Preliminary Flood Risk Assessment 2011

Preliminary Assessment Report

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Contents

Abbreviations

Acronym	Definition
AStSWF	Areas Susceptible to Surface Water Flooding
BHS	British Hydrological Society
BW	British Waterways
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
FMfSW	Flood Map for Surface Water
FRM	Flood Risk Management
FRMSCG	Flood Risk Management Strategic Co-ordinating Group
FWMA	Flood & Water Management Act 2010
GHG	Greenhouse Gas
GIS	Geographical Information System
IDB	Internal Drainage Board
IUD	Integrated Urban Drainage
LDF	Local Development Framework
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
LSDB	Lower Severn Drainage Board
NFU	National Farmers Union
PPS25	Planning and Policy Statement 25: Development and Flood Risk
PFRA	Preliminary Flood Risk Assessment
RBD	River Basin District
RFDC	Regional Flood Defence Committee
RPE	Return Period Event
SAB	SUDS Approving Body
SFRA	Strategic Flood Risk Assessment
STW	Severn Trent Water
SUDS	Sustainable Urban Drainage Systems
SWMP	Surface Water Management Plan
WCC	Worcestershire County Council
WLDG	Worcestershire Land Drainage Group

Executive Summary

Under the European Union (EU) Floods Directive, which has been transposed into UK law through the Flood Risk Regulations (2009), Worcestershire County Council (WCC) must undertake a Preliminary Flood Risk Assessment (PFRA). The primary purpose of the PFRA is to report 'Nationally Significant Areas of Flood Risk' to the EU. As Lead Local Flood Authority (LLFA), WCC must report on significant past and future flooding from all sources except for Main River and Reservoir, which are to be covered by the Environment Agency (EA), and sub-standard performance of the adopted sewer network, which falls under the remit of Severn Trent Water (STW).

The PFRA has been produced alongside the developing Surface Water Management Plan (SWMP). These two documents will then make a significant contribution to the Local Flood Risk Management (FRM) Strategy, the production of which is a requirement of the Flood and Water Management Act 2010 (FWMA).

The assessment of past and future flooding has been undertaken in partnership with key officers from WCC and the six district councils who have worked alongside others from organisations including the EA, STW and the Lower Severn Drainage Board (LSDB). It has also been informed by a great deal of information gathered from parish councils. This pooling of local knowledge combined with records of past flooding and model-based maps of projected future flooding have led to the adoption of the Locally Agreed Surface Water Information (see chapter 5 of this report).

Despite the map of 'Nationally Significant Areas of Flood Risk' indicating that a small part of the Midlands risk area crosses the Worcestershire border a closer assessment of flood risk in this part of the county demonstrates that this is simply an anomaly caused by methodology used by the Department for Environment, Food and Rural Affairs (Defra). It has, therefore, been agreed with the EA and Birmingham City Council that in reality there are no areas of 'Nationally Significant Areas of Flood Risk' within Worcestershire.

Neither have there been any single flood locations in Worcestershire where the criteria defined for 'Locally Significant Flood Risk' i.e. those which affect at least 3,000 people, have been met. However, over 4,780 properties were internally flooded during the severe 2007 flood event and this has been appropriately recorded within the PFRA.

During the 2007 event and on many occasions previous and subsequent to it a considerable number of smaller scale floods have had a considerable impact upon people, property, the economy and the environment and received national media coverage although each in isolation were unlikely to meet the defined criteria.

A considerable amount of work has been done to investigate flooding, prevent or reduce its future impact and develop a greater ability to deal with its impacts both during and after an event. However, flooding remains a high priority for WCC and its partners and efforts continue in earnest to ensure Worcestershire is more resilient in respect of reducing localised flood risk.

1. Introduction

1.0.1 Under the EU Floods Directive, which has been transposed into UK law through the Flood Risk Regulations (2009), WCC, as LLFA, must undertake a PFRA to assess the harmful consequences of past and potential future flooding and to identify areas of significant flood risk.

1.0.2 This report includes:

- an overview of the legislative requirements (Section 1);
- an overview of the study area (Section 1);
- the approach to partnership working for the PFRA (Section 2);
- the approach used and data gathered for the purposes of the PFRA (Section 3);
- a summary of past floods in Worcestershire (Section 4);
- a summary of the harmful consequences of potential future floods in Worcestershire (Section 5);
- the identification of 'flood risk areas' within Worcestershire (Section 6);
- a summary of the next steps to be undertaken, both in terms of the PFRA and wider Flood Risk Management (FRM) in Worcestershire (Section 7).

1.1 Overview of Flood Risk Regulations

1.1.1 The Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities consistent with the Flood and Water Management Act 2010 and provide for the delivery of the outputs required by the directive. The Regulations give responsibility to:

- the Environment Agency to prepare Directive deliverables: preliminary assessment report, flood risk maps and hazard maps and flood risk management plans - for flood risk from the sea, main rivers and reservoirs (it should be noted that the Environment Agency are responsible for collating and publishing the preliminary assessment reports, flood risk maps and hazard maps, and flood risk management plans);

- the LLFA (WCC) to do the same for all other forms of flooding (excluding sewer flooding), including surface runoff, groundwater and ordinary watercourses;

- both the EA and LLFAs to undertake a PFRA: the EA undertaking a PFRA per River Basin District (RBD) covering flood risk from Main Rivers, the sea and reservoirs; and LLFAs undertaking a PFRA for their administrative boundary covering flood risk from surface runoff, groundwater and ordinary watercourses (i.e. local flood risk).

1.1.2 The stages of the Flood Risk Regulations are illustrated in Figure 1 (taken from EA guidance on PFRAs).

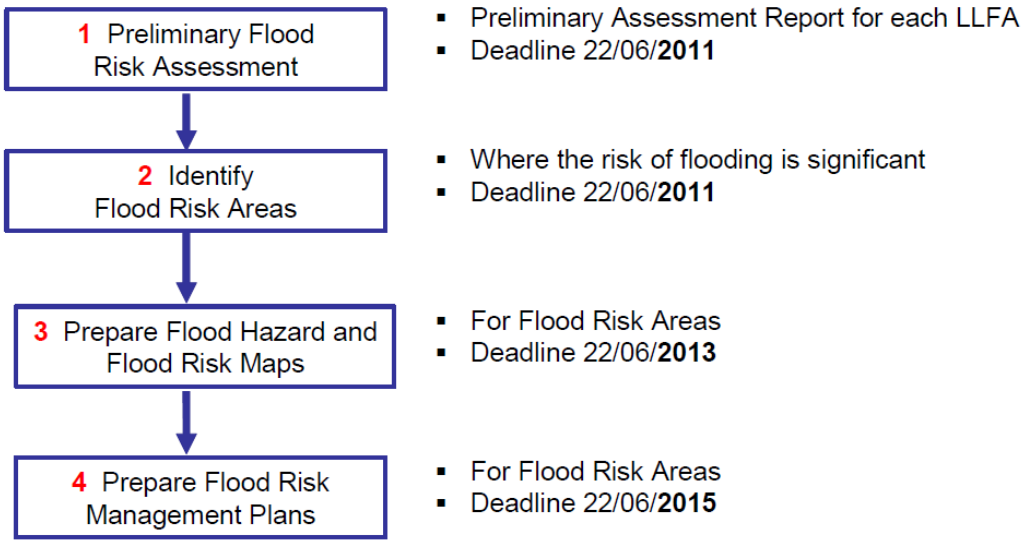

Figure 1: The stages of the Flood Risk Regulations

1.2 What is a Preliminary Flood Risk Assessment?

1.2.1 The first stage of the Flood Risk Regulations (2009) is the PFRA. The PFRA is a high level screening exercise to identify areas of most significant flood risk across Europe. There are four key steps which must be undertaken as part of the PFRA (1):

- **Assessment of past floods -** the PFRA should assess past floods which had harmful consequences for human health, economic activity or the environment or which could have harmful consequences if they were to occur now;

- **Assessment of future floods -** the PFRA should assess the possible harmful consequences of future floods and must take into account topography, watercourses, floodplains, defences, populated areas, economic centres and the impacts of climate change

- **Identification of 'flood risk areas' -** the PFRA should identify 'flood risk areas', which are locations considered to be most significantly at risk of flooding – the EA has defined criteria for identifying 'flood risk areas' and has provided 'indicative flood risk areas' on a national basis which should be used by LLFAs when undertaking their PFRAs.

- **Preliminary assessment report -** all of the information above should be captured in the preliminary assessment report, which is sent to the EA for publication.

[1] It should be noted that the PFRA should be based on 'available and readily derivable information' (http://publications.environment-agency.gov.uk/pdf/GEHO1210BTGH-e-e.pdf)

1.3 Overview of study area

1.3.1 Worcestershire is predominantly rural with a population centred around the main urban areas of Worcester, Kidderminster, Bromsgrove, Redditch, Evesham, Droitwich Spa, Stourport-on-Severn and Great Malvern, although there are also numerous other smaller towns, villages and scattered rural communities.

1.3.2 The County is drained almost entirely by the River Severn, which flows through the centre of Worcestershire from the north to the south. The majority of the County is of gentle topography, forming part of the broad River Severn basin, with the notable exceptions of the Malvern Hills, the Wyre Forest to the west of Kidderminster, the Clent Hills in the north-west of Bromsgrove and Bredon Hill in Wychavon.

1.3.3 The south of the County is largely underlain by impermeable Lower Lias clay and Triassic mudstones. By contrast, the north of the county includes a major aquifer due to the presence of Permian and Triassic sandstones beneath much of Wyre Forest, the west of Bromsgrove District and small parts of Wychavon and Malvern Hills and a minor aquifer due to the presence of Lower Old Red Sandstone beneath the western part of Malvern Hills.

1.3.4 Historical flooding records suggest that the major flood risk in Worcestershire is posed by watercourses flowing through urban areas such as the River Severn through Bewdley, Upton-upon-Severn, Stourport-on-Severn, and Worcester City, the River Avon through Evesham and the River Teme through Tenbury. However, there have also been many regular flooding events in scattered rural communities, often caused by surface water run-off.

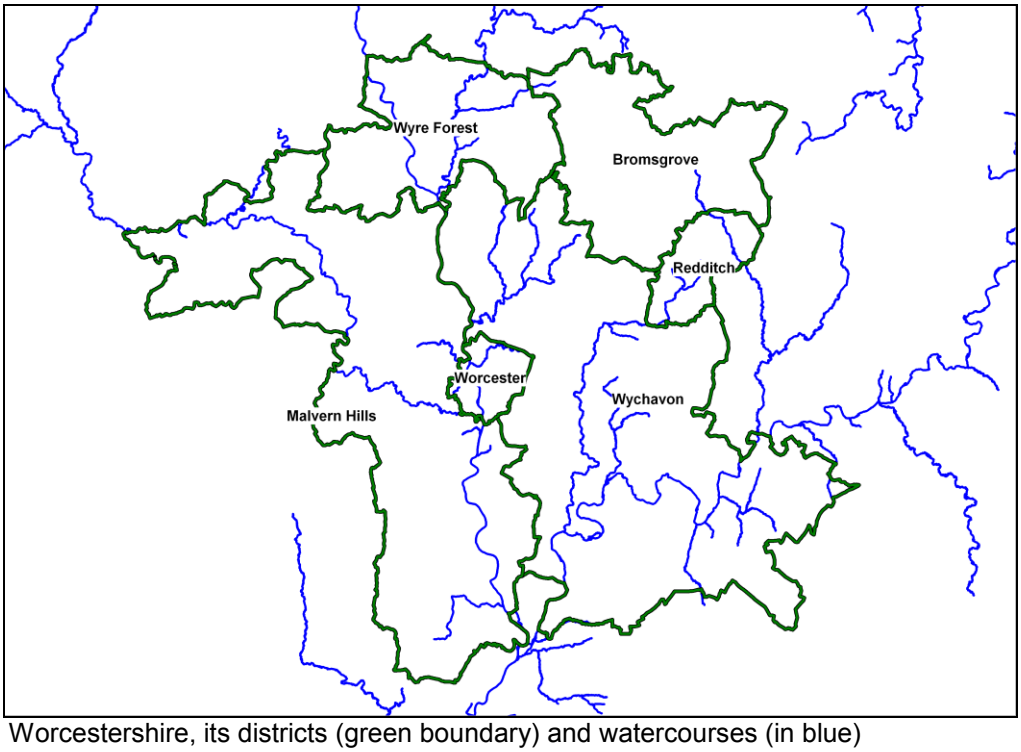

Figure 2: Worcestershire, its districts (green boundary) and watercourses (in blue)

2. Lead Local Flood Authority responsibilities

2.0.1 This section of the report outlines the model for partnership working which has been adopted in Worcestershire since 2007 and the level of engagement with partners for the PFRA. The responsibilities of the LLFA for the Flood Risk Regulations are described in section 1.

2.1 Partnership working

2.1.1 A partnership approach is the most efficient to co-ordinate local flood risk management activities. Strong local partnerships enable effective, efficient and integrated flood risk management activities and also allow for co-ordinated investments. Local flood risks can be complex in nature i.e. multiple sources and pathways managed by multiple organisations. Working in partnership is therefore essential to achieving optimum understanding of the risks, as well as integrated and efficient mitigation measures where multiple organisations are involved. By working collaboratively WCC and its partners gain an optimum understanding of local flood risks and identify and assess the most suitable risk management measures.

2.1.2 The Worcestershire Land Drainage Group (WLDG) was established in the wake of the 2007 floods and includes officers from County and District Council functions such as highways, emergency planning, strategic planning and land drainage, officers from the EA, STW, the NFU and the LSDB and landowner representatives. The Group works extremely well and focuses on an increasingly wide range of tactical and operational FRM issues.

2.1.3 In 2010 the Flood Risk Management Strategic Co-ordinating Group (FRMSCG) was established to focus on more strategic FRM issues. Alongside key officers from the local authorities and other relevant organisations, the Group also includes elected representatives from both WCC and the District Councils.

2.1.4 The work of the WLDG and the FRMSCG is informed by community groups and individuals and particularly parish councils, whose input into historic floodspot records and the development of resilience plans has been invaluable. The Local FRM Strategy will ensure thorough community engagement with all aspects of flood risk management in Worcestershire.

2.1.5 The flood risk management function has and continues to be thoroughly reviewed by the appropriate local authority Overview & Scrutiny processes through an annual review of progress and forthcoming actions.

3. Methodology and data review

As noted in chapter 1, the PFRA must assess both past floods and future floods. This section provides an overview of the available data for the PFRA and outlines the uses and restrictions of it.

3.1 Information gathered on 'past floods'

The key sources of information to assess past floods were:

- A series of workshops held with key officers from a range of partner organisations, many of whom have been involved in the management & recovery of flood events over a number of years.
- Information gathered from many affected Parish Councils.
- Interviews with key individuals
- Strategic Flood Risk Assessments (SFRAs) – Level 1 and 2
- Submissions from partner organisations including the EA, British Waterways (BW) and STW

3.1.1 All of this information has been recorded in WCC's Geographic Information System (GIS). This has led to the production of a map of over 1,500 historic floodspots, each of which has a range of attribute data including source, extent and impact of flooding and the status of investigation and mitigation works.

3.2 Information gathered on 'future floods'

The EA has produced two national surface water flood maps:

- The 'Areas Susceptible to Surface Water Flooding' national map (AStSWF) – this map, which covers England and Wales, was released in June 2009 to provide a general indication of areas which are more likely to suffer from surface water flooding, and;
- The 'Flood Map for Surface Water' national map (FMfSW) – this map, which covers England and Wales, was released in November 2010 and provides a revised approach to mapping surface water flooding including accounting for the presence of drainage systems and more realistic drainage paths being picked up by a more involved Digital Terrain Model (DTM) - buildings were included, for example.

3.2.1 Workshops with key land drainage officers from WCC and the six District Councils were held during which both of the above sets of data were studied in order to establish which most closely represented past and therefore likely future flooding in Worcestershire. Having concluded that the 'Flood Map for Surface Water' was the most accurate for the

whole of Worcestershire, an exercise was undertaken to prioritise the potential future flood spots which were indicated on it.

3.2.2 Although this prioritisation data is not required or recommended for inclusion in the PFRA it will form a valuable part of the ongoing SWMP and the Local FRM Strategy.

3.2.3 While local fluvial modelling of specific areas has been undertaken, as part of Level 2 SFRAs for example, these modelling studies all pertain to main rivers. There are no detailed fluvial models currently in the possession of WCC for the non-main rivers in Worcestershire.

Table 1: Main data sources used in the PFRA

Dataset	**Source**	**Availability / limitations of dataset**	**Systems to store data**	**Other relevant information, e.g. licensing, restrictions**
Historical flooding data from workshops, District Councils and Parish Councils	WCC, District Councils, Parish Councils, STW	More complete in some areas than others. Includes some anecdotal data	Available as GIS layer	No restrictions on use by WCC
Level 1 and Level 2 SFRAs in Worcestershire	District Councils	More complete in some areas than others. Includes some anecdotal data	Various GIS layers available as well as some reports	No restrictions on use by WCC
DG5 register	Severn Trent	Gives postcode locations only. Little data for large events	Register supplied as XL table with X and Y co-ordinates	For use by WCC and Halcrow only for PFRA and SWMP only
Areas Susceptible to Surface Water Flooding	EA	To be published on OS 1:50,000 or lower resolution background	GIS polygons	For FRM non-commercial use by WCC and partners up to 2013
Flood Map for Surface Water	EA	To be published on OS 1:25,000 or lower resolution background	GIS polygons	For FRM non-commercial use by WCC and partners
EA Flood Map Data (Flood Zones, Main rivers, historical flooding etc.)	EA	Disclaimer in licence	GIS polygons	WCC can read and use the data. EA retains intellectual property rights
Areas Susceptible to Groundwater Flooding	EA	Data automatically produced on a national scale	GIS polygons	For FRM non-commercial use by WCC and partners for PFRA
National Receptor Database	EA	Compiled from various sources - requires filtering	GIS layers	For FRM non-commercial use by WCC and partners
Chronology of British Hydrological Events	British Hydrological Society	Relies on external parties to add records	List	No restrictions

4. Assessment of past floods

4.1 Locally significant flooding

The PFRA guidance states that:

'LLFAs only need to record information on floods which had significant harmful consequences. Information on past floods often does not include information on the consequences, or the description is either vague or unreliable. Although no definition is provided in the legislation on what 'significant' means, LLFAs should be mindful of the significance criteria when determining whether past floods are harmful.'

4.1.2 Advice from the EA indicates that the threshold for past floods with 'significant harmful consequences' should be an order of magnitude lower than the significant threshold for 'future floods' (ie clusters of 30,000). Using this criterion would mean that past floods would need to have at least 3,000 people affected to be classified as having 'significant harmful consequences'.

4.1.3 However, the most significant events in living memory are those which occurred in June and July of 2007. Whereas previous events (such as that in April 1998) often struck one particular watercourse (in April 1998, the River Avon was particularly affected), in summer 2007 there were a large number of incidents recorded throughout the county from a range of sources. The flooding event in 2007 was extremely significant in terms of its impact on people, properties, businesses, infrastructure and the environment in Worcestershire. Over 4,700 properties were internally flooded during the event and, as a result and following advice from the EA, this flooding has been recorded in Annex 1 (Past floods worksheet) as a single event, although the impact was actually widespread and in a large number of individual locations.

4.1.4 However, in common with many other LLFAs, WCC believes that Worcestershire regularly experiences flood events which it considers to be 'locally significant'. Again in common with many other LLFAs, WCC has been using criteria which identify, as 'locally significant', any event in which:

- five or more properties flooded internally and / or;
- two or more non-residential properties flooded and / or;
- one or more critical infrastructure (e.g. hospital) flooded.

4.1.5 Using the first and third of these criteria 154 of the total 1,500 floodspots have been identified as being a high priority and these are listed in Annex 5. This number is likely to increase slightly when the second criteria is applied in due course.

4.1.6 Of these high priority flood spots or 'hotspots' nearly all have had some works completed, eg; gulley cleaning etc and over 90% have already been investigated in detail and have work planned or carried out. The remaining hotspots will provide the focus for WCC and

its partners for further future action in the short term followed by the remaining floodspots in the medium and longer term.

An excerpt from the historical floodspots map collated by WCC is shown in Figure 3.

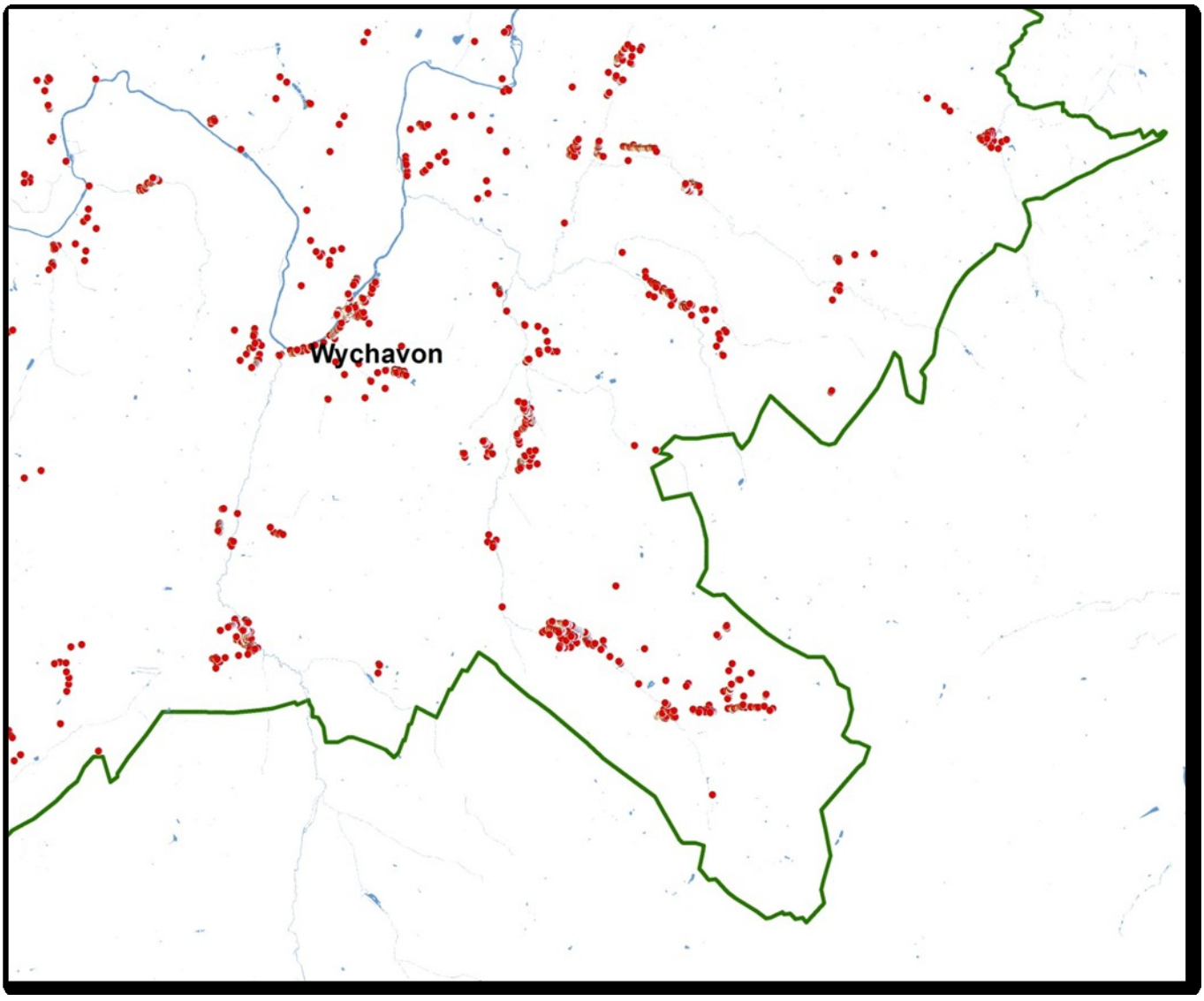

Figure 3: Excerpt from WCC's historic floodspot map showing some of the 1,500 floodspots

5. Assessment of future floods

5.1 Locally agreed surface water information

The PFRA guidance states that:

'LLFAs should: review, discuss, agree and record, with us [Environment Agency]*, water companies, IDBs and other interested parties, what surface water flood data best represents local conditions. This is known as 'locally agreed surface water information'. LLFAs should determine what 'locally agreed surface water information' means early within the PFRA process.'*

5.1.1 Various datasets pertaining to potential future flooding were examined, specifically the Flood Map for Surface Water (FMfSW) and Areas Susceptible to Surface Water Flooding (AStSWF). These were compared with known locations of historical flooding with representatives from each of the six districts during a series of workshops. Specific areas of interest were examined (see such an example in Figure 4) and a consensus was reached that the second generation FMfSW better represented potential surface water flood risk than the first generation AStSWF. While the AStSWF maps tended to show surface water gathering where there are existing watercourses (the intermediate scenario is shown with orange polygons in Figure 4), the FMfSW (the 200 year return period event, 300mm deep or greater, is denoted by green polygons in Figure 4) correlated better with areas of known historical flooding (shown by red dots in Figure 4).

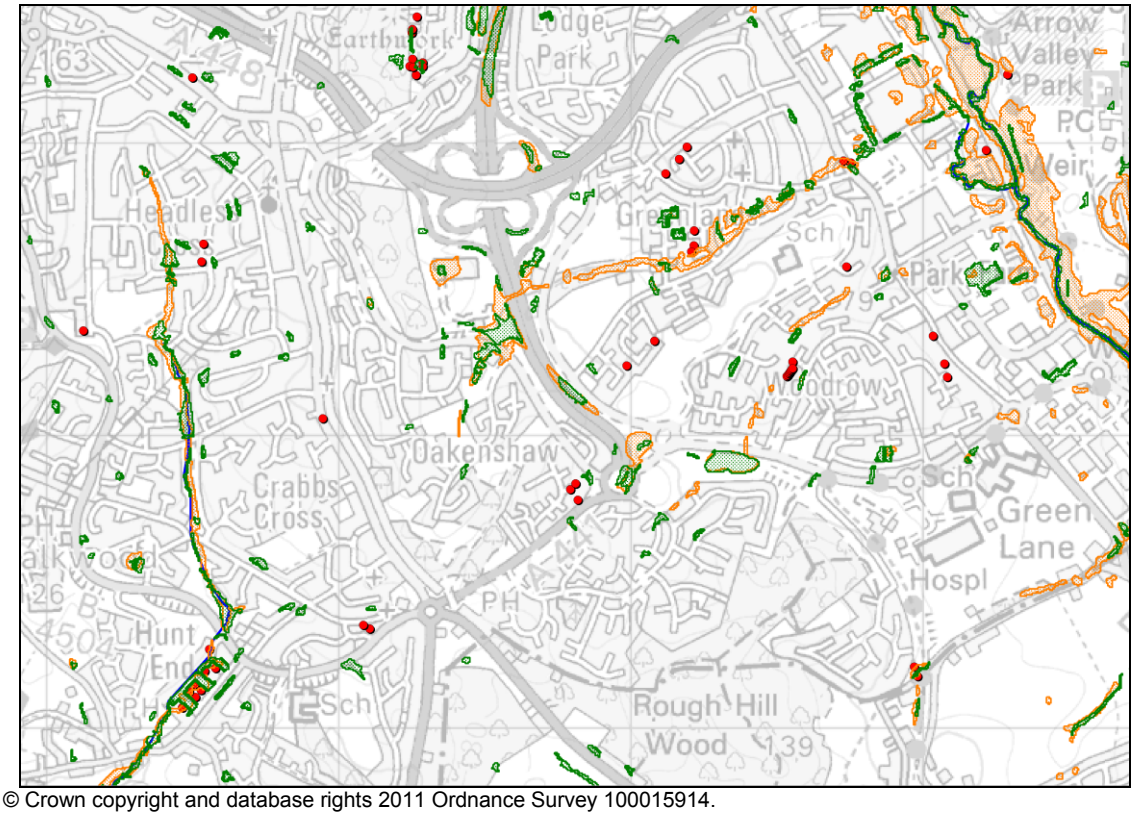

Figure 4: Example of the FMfSW map (green polygons denoting the 200 year return period scenario with the depth of flooding of 300mm or greater) and AStSWF map (orange polygons denoting) superimposed on WCC's collated historical floodspots (red)

5.2 Future floods in Worcestershire

5.2.1 When considering potential future flooding as part of flood risk management it is necessary to consider and communicate in terms of probabilities and impacts. Probabilities are often described in terms of return periods (a 1 in 30 year event, for example, would be an event with a 1 in 30 chance of happening in any given year), but there is always a degree of uncertainty associated with these projections. These are normally written as 30 year Return Period Event (RPE) Impacts are described in terms of the number and vulnerability of potential receptors.

5.2.2 As part of the PFRA process, WCC has analysed all existing data relating to potential future flooding in order to try to ascertain with the greatest accuracy the location, depth and frequency of potential future flooding. Part of this process included comparison of projections for future flooding with historical floodspots described in the previous section (Locally agreed surface water information). In order to make use of this analysis, the FMfSW data was used in preference to the AStSWF data in order to derive the potential impact of future flooding in each of Worcestershire's six districts (see the Future Floods tab in the PFRA spreadsheet in Annex 2).

5.2.3 While the data in Annex 2 will satisfy the reporting requirements of the PFRA, the ongoing SWMP will seek to look in more detail at potential future floodspots in the light of historical data in order to prioritise floodspots and concentrate any further works on areas of greatest risk, both in terms of the probability of flooding and its potential consequences.

5.3 The impacts of climate change

5.3.1 The impact of climate change on local flood risk is relatively poorly understood. Several national flood maps have informed the preliminary assessment report - specifically the Flood Map for Surface Water (surface runoff), Areas Susceptible to Surface Water Flooding (surface runoff), Areas Susceptible to Groundwater Flooding (groundwater) and Flood Map (ordinary watercourses). These do not show the impact of climate change on local flood risk.

5.3.2 There was consensus amongst climate model projections presented in the IPCC fourth assessment report for northern Europe suggesting that in winter high extremes of precipitation are very likely to increase in magnitude and frequency. These models project drier summers with increased chance of intense precipitation — intense heavy downpours interspersed with longer, relatively dry periods (Solomon et al., 2007).

5.4 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 rain storms 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%.

5.5 UKCP09

5.5.1 United Kingdom Climate Projections 2009 (UKCP09) provides the most up to date projections of future climate for the UK (http://ukclimateprojections.defra.gov.uk/). In terms of precipitation, the key findings are:

- by the 2080s, under Medium emissions, over most of lowland UK:
    - central estimates are for heavy rain days (rainfall greater than 25 mm) to increase by a factor of between 2 and 3.5 in winter, and 1 to 2 in summer;
- by the 2080s, under Medium emissions, across regions in England & Wales:
    - the central estimate (50% probability) for winter mean precipitation % change ranges from +14 to +23;
    - central estimate for summer mean precipitation % change ranges from -18 to -24.

5.5.2 Certain key processes such as localised convective rainfall are not represented within this modelling so there is still considerable uncertainty about rarer extreme rainfall events for the UK. We can be more certain that heavy rainfall will intensify in winter compared to summer. The proportion of summertime rainfall falling as heavy downpours may increase. The impact of these changes on local flood risk is not yet known.

5.6 Appraisal guidance

5.6.1 Current project appraisal guidance (Defra, 2006) provides indicative sensitivity ranges for peak rainfall intensity, for use on small catchments and urban/local drainage sites. These are due to be updated following the UKCP09 projections above. They describe the following changes in peak rainfall intensity; +5% (1990-2025), +10% (2025-2055), +20% (2055-2085) and +30% (2085-2115). This was reviewed by the Met Office in 2008 using

UKCP09 models (Brown et al., 2008). They suggest that, on the basis of our current understanding, these levels represent a pragmatic but not a precautionary response to uncertainty in future climate impacts. In particular for a 1 in 5 year event, increases in precipitation intensity of 40% or more by the 2080s are plausible across the UK at the local scale.

5.7 Key Projections for Severn River Basin District

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

- winter precipitation increases of around 12% (very likely to be between 2 and 26%);
- precipitation on the wettest day in winter up by around 9% (very unlikely to be more than 22%);
- relative sea level at Bristol 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 9 and 18%.

Increases in rain are projected to be greater at the coast and in the south of the district.

5.8 Implications for Flood Risk

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

5.8.2 Wetter winters and more of this rain falling in wet spells may increase river flooding along the Severn and its tributaries. 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, so we need to be prepared to react to the unexpected short term localised storms.

5.8.3 A number of drainage systems across the County have been modified to help improve the management of water levels and could help in adapting locally to some impacts of future climate change on flooding.

5.8.4 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.

5.9 Long term developments

5.9.1 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.

5.9.2 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".

5.9.3 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), but should be recorded here so that they can be reviewed in the future.

6. Review and identification of 'Flood Risk Areas'

6.0.1 The PFRA is a high level screening exercise to identify the most significant 'flood risk areas' across Europe. In England the following process has been undertaken by the EA to identify 'flood risk areas':

- England has been divided up into a 1km^2 grid;
- the EA 'FMfSW' has been used to count the number of people, number of non-residential properties and number of critical services at risk of surface water flooding within each 1km^2 cell;
- where a 1km^2 cell has more than 200 people and/or more than 20 non-residential properties and/or one of more critical service at risk of surface water flooding the cell is classified as a 'place above flood risk thresholds';
- clustering analysis has been undertaken to identify clusters of 1km^2 cells which are 'places above flood risk thresholds', and;
- where the cluster contains 30,000 people or more at risk of surface water flooding this has been classified as an 'indicative flood risk area'.

6.0.2 Using the EA criteria stated above, there are no 'Nationally Significant Flood Risk Areas' identified in Worcestershire for the purposes of the Flood Risk Regulations. WCC is not proposing to add any new 'Flood Risk Areas' for the PFRA. It should be noted that a large part of the West Midlands (which borders Worcestershire) is considered as a Flood Risk Area and some of the 1km2 cells that form this cluster straddle the Worcestershire boundary. This is due to the way that the Flood Risk Area for the West Midlands has been delineated and it has therefore been agreed that these areas on the boundary do not represent the areas of greatest flood risk in Worcestershire and that technically there is no area of 'Nationally Significant Flood Risk' within the County boundary. However, WCC and its partners will co-operate in any reasonable way with flooding issues across the border which are either caused or contributed to by water from Worcestershire.

7. Next steps

7.0.1 The PFRA process, will undergo internal review and scrutiny by WCC before being submitted for EA review. The aim is that this report will adequately illustrate the significant flood risk in Worcestershire such that it may be a useful stepping-stone towards developing a useful and live Local FRM Strategy, while also satisfying the reporting requirements for the Flood Risk Regulations and the EU Floods Directive.

7.0.2 In accordance with the Flood Risk Regulations the PFRA is to be reviewed on a 6 yearly cycle. To support the review of the PFRA every six years, WCC will be developing a local Flood Risk Management Strategy, drawing on this PFRA study as well as the ongoing SWMP. Specific aspects of this over-arching strategy that will inform future PFRAs include:

- developing an online GIS mapping tool to capture, view and edit relevant information on flood risk management, including flood incident and asset data – all local flood risk management partners will be able to access the tool to view, edit and add flood incident and asset data relevant to local flood risk management;
- developing detailed Surface Water Management Plans in the areas most vulnerable to surface water flooding in Worcestershire, and;
- continuing to build close partnership working with local flood risk management partners to better understand and alleviate flood risk in Worcestershire.

7.0.3 The Local FRM Strategy within Worcestershire will also see WCC, as a LLFA, beginning to fulfil its broader responsibilities including data collection, developing an asset register for FRM assets, designating assets where necessary and becoming the SUDs Approval Body for developments within the County boundaries.

Annexes

Annex 1: Records of past floods and their significant consequences (Preliminary Assessment Report Spreadsheet)

(See separate XL file named ‘PFRA Annex 1- records of past floods.xls’.)

Annex 2: Records of future floods and their significant consequences (Preliminary Assessment Report Spreadsheet)

(Separate XL file named ‘PFRA Annex 2 – Future flooding.xls’)

Annex 3: Flood Risk Areas

(Nil return – see section 6)

Annex 4: Review Checklist

(See separate XL file named ‘PFRA Annex 4 - PFRA Checklist.xls’.)

Annex 5: High priority flood hotspots

(See separate XL file named ‘PFRA Annex 5 - high priority flood hotspots.xls’.)

Annex 6: Excerpts from the Chronology of British Hydrological Events

(Separate XL file named ‘PFRA Annex 6 – Excerpt from BHS Hydrological Chronology')