developed in England and Wales for fluvial and tidal/coastal flooding – the principal risks
- Few warning services yet for pluvial, surface water and groundwater flooding
- Different flood warning services emerging for a) professional responders and b) the public
- Learned through experience that flood warning systems must be designed from the start with strong 'customer' involvement (i.e. 'bottom up')
- Low public flood risk awareness remains a key issue



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- **June and July 2007 floods**

Two-thirds of the 55,000 homes/businesses flooded in summer 2007 were flooded from pluvial and surface water flooding (13 deaths, 140,000 without water supplies for two weeks)

- **The Pitt Review recommended**

A new Flood Forecasting Centre to forecast floods from all sources



At risk from flooding	England	Wales
Only at risk from pluvial or surface water flooding (SWF)	2.8 m properties	0.137m properties
At risk from pluvial/SWF and other types of flooding (river and/or coastal)	3.8 m properties	0.237m properties



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# Extreme Rainfall Alerts – introduced 2009

Ensemble, probabilistic forecasts assessed against rainfall thresholds likely to cause flooding

Current thresholds:  
 30mm in 1 hr; 40mm in 3 hrs, 50mm in 6 hrs

Guidance issued at  
 10% probability, Alert at 20% probability



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### FLOODFORECASTINGCENTRE

Environment Agency Met Office

#### Flood Guidance Statement 15:00hrs 14 May 2009

Our assessment of daily flood risk for England and Wales is below.



1500 - 2359hrs Thursday 14 May 2009	0000 - 2359hrs Friday 15 May 2009	0000 - 2359hrs Saturday 16 May 2009	0000 - 2359hrs Sunday 17 May 2009	0000 - 2359hrs Monday 18 May 2009
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#### General Overview

Localised flooding is possible from 15:00 today onwards as a result of slow moving heavy showers across much of England and Wales.

#### Thursday

There is a very low risk of river or coastal flooding, but Extreme Rainfall Alerts have been issued for the risk of surface water and localised flooding problems (areas coloured amber). Heavy showers, possibly thundery, are already established over the South West and these will persist into the evening. Heavy showers will also become persistent into the evening across Central and Southern England and Wales. Northern parts of England are less likely to see the heaviest of the rain.

#### Friday

There is a low risk of Extreme Rainfall Thresholds being met (10-20%). Rain, some heavy and prolonged, will affect Wales, Midlands and much of Southern England at first moving slowly north westwards during the day. This will be followed by a scattering of locally heavy showers.

#### Saturday, Sunday and Monday

Although rain is possible almost anywhere on Saturday, the heaviest may be in the southwest of England where there is a very low risk of Extreme Rainfall Criteria being met. Sunday and Monday will see thundery showers, or spells of more persistent rain, heavy and prolonged in places, especially in the West.

There is a very low risk of coastal flooding across the whole time period.

#### Weather Warnings & Flood Warnings in force as of 15:00hrs

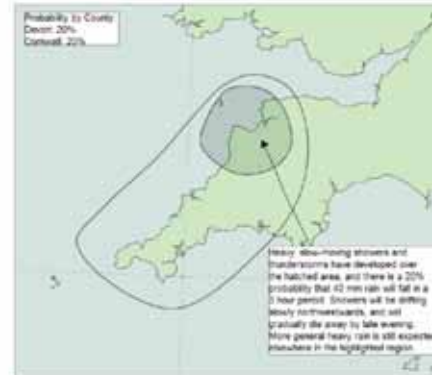
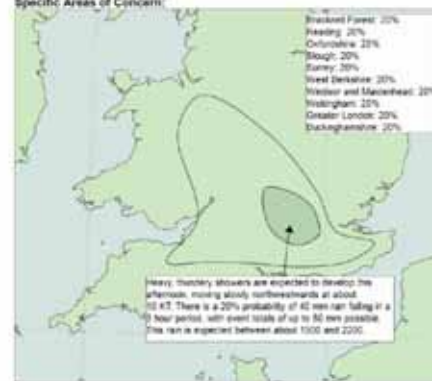
0 severe flood warnings / 0 food warnings / 0 food watches  
2 extreme rainfall alerts

#### Best Judgement

The flood guidance maps are more of a reflection of the risk of Extreme Rainfall Criteria being met than river flooding. However, Thursday and Friday may see flooding from smaller, fast responding river catchments or within urban areas if rainfall accumulations are high enough and the heaviest rainfall is localised directly over these smaller catchments or urban areas. On Saturday and Sunday however, there is a very low risk of flooding occurring from slower responding rivers as they react to the previous days' rainfall.

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#### Specific Areas of Concern:



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# Flood Guidance Statements

- an example

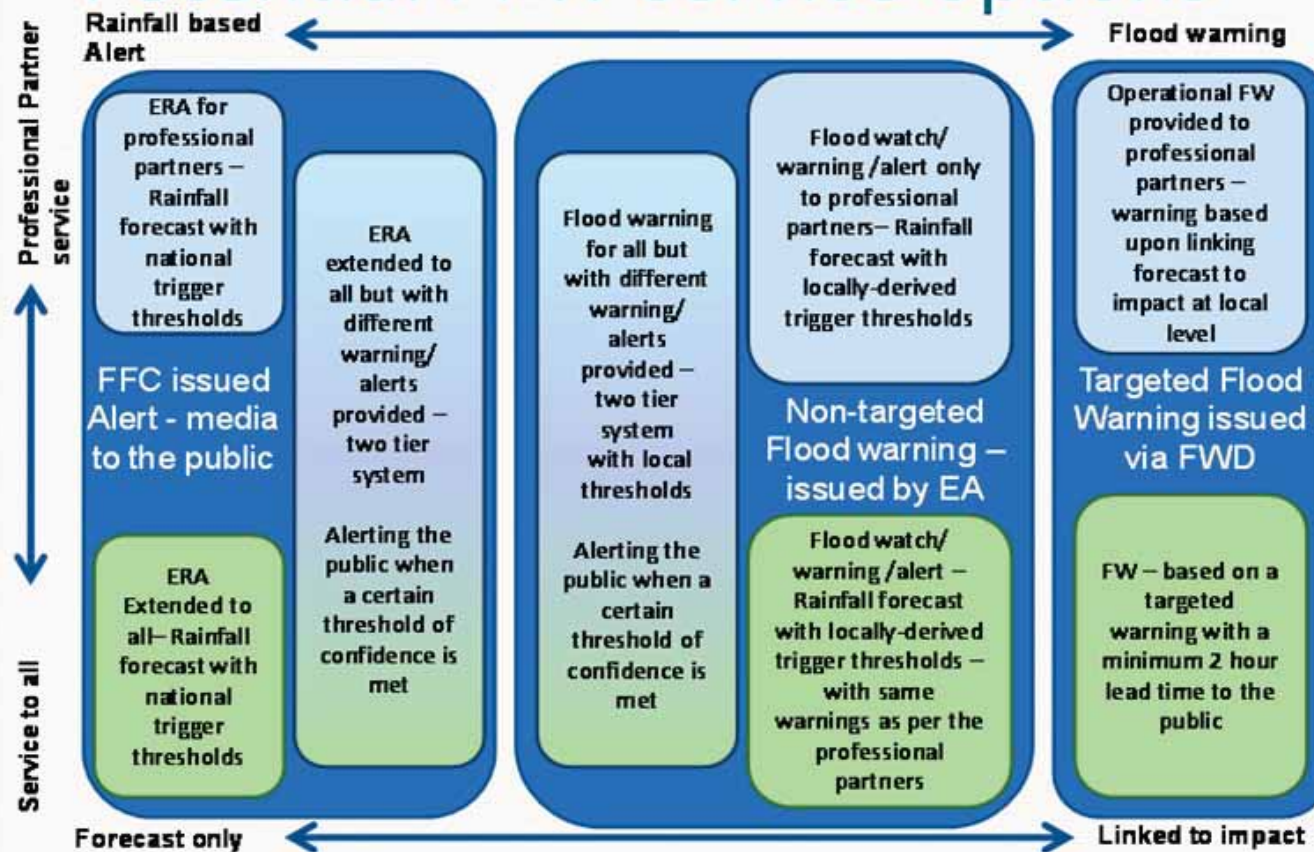
- 5 day overview
- daily
- for professional responder organisations



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# Potential PFW service options





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## The three pluvial flood warning options

- Rainfall-based alerts with either national or local rainfall thresholds
- Rainfall-based alert using locally specific runoff thresholds
- Flood warnings linked to local to runoff and local drainage, using a flood spreading model or hydrodynamic modelling





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## Methods of gaining user feedback and preferences

- 24 interviews with professional responders across the country about their experience so far with ERAs
- Local trials in two case study areas (one with and one without recent flood experience) of three pluvial flood warning options:
  - one workshop in each area for professional responders
  - focus groups – two in each case study area – with a representative sample of members of the public (31 people) living in areas at risk from pluvial flooding



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## Two case study areas

### Wealdstone Brook, West London

- Complex risk - suffers from pluvial, fluvial and sewer flooding
- Large, continuous urbanised area
- Area with a population that is less experienced

### Rotherham, Yorkshire

- Single risk – surface water flooding only
- Smaller, less dense urban areas
- Flooded recently from surface water flooding – major flood event in 2009

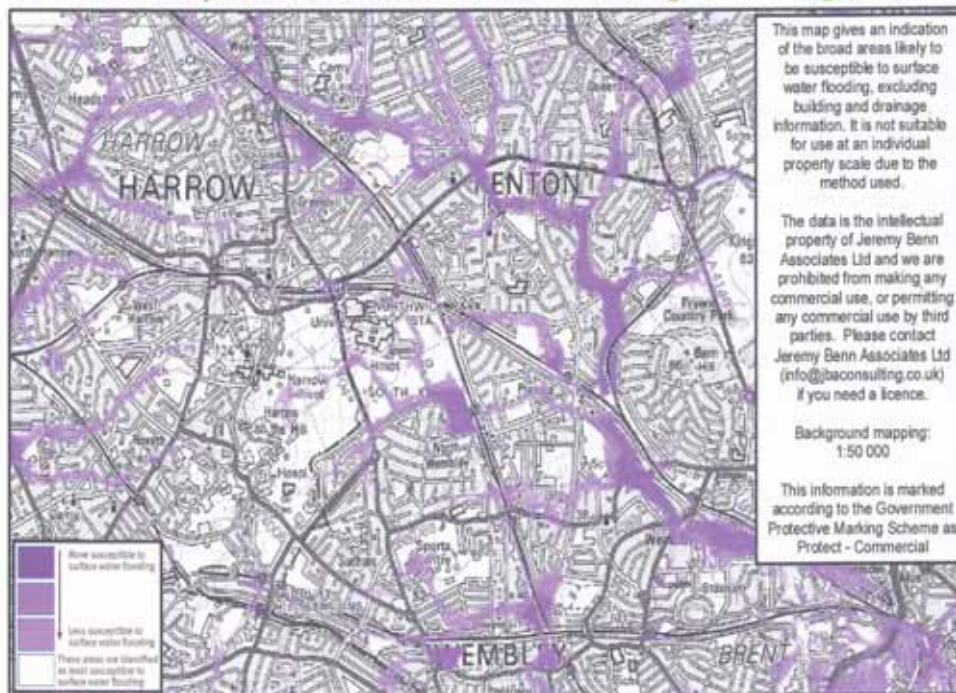


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# West London case study

Areas Susceptible to Surface Water Flooding



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July 2009

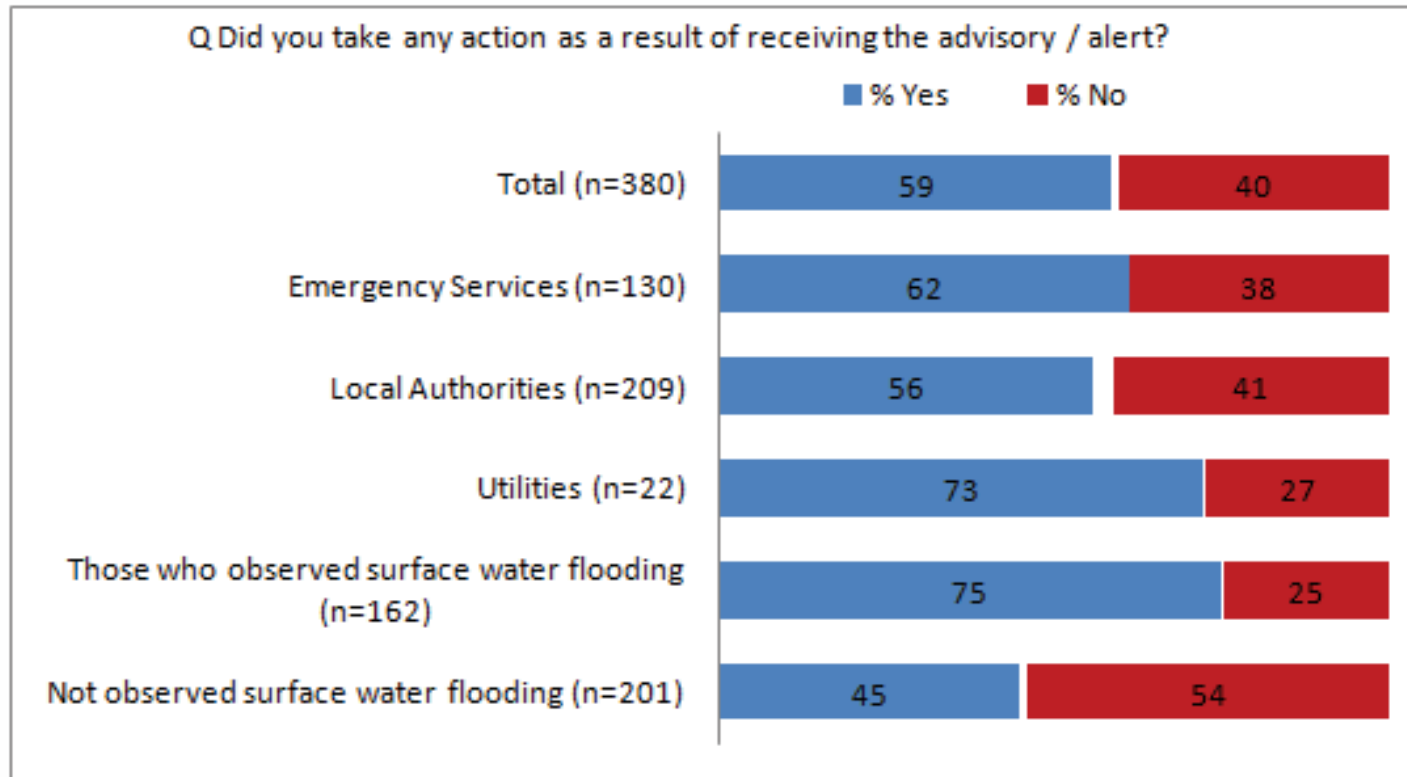
- We want to learn from your recent experience and thoughts
  - Are the existing warnings (e.g. Flash) useful?
  - Would a different flood warning be more helpful?
  - What additional information would be needed?
  - What messages should be used?



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## Professional responders responses to ERAs





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## Feedback from professional responder workshops

- Uncertainty over spatial scale of ERA alerts and timing makes response difficult, but allows some increased preparedness
- A min probability of occurrence of 60% and a 2 hour+ lead time required
- Local authorities need warnings during normal working hours
- Linkage required between rainfall forecast and flooding impact
- Rainfall-based alerts using locally specific runoff thresholds preferred
- Belief that existing forecasting uncertainties are too great for public use, but public seen as the 'first-line responders' to pluvial events



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## Feedback from the at-risk public

- pluvial warnings are a second class solution – improve drainage capacity first
- pluvial warnings need to be very specific in location and timing to be useful: warnings covering large areas will be ignored and ineffective
- the short warning time provided will be of limited value
- do not accept ‘front-line responder’ role – this should be ‘the authorities’
- forecast uncertainties will lead to false alarms and loss of belief in warnings
- lack of trust in authorities – belief that warnings best issued by people in the local community but this may be impractical



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## Underlying issues

- Lack of public awareness of pluvial flood risk is widespread
- Most members of the public do not distinguish pluvial flood risk from other flood risks e.g. sewer flooding, fluvial flooding
- Providing flood warnings separately for different types of flooding will be very confusing to the public
- The at-risk public do not believe that the science can deliver useful pluvial flood warnings
- Lack of trust in authority potentially undermines efficacy



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## Six recommendations (of 19) of research report

- develop pilot pluvial/SFW warnings targeted at only professional responders
- a programme to identify local rainfall thresholds with local stakeholders
- experiment with local flood impact modelling linked to rainfall thresholds
- warning recipient's confidence in existing flood warnings to be closely monitored for possible negative impacts of new pluvial service
- provide feedback to warning recipients on post-event outcome of warning
- improved mapping of areas prone to SFW risks





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## Acknowledgements

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We also wish to acknowledge the contributions to the research made by our partners, HR Wallingford Ltd



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