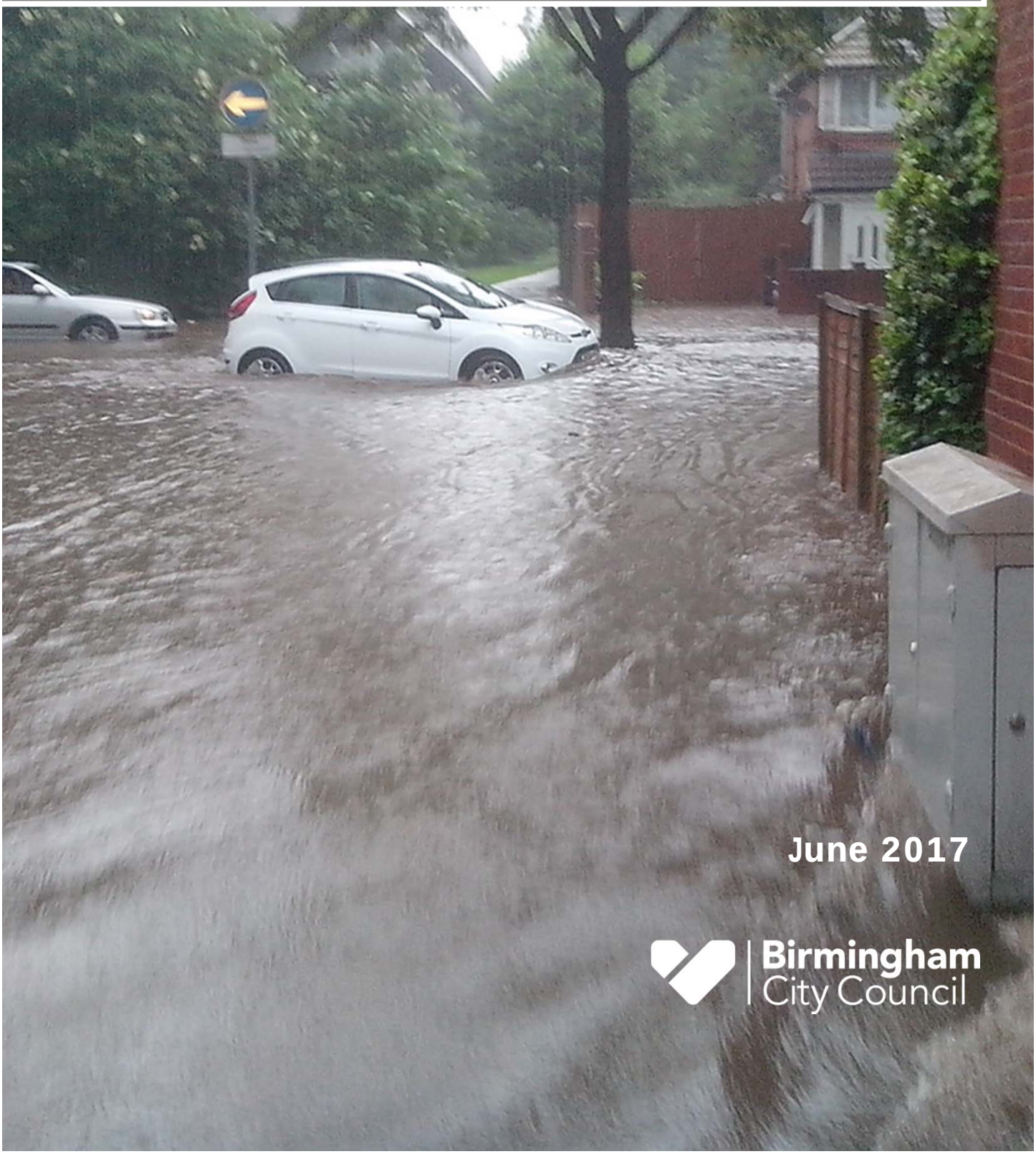
Birmingham City Council

Preliminary Flood Risk Assessment



June 2017

Birmingham City Council

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Document History

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Abbreviations

Term	Meaning / Definition
The Act	Flood and Water Management Act 2010
BCC	Birmingham City Council
BGS	British Geological Society
C@R	Communities at Risk
Defra	Department for Environment, Food and Rural Affairs
FMfP	Flood Map for Planning
FRA	Flood Risk Area
FRR	Flood Risk Regulations
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
PFRA	Preliminary Flood Risk Assessment
The Regulations	The Flood Risk Regulations 2009
RoFRS	Risk of Flooding Rivers and Seas
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
STW	Severn Trent Water
SWMP	Surface Water Management Plan

Executive Summary

This report has been prepared by Birmingham City Council to meet the requirements of the Flood Risk Regulations (2009). Under the regulations Lead Local Flood Authorities are responsible for undertaking a Preliminary Flood Risk Assessment (PFRA) for local sources of flood risk, primarily from surface water, groundwater and ordinary watercourses. The LLFA is not instructed to assess the risk from Main Rivers, the sea and large raised reservoirs as part of this review; this is the responsibility of the Environment Agency.

The PFRA is a high level screening exercise which entails collecting information on past (historic) and future (predicted) floods, assembling it into a PFRA report and using it to identify Flood Risk Areas which are areas where the risk of flooding is significant.

Birmingham City Council completed a PFRA in 2011. This report meets the requirements of the second round of the six year Flood Risk Regulations cycle.

Flood risk data for historic flood events has been collected and mapped. Based on the evidence collected the flooding events of June 2016 were considered to have had ‘significant harmful consequence’ as defined by the guidance as result of the combined effect of 3 flood events in 8 days. Flooding events also occurred in June 2012 and July 2013, these are considered notable at a local level but are not required to be reported to Europe.

Future flood risk data has also been mapped for predicted flooding from surface water and groundwater, this has been undertaken using national datasets. Details of future surface water floods and their consequences in terms of the number of people, businesses and critical services affect are outlined.

The Environment Agency has used the criteria defined by Defra to determine indicative Flood Risk Areas across England. The majority of the Birmingham City Council administrative area is covered by the Flood Risk Area for Birmingham, with the exception of Sutton Coldfield. Birmingham City Council has reviewed this flood risk area and considers that this does provide an appropriate representation of the flood risk to Birmingham.

1. Introduction

1.1 Scope

Flood Risk Management Plans (FRMPs), as required by the Flood Risk Regulations 2009 (FRR)[1], play an important part in how we protect lives and livelihoods from the risk of flooding. The plans give us an opportunity to bring together information about all sources of flooding and the measures and actions being considered to manage risk and improve resilience.

Lead Local Flood Authorities (LLFAs) worked with the Environment Agency to publish the first set of FRMPs, covering the 10 river basin districts in England, on 17 March 2016. These plans set out how risk management authorities are working together, and with communities, to manage flood and coastal risk over the next 6 years up to December 2021.

We now need to review, and where needed, revise our risk assessments, maps and plans. By doing this we can make sure we improve the quality of flood risk management across England to reflect improving flood risk information and knowledge (including climate change predictions) and lessons from the floods we experience.

The FRR implement the EU Floods Directive in England. They provide a framework for managing flood risk over a 6 year cycle, comprising:

- preliminary flood risk assessment (PFRA)
- identification of areas of potential significant risk, referred to as flood risk areas (FRAs)
- mapping of flood hazards and risk and
- Flood Risk Management Plans (FRMPs), setting out measures and actions to reduce the risk

The FRR state that each of the above four elements must be reviewed, and updated where necessary, at least every 6 years.

Birmingham City Council completed a PFRA in 2011. All LLFAs are now required to review their PFRAs by 22 June 2017, as required by the FRR.

Under the regulations and in line with the Flood and Water Management Act[2] (the Act) which gained Royal Ascent in April 2010, LLFAs are responsible for undertaking a PFRA for local sources of flood risk, primarily from surface water, groundwater and ordinary watercourses. The LLFA is not responsible for assessing the risk from Main Rivers, the sea and large raised reservoirs; this is the responsibility of the Environment Agency. However the interaction of flooding from Main Rivers and reservoirs with local sources will need to be taken into account, this is particularly important in the highly urbanised catchment of Birmingham where flooding regularly occurs as a result of interaction from several sources.

The PFRA is a high level screening exercise which entails collecting information on past (historic) and future (predicted) floods, assembling it into a PFRA report and using it to identify Flood Risk Areas which are areas where the risk of flooding is significant. The PFRA will draw on historic information from a variety of sources, however of particular relevance are the draft Local Flood Risk Management Strategy (LFRMS), the Birmingham Surface Water Management Plan (SWMP) and the Section 19 Flooding Investigation following the June 2016 floods.

[1] http://www.legislation.gov.uk/uksi/2009/3042/regulation/17/made
[2] House of Lords and House of Commons, Flood and Water Management Act 2010

The PFRA forms part of a six year cycle of planning based on a four stage process as outlined in Table 1.1.

Stage	Requirement	Submission Date
1	Prepare **Preliminary Flood Risk Assessment**	22nd June 2017
2	Identify **Flood Risk Areas**	22nd June 2017
3	Prepare **Flood Hazard Maps** and **Flood Risk Maps** for each Flood Risk Area	22nd June 2019
4	Prepare **Flood Risk Management Plans** for Each Flood risk Area	22nd June 2021

Table 1.1 - Work Required under the Flood Risk Regulations 2009

1.2 The Study Area

The study area is defined by BCC's administrative boundary of nearly 270km^2 which is located in the centre of the West Midlands region. This is the largest local authority in both the United Kingdom and Europe with a population of over 1 million (2006 estimate). Against this background, it is not surprising that much of the study area is urbanised and is neighboured by several other large conurbations, including Solihull, Wolverhampton, Coventry and the towns of the Black Country.

The study area falls primarily into the Humber River Basin District, however 0.5% of the study area to the south-west of the conurbation drains to the Severn River Basin District. The Area is served by the Environment Agency West Midlands Area and Severn Trent Water.

1.3 Aims and Objectives

The aim of this PFRA is to provide an updated assessment of the local flood risk for the Birmingham administrative area and to review the national assessment of Flood Risk Areas provided by the Environment Agency.

The objectives of the PFRA are:

- to identify relevant partner organisations involved in flood risk within Birmingham and the partnerships in place;
- to demonstrate that appropriate flood risk data collection and management systems are in place;
- to collate information on past and future floods and agree which information best represents the surface water flood risk; including summarising the main changes in understanding of risk for the area compared to 2011;
- to record information on past and predicted future flood events since 2011 with significant consequence; and
- to review the indicative Flood Risk Areas provided by the Environment Agency using local information and provide justification for any proposed amendments.

2. Lead Local Flood Authority Responsibilities

2.1 Introduction

This section provides an overview of the governance and partnership arrangements in place within Birmingham. It also outlines the plans in place for stakeholder and public communication.

2.2 Governance and Partnership Arrangements

The Pitt Review[3], the subsequent Flood and Water Management Act 2010[2] and the Flood Risk Regulations 2009[Error! Bookmark not defined.] identify that partnership working is essential in the management of local flood risk. To ensure the effective management of not only the PFRA process, but flood risk management as a whole, Birmingham City Council has developed partnerships with Severn Trent Water, the Environment Agency and other key stakeholders over a number of years.

Birmingham has worked with its partner organisations to develop a three tiered approach to managing flood risk. Figure 2.1 shows the three tiered structure.

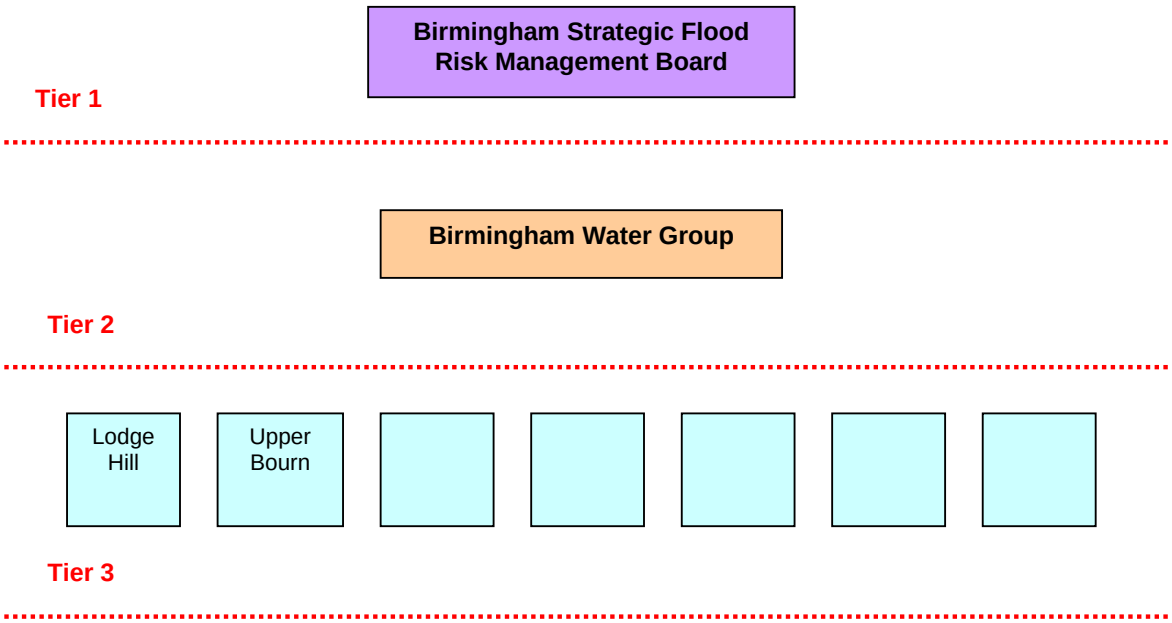

Figure 2.1 – Birmingham Three Tiered Flood Risk Management Structure

[3] Pitt, M. (2008) – *Learning Lessons From the 2007 Summer Floods*, Cabinet Office, London

2.2.1 Upper Tier – Birmingham Strategic Flood Risk Management Board

The Strategic Flood Risk Management Board is a Member-led partnership with representatives from Birmingham City Council, Severn Trent Water and the Environment Agency. It aims to set the strategic policy and agree investment priorities and service targets for managing and mitigating flood risk in Birmingham.

A Memorandum of Understanding has been developed to encourage the essential sharing of information amongst the Group members in an efficient and effective way, and to set the governance rules to ensure that no party's confidentiality, intellectual property rights or commercial interests would be compromised.

2.2.2 Middle Tier – Birmingham Water Group

The Birmingham Water Group is an operational level group with senior officers and specialists from Birmingham City Council, Severn Trent Water, the Environment Agency and other risk management authorities, representing all relevant flood risk management work areas, including; drainage engineers, planners, emergency planners, development control, flood risk mapping, asset management, climate change adaptation and green infrastructure. The aim of the group is to ensure a joined up approach to all flood and water management activities within and across each organisation.

2.2.3 Lower Tier – Project Specific Partner Groups

Individual project specific groups meet to discuss local drainage and flooding issues and solutions. This approach ensures that issues and concerns are communicated to those who need to deal with them. Progress, news and events are shared at regular meetings.

A number of projects have been delivered through this process including the Surface Water Management Plan. The current projects underway with their own project specific partner groups include:

- Lodge Hill Flood Alleviation Scheme
- Upper Bourn Strategy

3. Methodology and Data Review

3.1 Introduction

The PFRA should be based on readily available or derivable data. The data collection, availability, limitations and methodology for sharing data are outlined in this section.

3.2 Data Collection & Quality

Birmingham established a data register during the development of the 2011 PFRA which records the type of data, source, format and quality. The data register is also a valuable tool for identifying gaps in the data.

The quality of the data is assessed using the data quality scoring system provided in the SWMP Technical Guidance[4] as outlined in Table 3.1. It is important to understand the quality of the data so that any uncertainty or perceived weakness is understood and available for consideration during the assessment stage.

Data Quality Score	Description	Explanations	Example
1	Best possible	No better available; not possible to improve in the near future	High resolution LiDAR River/sewer flow data Rain gauge data
2	Data with known deficiencies	Best replaced as soon as new data are available	Typical sewer or river model that is a few years old
3	Gross assumptions	Not invented but based on experience and judgement	Location, extent and depth of surface water flooding Operation of un-modelled highway drainage 'future risk' inputs e.g. rainfall, population
4	Heroic assumptions	An educated guess	Ground roughness for 2d models

Table 3.1 – SWMP Data Quality Scoring System

The current BCC data register is outlined in Table 3.2. Not all of the data listed in the table is directly relevant to the PFRA, some of it has been used for other flood risk management purposes.

3.3 Data Sharing, Security and Restrictions

Birmingham regularly shares and requests data from its partners. Data from partner organisations is shared and used in accordance with the licensing and confidentiality agreements stipulated by

[4] Defra (2010) – Surface Water Management Plan Technical Guidance

the partners. Birmingham keeps a register of data sharing agreements that have been entered into.

3.4 Public Asset Register

Lead Local Flood Authorities are required, under Section 21 of the Flood and Water Management Act 2010, to 'establish and maintain a register of structures or features which, in the opinion of the authority, are likely to have a significant effect on a flood risk in its area. The Act also requires that the lead local flood authority must arrange for the register to be available for inspection at all reasonable times.

Birmingham have developed a web-based system that is accessible to the public at all times[5], it brings together information about flood risk assets that are managed by a number of Flood Risk Management Authorities.

The asset register shows structures and features that are important to managing flood risk (such as flood defence wall, storage tanks, balancing ponds, land drainage, highway drainage) along with the relevant Flood Risk Management Authority responsible for their maintenance.

The Flood and Water Management Act requires that only significant assets are included on the register, therefore every asset in Birmingham will not be shown. Furthermore there may be significant assets which we are not aware of at the present time, therefore the asset register will be updated regularly, and additional information will be added as it is identified.

Assets on the register are inspected on a frequency dependent on the level of risk and likelihood of failure/blockage. The inspections range from 6 monthly for structure such as trash screens up to 10 years for large culverts.

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[5] www.birmingham.gov.uk/floodassets

Source	Data Type	Description of Data	Data Provided	Quality Score	Reason
Birmingham City Council	Ordnance Survey Data	Digital mapping provided by Ordnance Survey	MasterMap 2009	1	No better data available
			Street Gazetteer 2009		
			1:10,000		
			1:50,000		
	BCC Boundary Data	Digital mapping of the Birmingham administrative boundary	Birmingham City Boundary	1	Confirmed BCC administrative boundary
	Historic Flooding Records	Historic flooding records of flooding	Flooding Records	2	Limitations as only based on returned flood questionnaires
	Water Features Layers	Digital mapping of water features within Birmingham administrative boundary	Ordinary Watercourse Open Channel	2	Best data available at present time, however may be some missing data particularly in relation to small watercourses and pools. May also be errors in data particularly in relation to location of culverts.
			Ordinary Watercourse Culvert		
			Canals		
			Canal Tunnel		
			Canal Feeder		
			Canal Feeder Tunnel		
			Reservoirs		
			Covered Reservoirs		
			Raised Water Bodies		
			Pools		

Source	Data Type	Description of Data	Data Provided	Quality Score	Reason
	Gully maintenace records	All the locations where gullies have been cleaned within two working days of a daily gauged rainfall exceeding 25mm at Frankley and Saltley gauges	Gully Cleansing over 25mm Rainfall	2	Data interpolated from rainfall records and highway maintenance records, therefore may be some deficiencies.
	Amey Gully Data	All the locations where new gullies have been installed between 1999-2010, as a means of highlighting where surface water flooding is/has been problematic	New Gullies	2	No better data available. Needs updating with gullies added since 2010.
	Road Classifications	Traffic sensitive roads within Birmingham:	Winter Gritting Route 07:00-19:00, 7 days a week;	1	No better data available
			Winter Gritting and Christmas Embargo Route 24 Hours a day 7 days; and		
			Tourist Route 24 Hours a Day, 7 days a week		
	Drainage Asset Records	Birmingham City Drainage Assets	Grills	2	No better data available, based upon local knoweldge and new scheme data uploaded - Including Ownership Knowledge
			Gullies		
			Reservoirs		
			Storage		
			Structures		
			Channels		
			DefenceWalls		
			Drainage (Aco, Beany, Linear)		

Source	Data Type	Description of Data	Data Provided	Quality Score	Reason
	Integrated Modelling	Modelling from SWMP and other strategies	Cole Integrated Model - Feb 2013	2	Based on sewer models from 2012/13 which have since been updated
			Hockley Brook - Feb 2014		
			SWMP Outlines Oct 14		
External Data	External Blue Sky Data with BCC Analysis	Tree Coverage	Tree Canopy Tree Cover %	2	No better analysis available
			Blue Sky Data	2	Tree Canopy Mapping Most Accurate available
			Street Cleaning Route Data Set	2	Data analysed by Buffer
Canal and River Trust	Breach and Overtopping Records	Historic flooding records of breach and overtopping of canals	Overtopping	1	No better data available
			Breaches		
	Canal Features	Digital mapping of canal features within Birmingham administrative boundary	Locks		
			Sluices		
			Weirs		
			BW_Waterways		
Severn Trent Water	Sewer Network	Digital mapping of Severn Trent sewer network within Birmingham administrative boundary	culverted watercourse manhole_all	2	Data several years old, request made for updated dataset
			foul_combined manhole_all		
			highway drain manhole_all		
			highway drain pipe_all		
			MapInfoAllSTWStormWater_ManholesAppendTable_all		
			private manhole_all		
			public surface water manhole_all		
			Section 18 manhole_all		
			Section 24 manhole_all		
			Section 104 manhole		
			Western_Boundary_all		

Source	Data Type	Description of Data	Data Provided	Quality Score	Reason
Environment Agency	Flood Map for Planning	Digital mapping of Environment Agency features and flood risk data within Birmingham administrative boundary	flood-map-for-planning-rivers-and-sea-flood-zone-2	1	No better data available
			flood-map-for-planning-rivers-and-sea-flood-zone-3		
	Risk of Flooding from Rivers and Seas		risk-of-flooding-from-rivers-and-sea1		
	Flood Storage Areas		flood-map-for-planning-rivers-and-sea-flood-storage-areas		
	Flood Warning Areas		flood-warning-areas		
	Risk of Flooding from Surface Water		flood-map-for-surface-water-1-30		
			flood-map-for-surface-water-1-100-rainfall (Unpublished not available)		
			flood-map-for-surface-water-1-1000-rainfall (Unpublished not available)		
	Statutory Main River Map		statutory-main-river-map1		
	Detailed River Network		Detailed river Network (DRN) (Unpublished not available)		
British Geological Society	Infiltration SuDS Map	Digital mapping of soil suitability for infiltration	Drain	1	No better data available
			Severe_Constraints		
			Stability		
			Water Quality		
	Groundwater Susceptibility	Digital mapping of susceptibility to groundwater flooding	Groundwater Flooding	1	No better data available

Table 3.2 – Flood Risk Management Data Register

4. Past Flood Risk

4.1 Introduction

This section summarises relevant information on all past floods. It also considers whether Birmingham has experienced floods which are considered to have 'significant harmful consequences'

4.2 Historic Flood Risk in Birmingham

A dataset has been collated to assess the local historic flood risk in Birmingham; this includes flooding from watercourses, surface water and groundwater. However due to the urbanised nature of the Birmingham catchment there are often significant interactions between sources of flooding and it is not always possible to ascertain the source of the flooding, therefore the type of flooding is not defined. As the PFRA should only consider local sources and exclude Main River this can often be difficult in Birmingham as Main River flooding is often combined with flooding from ordinary watercourses and localised surface water flooding. Therefore all historic incidents of flooding, including that which is considered to be primarily from Main River is included in the data, as there will inevitably have been interaction with surface water flooding.

4.2.1 Historic Records

Historical flooding records provide a source of data that indicates the date, location and depth of flooding. Recent years have seen a number of flooding events affecting Birmingham; September 1998, April 1999. June 1999, July 2000, June 2005, June 2007, July 2007 and September 2008. Since the 2011 PFRA 5 further flooding events have occurred, June 2012, July 2013 and three events in June 2016.

This data is presented in Figure 4.1 and shows all reports of internal property flooding across Birmingham.

Birmingham City Council also publishes its historic flooding online[6], to protect the sensitivity of this data and to build up an understanding of the areas that are susceptible to flooding, this has been plotted using postcode polygons whereby each polygon represents one or more properties which have flooded. Each polygon contains data on the number of flooding incidents and the date of each incident.

4.3 Consequences of Historic Flood Risk

The Regulations require PFRAs to include information on past floods that had significant harmful consequences and which could occur again. This is separate from the identification of Flood Risk Areas which is based on Defra guidance providing a national perspective of significant (potential) flood risk.

The guidance states that only past floods with 'significant harmful consequences' of a level sufficient to justify reporting to Europe must be considered in the preliminary assessment report and recorded in the Annex 1 spreadsheet. However this does not preclude LLFAs making reference to the occurrence of less severe flooding in general terms in the report if this is considered relevant and useful for a more complete picture.

[6] https://localview.birmingham.gov.uk/Highways/Sites/Drainage/#

In the development of the 2011, PFRA, the following factors were considered as defining a flood as having “significant harmful consequences”:

- The flooding registered on a national scale even if only occurring over a relatively small area. The aim being to avoid recording large numbers of historic floods where the consequences were moderate or low or unlikely to occur again due to risk reduction actions having been taken.
- The flooding event was memorable or notable (Summer 2007, Easter 1998)
- The flooding is considered considerable when taking into account the scale of flooding, its harmful consequences (for human health, economic activity and the environment) and the level of response (e.g. it involved the formation of the strategic co-ordinating group)
- The impact of the flooding was severe. For instance, internal flooding of a large number of properties is likely to be considered significant, but flooding to a large number of gardens is not.
- The quality of the historic information is sufficient to determine if there were 'significant harmful consequences.'

In reviewing the data provided in Section 4.2, a series of three flood events in eight days in June 2016 are considered to have had “significant harmful consequences”. Two of these three storms were very significant and therefore will be recorded in Annex 1, the Preliminary Assessment Spreadsheet. The flooding records for June 2016 are shown in Figure 4.2. However it is important to note that many of the floods identified by the historic flooding records are still viewed as notable at a local level but are not required to be recorded in Annex 1 or reported to Europe.

A number of storms occurred in June 2016 across the West Midlands which impact many areas, including Birmingham. The storms which occurred were typical of summer storms in the UK, with them being short, intense and highly localised storms.

As a result of these storms, a significant number of flooding incidents were reported to Birmingham City Council. Immediately following the events, Birmingham City Council distributed ‘Flood Surveys’ to all residents within, or in close proximity, to all areas where flooding was reported. Over 700 responses were received, providing accounts of duration and depth of flooding along with any other pertinent information.

These responses reported flood incidents which included internal property flooding, flooding to gardens and flooding to highways and surrounding areas. In total, 435 incidents of flooding were reported, with 23 areas identified to have experienced internal property flooding.

As part of its duties under Section 19 of the Flood and Water Management Act, Birmingham City Council, in partnership with the Environment Agency and Severn Trent Water, has undertaken an investigation in each of the 23 areas where internal property flooding was reported, to determine the most likely cause of flooding and the actions that have been completed, or are proposed to be completed in the future. This information is summarised in the June 2016 Flooding: Section 19 Investigation report[7]

[7] www.birmingham.gov.uk/floodincidents

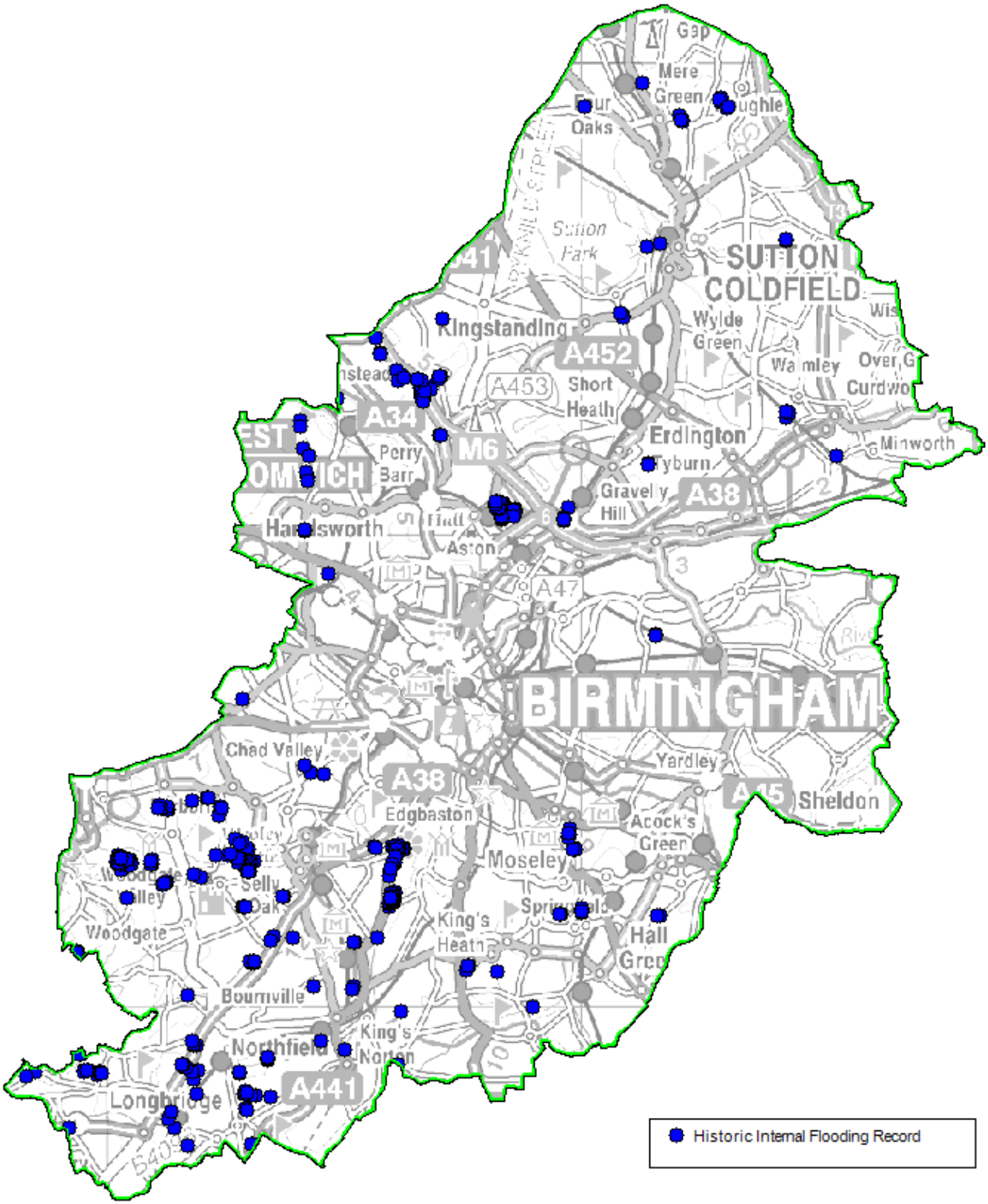

Figure 4.1 –Historic Flooding Locations

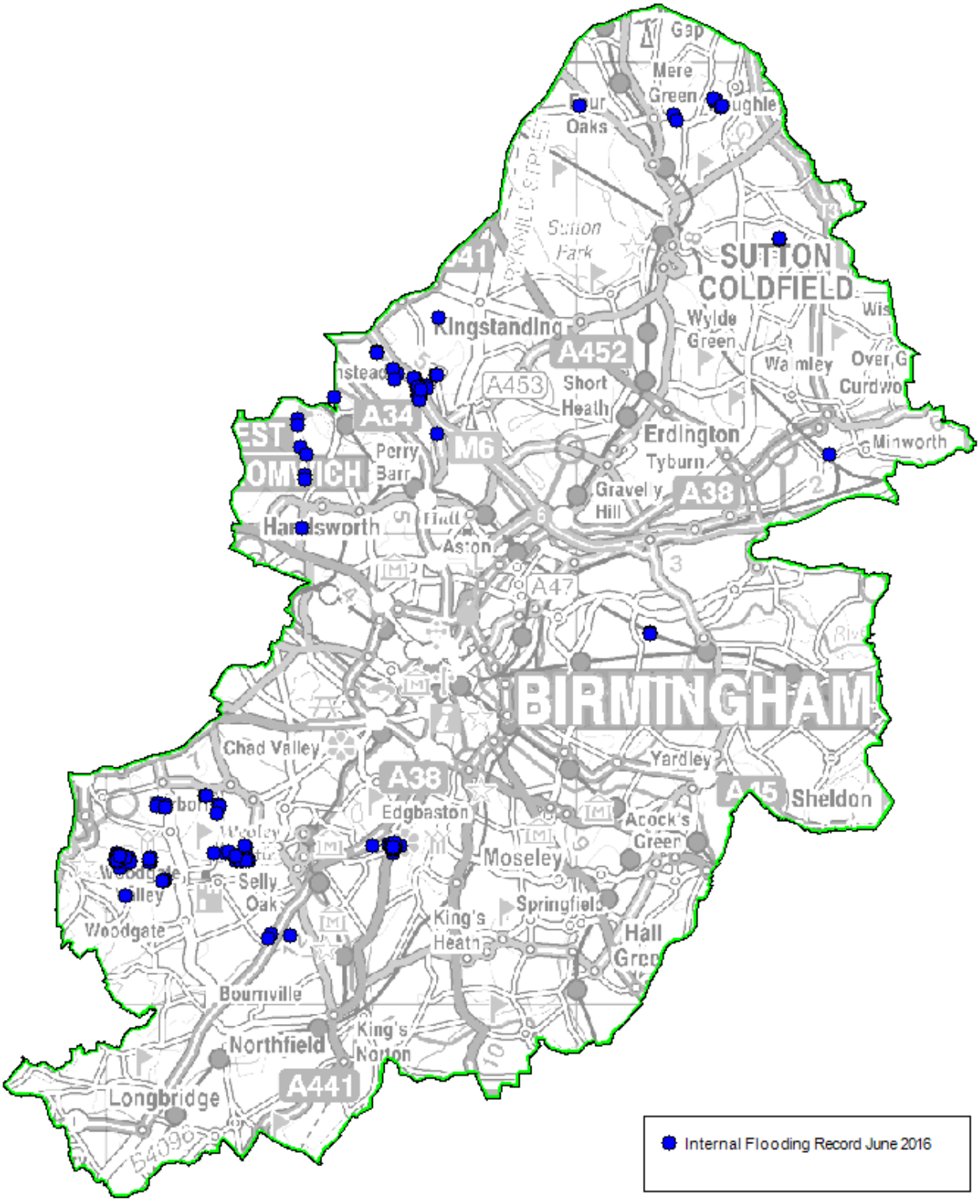

Figure 4.2 - Historic Flooding of Significant Consequence

5. Future Flood Risk

5.1 Introduction

This section summarises all relevant information on future flood risk in Birmingham including climate change.

5.2 Surface Water Flood Risk

5.2.1 National Information on Surface Water Flood Risk

The Environment Agency has produced the Risk of Flooding from Surface Water (RoFSW) dataset which shows predicted surface water flooding.

The dataset is based on a bare earth model edited to account for buildings, roads, flow paths through structures and surface cover.

The mapping shows areas where surface water would be expected to flow or pond.

Three rainfall events, with probabilities of 3.3% (1 in30), 1% (1 in 100) and 0.1% (1 in 1000) chance of occurring in any year are modelled and mapped.

For each rainfall probability, flood extents are derived; model results are also produced for depth, velocity, hazard rating and flow direction for maximum velocity.

5.2.2 Local information on Surface Water Flood Risk

As part of the SWMP for Birmingham, maps have been developed that indicate the areas shown to be at risk of surface water flooding from a number of sources. This data does not cover the entire City, just those areas that were considered to be at the most significant risk of surface water flooding.

The flood extents are based on detailed hydraulic models that take account of rivers, minor open watercourses and piped networks of culverted watercourses and public sewers. When rainfall is applied to the model, it flows through the systems and floods where they become overloaded. The flow of flood water across the surface is also modelled in key areas, so that flood depths, speed and direction can be plotted.

The SWMP modelling assesses flooding scenarios as a result of rainfall with the following chance of occurring in any given year (annual probability of flooding is shown in brackets):

- 1 in 30 (3.3%)
- 1 in 100 (1%)
- 1 in 200 (0.5%)

The peak depths are mapped to produce the flood outline maps. Depths of flooding less than 0.1m have been excluded for clarity. In addition, these would be unlikely to affect properties and would be seen as normal overland flow or puddles in the heavy rainfall that has been modelled.

5.2.3 Locally Agreed Surface Water Information

The Environment Agency guidance on surface water flood risk information recommends that Lead Local Flood Authorities should review, discuss, agree and record with partners what surface water information best represents local conditions, this is known as ”locally agreed surface water information”.

Birmingham’s locally agreed surface water information will consist of the RoFSW maps overlaid by the SWMP maps in areas where detailed studies were carried out.

The reasoning is that the SWMP process has taken account the effect of the drainage system in much greater detail than the RoFSW maps process in the areas modelled. This means that the results should be more representative of local risk. Outside these areas, we have no specific results to plot, so the maps are the best available. Users may wish to interpret these in the light of comparisons in the detailed areas and to decide accordingly what additional information they may need to assess flood risk.

Figure 5.1 shows the RoFSW map and highlights the areas where SWMP maps are available.

5.3 Groundwater Flood Risk

5.3.1 National Information on Groundwater Flood Risk

In response to the need for more information on groundwater flooding, the British Geological Society (BGS) has produced the first national hazard or susceptibility data set of groundwater flooding. The data is based on geological and hydrogeological information and can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface.

Although this is not a risk data set in that it does not provide information about the likelihood of a groundwater flood occurring, it can be used to provide an understanding of groundwater flooding. The five susceptibility zones are shown in the Table 5.1.

This data is presented in Figure 5.2 and shows the areas at high or very high susceptibility to groundwater flooding are illustrated.

Geological Class	Susceptibility
1	Very High
2	High
3	Moderate
4	Low
5	Very Low
No data	No susceptibility

Table 5.1 –Groundwater Susceptibility Zones

5.3.2 Local Information on Groundwater Rebound

Local information on groundwater flood risk is based on the CIRIA Special Publication 92 (1993) Titled: Rising Groundwater Levels in Birmingham and the Engineering Implications[8].

The study found that the Triassic Sandstones that underlie much of the city of Birmingham are water bearing and were used for well over a century as a major source of supply for local industry and commerce, and originally also for local public water supply. Between about 1860 and 1930 many wells and boreholes were sunk to meet the needs of industrial development and urbanisation. Abstraction rates exceeded recharge, as a direct consequence groundwater levels in the sandstone aquifer fell.

[8] ClRIA Special Publication 92 (1993) Rising Groundwater Levels in Birmingham and the Engineering Implications

During the last 40 years there has been an appreciable reduction in the amount of pumping in the area. Licensed abstractions within the Birmingham Groundwater Unit have fallen in total to less than a fifth of the peak, from an estimated maximum of over 75 Ml/d (megalitres per day) during the 1940s, to less than 15 Ml/d in 1993.[8]

The excess of natural recharge and leakage over abstraction from the aquifer has led to a rapid rise in groundwater levels. Ultimately the groundwater surface will return to historic levels, subject to the effects of changes in surface land use, drainage and continued abstractions.

The area affected by the rebounding of groundwater levels corresponds to the extent of water bearing sandstones under and around the city of Birmingham, an area of approximately 110 square kilometres. This area is approximately 6 to 8 kilometres wide, extending from the districts of Weoley Castle and Bournville in the south, to Streetly in the north, a distance of 18 kilometres.

The groundwater modelling studies of the Birmingham Aquifer presented in the 1993 CIRIA were run for a number of future options in terms of abstraction rates and locations. The worst case modelling assumptions assumed a relatively low rate of abstraction from the Birmingham aquifer. The impacts predicted were for rising levels of between 10 and 12 m to the south of the River Tame between 1990 and 2020, and relatively little change north of the River Tame.[8]

Rising levels in the main Birmingham aquifer units will cause water to overspill into superficial groundwater units over a wider area. This is particularly the case along the Birmingham Fault were levels were already over-spilling into the superficial aquifers overlying the Mercia Mudstones west of the fault in places in the early 1990s.

In summary there is likely to be continuing widespread impacts as a result of groundwater level rebound in the Birmingham area. Localised management and dewatering operations to stabilise and protect buildings, buried structures and avoid flooding of basements and low lying areas are likely to be required unless substantial increases in groundwater abstraction rates have occurred in recent years.

5.4 Ordinary Watercourses

5.4.1 National Information on Ordinary Watercourse Flood Risk

There are no national datasets that deal solely with predicted fluvial flood risk from ordinary watercourses; however there are a number datasets which contain relevant information, these being:

- Surface Water Management Plan

  The SWMP flood extents are based on detailed hydraulic models that take account of rivers, minor open watercourses and piped networks of culverted watercourses and public sewers. Therefore in areas which are covered by the plan they provide a good indication of ordinary watercourse flood risk.

- Risk of Flooding from Surface Water

  The RoFSW datasets can be used to make assumptions about the extent of flooding from surface water and small ordinary watercourses as in many cases this will be similar.

- Risk of Flooding from Rivers and Sea (RoFRS) & Flood Map for Planning (FMfP)

  Whilst these datasets primarily show flood risk from Main Rivers they also shows flood risk from larger ordinary watercourses where the catchment is greater than 3km^2. Flood outlines are available for the following ordinary watercourses:

- River Cole
- Chinn Brook
- Hockley Brook
- Griffins Brook
- Chad Brook
- Perry Brook
- Plants Brook

5.4.2 Local Information on Ordinary Watercourse Flood Risk

There is no specific local ordinary watercourse flood risk information for Birmingham; however the outputs from SWMP can be used where available supplemented by the RoFSW, RoFRS and FMfP where appropriate.

Generally, due to the highly urbanised nature of Birmingham and the close interactions between watercourses, sewers and rainfall, Birmingham City Council prefers to undertake integrated modelling that considers how all sources of flooding interact as it is believed that gives a better indication of actual risk. Birmingham City Council will continue to develop these models where appropriate as part of its investigation and understanding of flood risk.

5.5 Potential Consequences of Future Flooding.

The potential consequence of future flooding from surface water is included in Annex 2 of the Preliminary Assessment Report Spreadsheet.

5.6 Climate Change and Long Term Developments

5.6.1 The Evidence

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

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.

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.

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%.

5.6.2 Key Projections for Humber River Basin District

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 12% (very unlikely to be more than 24%)
- Relative sea level at Grimsby very likely to be up between 10 and 41cm 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 14%

Implications for Flood Risk

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

Wetter winters and more of this rain falling in wet spells may increase river flooding. 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 for the unexpected.

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 the future, but won't help the existing risk without significant retrofitting of flood alleviation measures including SuDS.

5.6.3 Adapting to Change

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

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

Long Term Developments

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.

The Environment Agency has carried out a simple analysis at the national level to compare the number of people at risk from surface water flooding from a rainfall event with a 1% chance of occurring in any year to the number at risk from an event with a 0.1% chance of occurring in any year. The numbers of people at risk are counted per 1 kilometre grid square across England. The resulting 'heat map' shows how the absolute number of people at risk increases between these two rainfall events for each 1km grid square.

This method is not based on climate projections, and it does not account for future population growth. It does provide a simple way, however, of identifying areas that could be susceptible to increased rainfall intensity as a proxy for climate change. It is a reasonable proxy for an upper end climate change scenario for the end of the century, both in the pattern of change across the country and the percentage increase in intensity compared to the current climate.

Figure 5.3 shows an extract from the 'Heat Map'. Red and orange squares indicate the highest increase in numbers of people at risk, and green and grey indicate lower increases.

In England, The National Planning Policy Framework (NPPF) sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate

change. NPPF and supporting planning practice guidance on Flood Risk and Coastal Change explain when and how flood risk assessments should be used. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account. Local planning authorities refer to this when preparing local plans and considering planning applications.

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).

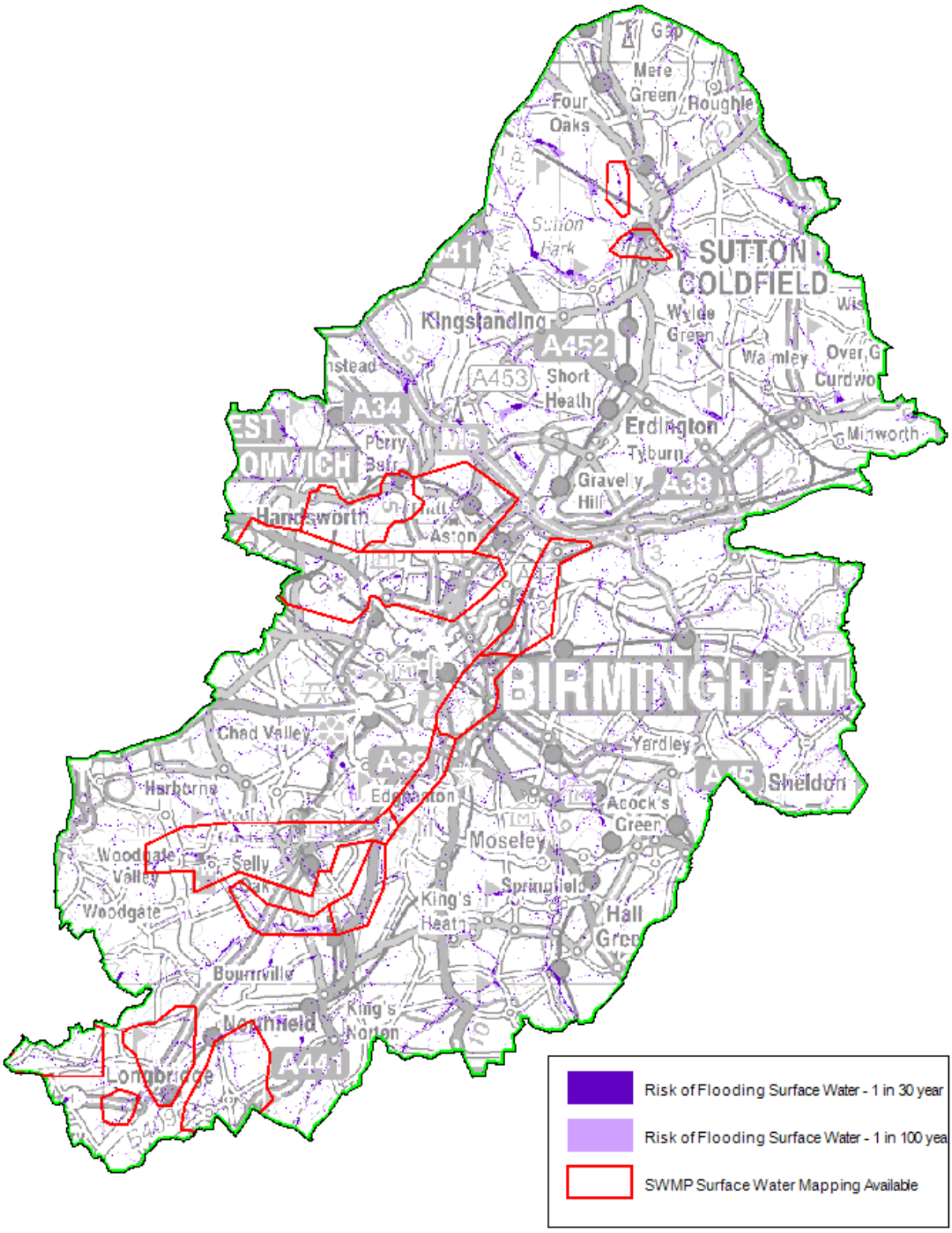

Figure 5.1 –Surface Water Flood Risk

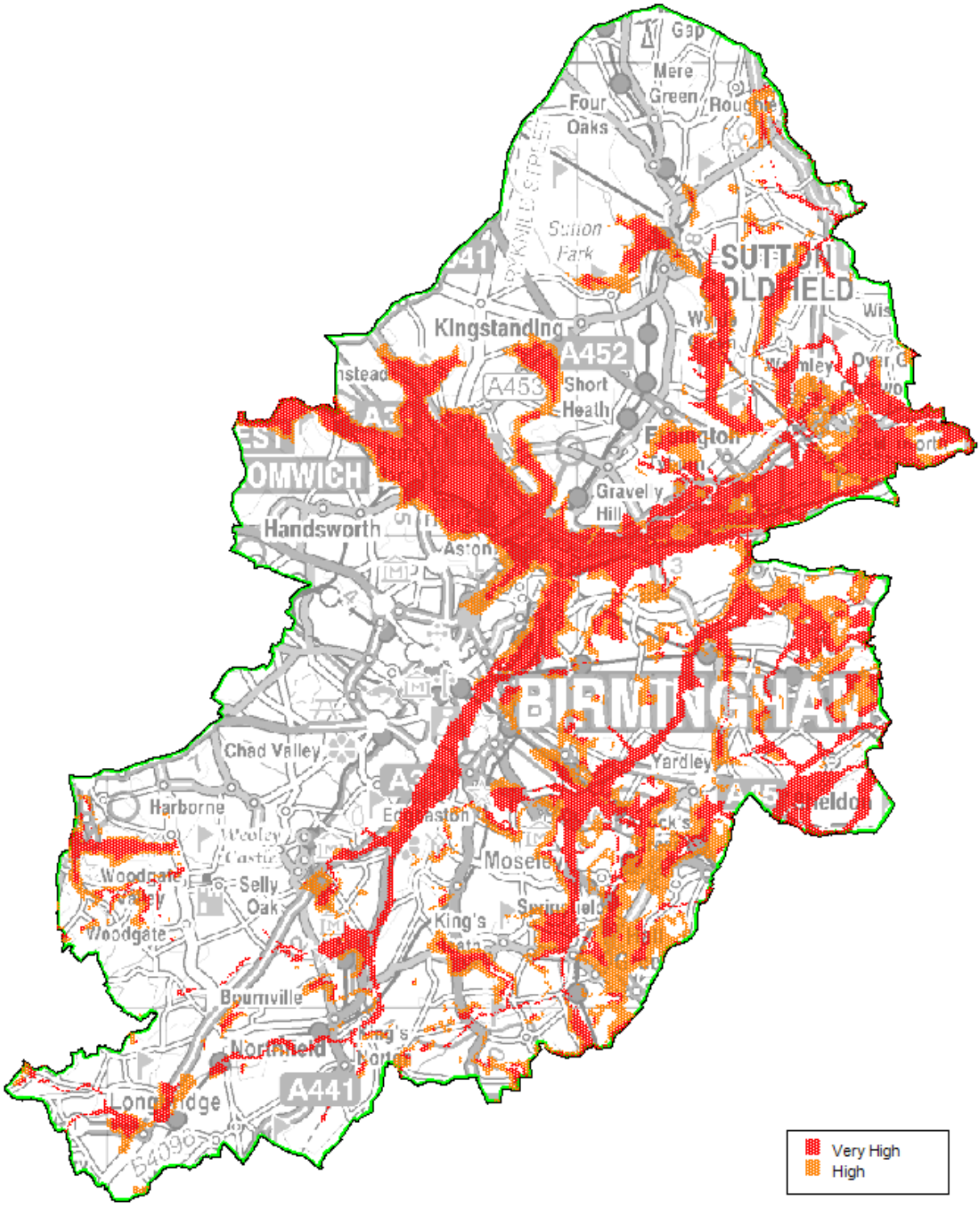

Figure 5.2 –Groundwater Flood Risk

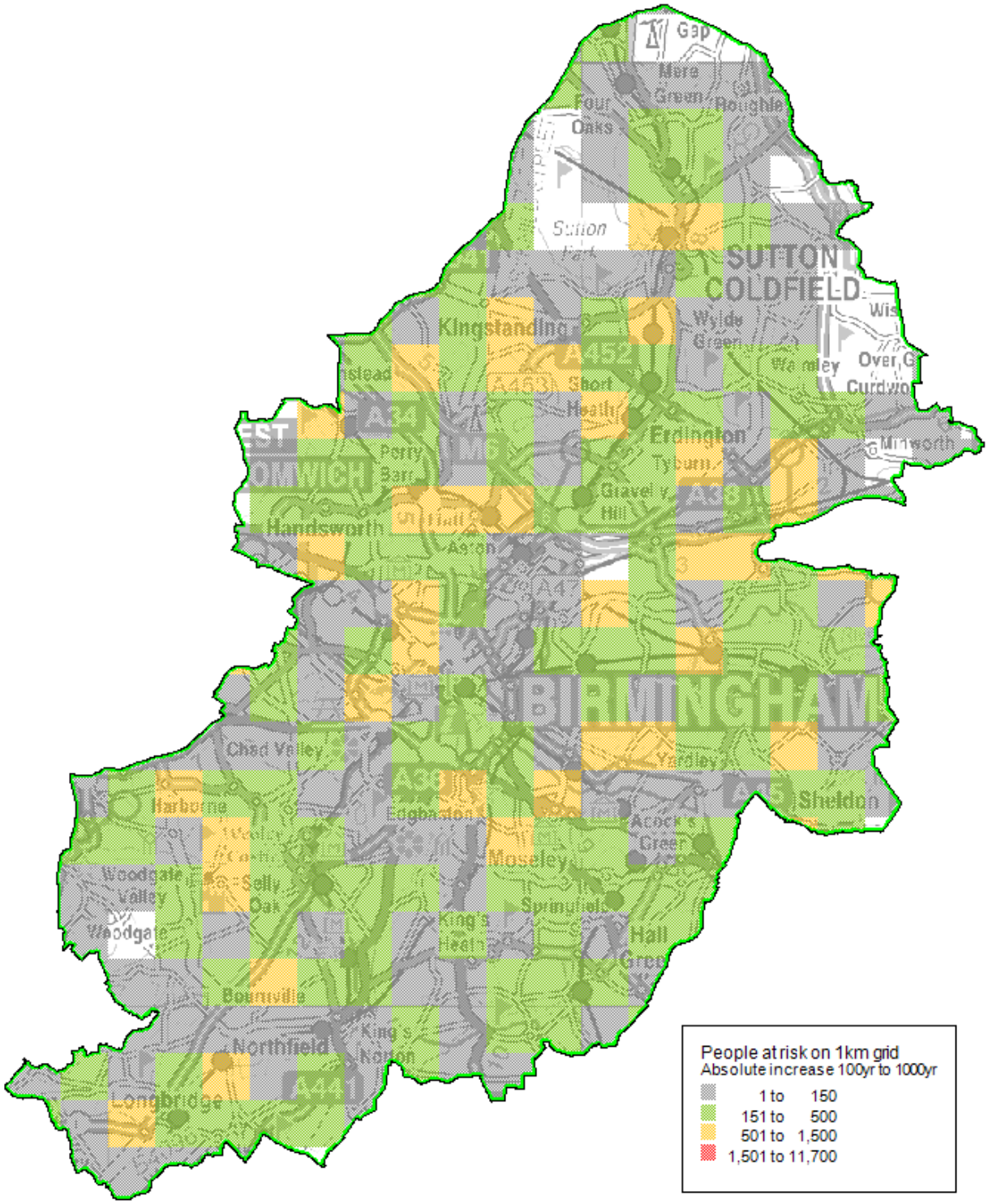

Figure 5.3 - 'Heat Map'

6. Flood Risk Areas

6.1 Introduction

This section summarises the process used to identify Indicative Flood Risk Areas (FRA) and reviews the Indicative Flood Risk area for Birmingham.

6.2 Identification of Flood Risk Areas

The FRR require LLFAs to determine whether any part their area faces significant risk of local flooding, and to identify any such area or areas as FRAs.

In 2010, Defra provided guidance for identification of FRAs for the first planning cycle. Thresholds for FRAs for local sources of risk were set very high in the first cycle, which resulted in only 10 FRAs being identified across England, including the West Midlands FRA which covered most of Birmingham. .

FRAs in the first cycle focused on areas with the highest levels of risk. It is logical now to widen the focus. Defra has provided revised ministerial guidance on significant risk for identification of FRAs for the second cycle of PFRAs.

The approach uses a similar clustering methodology to that used in 2010, and is supplemented with information based on the 'communities at risk' approach developed in the Environment Agency since 2010, based on Office for National Statistics built-up area (BUA) and built-up area sub-divisions (BUASD).

There are more indicative FRAs for the second cycle than in the first, but it is considered that this provides a more complete picture of local risk across England.

6.2.1 Method used to Develop Indicative FRAs

Two methods were used to identify areas of potentially significant risk as the basis for the indicative FRAs. In each case national information from the current (2016) Risk of Flooding from Surface Water (RoFSW) map - and a rainfall event with a 1% chance of occurring in any year was used.

Method 1 - Cluster analysis for concentrations of people/property at risk

The Flood Risk Areas cluster method, as used in the first cycle to identify high concentrations of risk. The country was divided into 1km squares and national information used to identify wherever at least 200 people or 20 non-residential properties or more than 1 key service might be flooded. A cluster is formed wherever, within a 3x3 km square grid, there are at least 5 squares meeting the criteria. Often multiple grids that meet this requirement will overlap. Overlapping grids are unified to form a larger cluster. All clusters, large and small are identified as indicative Flood Risk Areas.

Method 2 - Communities at Risk

The Environment Agency's Communities at Risk C@R method, developed since 2010 which complements and validates the cluster method by identifying built up areas where total flood risk is high. Indicative flood risk areas are identified wherever there are 3000 or more reportable properties (residential and non- residential) at risk within a built-up area (BUA) or built-up area sub-division (BUASD) as defined by the Office for National Statistics.

6.2.2 Lead Local Flood Authority Review of Flood Risk Areas

LLFAs are required to review the indicative FRAs that have been provided in light of local knowledge.

The indicative FRAs only represent risk from surface water flooding and should therefore be reviewed against current local understanding of surface water flood risk.

There may then be other local factors which influence the consideration of risk such as:

- flood risk from other local sources eg groundwater, local watercourses
- the combined impact of flooding from multiple sources
- areas susceptible to more frequent, less extensive flooding, that could over time result in significant damages
- consequences of flooding for agricultural land
- consequences of flooding for roads, rail or other infrastructure
- consequences of flooding for internationally or nationally designated environmental sites or internationally or nationally important cultural heritage features, and
- location of sites subject to Integrated Pollution Prevention and Control or Control of Major Accident Hazard regulation.

LLFAs can suggest amendments to the indicative FRAs, or propose additional FRAs, on the basis of some of these factors.

6.3 Review of Indicative Flood Risk Areas

The geographical extent of the Flood Risk Area for Birmingham is shown in Figure 6.1, this area was identified using the C@R method . The proposed Flood Risk Area also covers small parts of many neighboring LLFAs including, Solihull, Sandwell, Walsall, Dudley, Worcestershire, and Warwickshire.

Birmingham City Council does not propose to make any amendments to the Flood Risk Area for Birmingham The majority of the Birmingham City Council administrative area is covered by the Flood Risk Area, with the exception of Sutton Coldfield. A significant part of this area is predominantly rural land and the remaining areas are not considered to be at considerable flood risk. Whilst there are locations outside of the Flood Risk Area which flooded in June 2016 the majority of these are isolated sites where only a small number of properties were affected, or investigation has shown that sewer flooding was a significant factor.

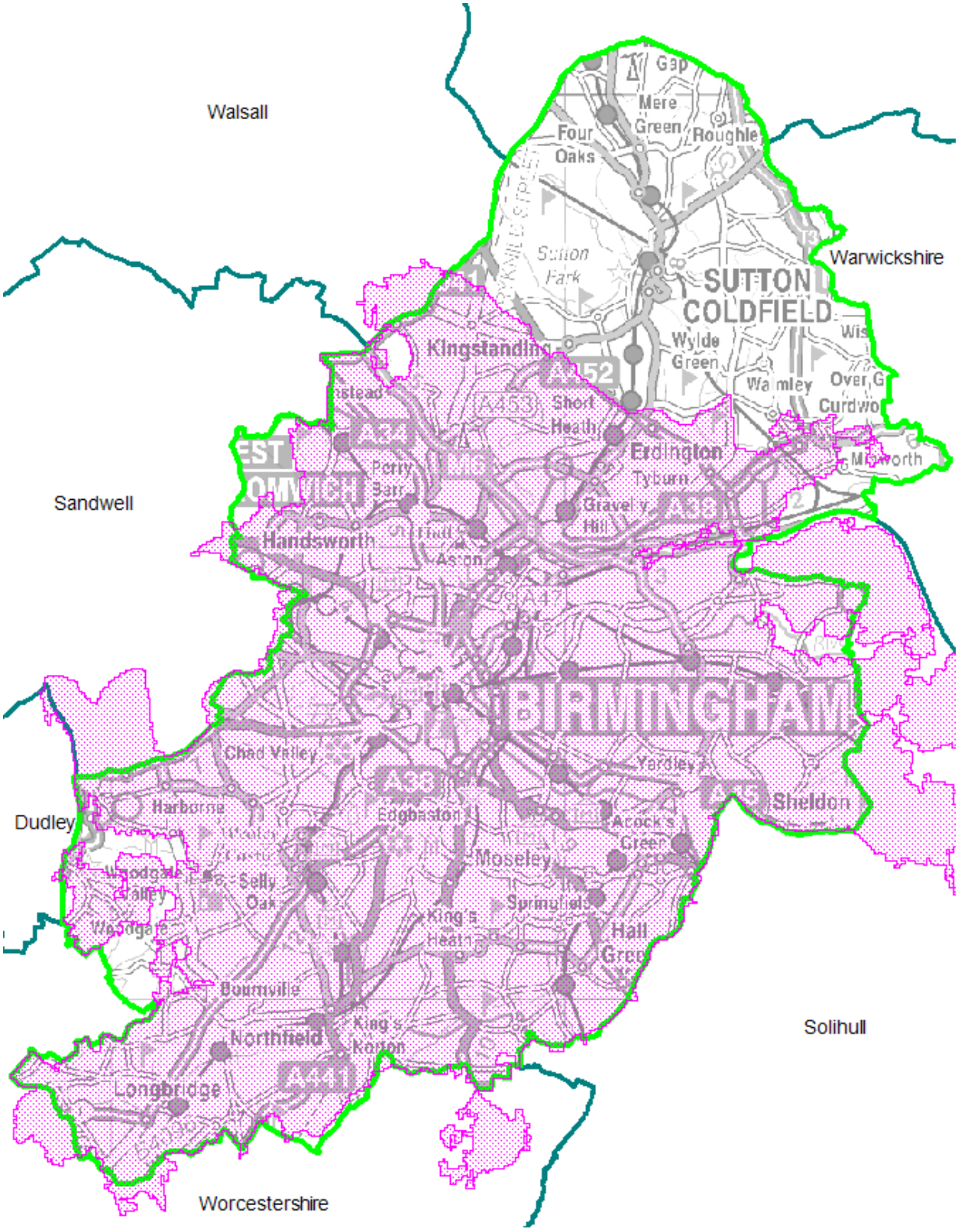

Figure 6.1 –Flood Risk Area

7. Next Steps

7.1 Introduction

This section outlines the measures proposed by Birmingham City Council to support the review of the PFRA every 6 years, including the collection of the information.

7.2 PFRA Process

This report has been prepared by Birmingham City Council in accordance with the guidance to meet the submission deadline of 22nd June 2011.

Birmingham will continue to work with the Environment Agency and neighbouring LLFAs towards the next stages in the cycle, culminating in the production of the Flood Risk Management Plan by June 2021.

7.3 Future Arrangements

Birmingham City Council recognises that as part of their Role as Lead Local Flood Authority they are required to investigate future flood events and ensure that flood risk data and information is collected, assessed and stored in an appropriate manner and passed to the appropriate responsible organisation for further investigation.

Birmingham City Council will continue to work with its professional partners to ensure this process is effective and that data is available for the review of the PFRA in 2023.

Annex 1- Records of Past Floods and their Significant Consequences

(Preliminary Assessment Report Spreadsheet – Electronic Copy Available)

Annex 2- Records of Future Floods and their Consequences

(Preliminary Assessment Report Spreadsheet – Electronic Copy Available)

Annex 3- Records of Flood Risk Areas and their Rationale

(Preliminary Assessment Report Spreadsheet – Electronic Copy Available)

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