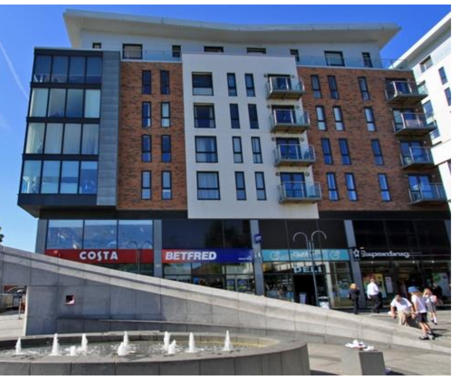
Bury Local Plan

Topic Paper 6

Flood Risk



October 2018

Bury
COUNCIL

Contents

1 Introduction

1.1 This Flood Risk Topic Paper is one of a series that has been prepared as part of the process of evidence gathering to support Bury's emerging Local Plan. The full range of Topic Papers deal with the following:

- 1 – Housing
- 2 – Economy and Employment
- 3 – Town Centres and Main Town Centre Uses
- 4 – Health and Wellbeing
- 5 – Energy and Physical Infrastructure
- 6 – Flood Risk
- 7 – Natural Environment
- 8 – Open Land
- 9 – Built Environment
- 10 – Transport
- 11 – Community Facilities

1.2 The principal aim of the Topic Paper is to set out current key policies, plans and strategies relating to flood risk that will form the framework for the development of the Local Plan and to present a profile of the Borough that will highlight key issues, problems and challenges that the Local Plan should ultimately seek to deal with.

1.3 This will subsequently help to shape and influence the direction and focus of the Local Plan's planning policies, designations and site allocations.

1.4 It is intended that the Topic Papers will be 'living' documents that can, if necessary, be updated to reflect the most up-to-date circumstances. **For example, some of the evidence contained within the Topic Papers has been drawn from evidence that has been developed to support the draft Greater Manchester Spatial Framework (GMSF). Any subsequent amendments to the GMSF and/or its supporting evidence, will be reflected in the evidence supporting Bury's Local Plan**.

1.5 Flooding is a natural process and does not respect political or administrative boundaries. It is principally influenced by natural elements of rainfall, tides, geology, topography, river and streams and manmade interventions such as flood defences, roads, buildings, sewers and other infrastructure.

1.6 In Bury, the presence of major rivers, small watercourses, ageing infrastructure and the threat of surface water in some areas means flooding is a real issue and, when it occurs, it can seriously affect people's lives and businesses, as witnessed in December 2015.

2 Key Policies, Plans and Strategies

2.1 One of the key early stages in the process is to review other policies, plans and strategies which are of relevance to this particular topic area and which will help to inform and influence the direction of the Local Plan. Clearly, there is a need for the Local Plan to be consistent with planning policy at different levels.

2.2 The National Planning Policy Framework (NPPF) sets out Government Policy in respect of planning matters and this is supported by Planning Practice Guidance (PPG). This sets out the broad planning framework within which development plans are produced.

2.3 Sub-regionally, the emerging Greater Manchester Spatial Framework will establish strategic policies and site allocations across Greater Manchester. This document will, once adopted, form part of Bury’s development plan alongside the Local Plan.

2.4 There are also a range of other plans and strategies that, whilst not being policy, are considered to be of relevance to the Borough from a flood risk perspective.

National Planning Policy Framework

2.5 The NPPF provides comprehensive guidance to Local Planning Authorities on mitigating flood risk. Paragraph 155 states that:

‘Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

2.6 The NPPF requires Local Plans to develop policies to manage flood risk from all sources and apply a sequential, risk based approach (the Sequential Test) to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impact of climate change.

2.7 The Sequential Test is designed to steer new development to areas with the lowest probability of flooding.

2.8 If, following application of the Sequential Test, it is not possible, for development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. The Exception Test comprises two elements:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh the flood risk; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.

2.9 Paragraph 163 of the NPPF states:

"When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site specific flood risk assessment[1]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (as the sequential and exception tests, as applicable) it can be demonstrated that:

- *within the site, the most vulnerable development is located in areas at lowest risk unless there are overriding reasons to prefer a different location;*
- *the development is appropriately flood resilient and resistant;*
- *it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- *any residual risk can be safely managed;*
- *safe access and escape routes are included where appropriate, as part of an agreed emergency plan.*

2.10 Paragraph 165 requires major developments to incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate.

Planning Practice Guidance

2.11 Flood risk is defined by the Planning Practice Guidance (PPG) on Flood Risk and Coastal Change as a combination of the probability and potential consequences of flooding from all sources. The Flood Zones refer to the current probability of river and sea flooding, ignoring the presence of defences.

2.12 Table 1of the NPPF defines the Flood Zones. It separates Flood Zone 3 into zones 3a and 3b. Flood Zone 3b, the functional floodplain is defined as land where water has to flow or be stored in times of flood.

[1] A site specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in the future; or land that may be subject to other sources of flooding, where tis development would introduce a more vulnerable use.

2.13 Table 2 of the NPPF classifies land uses according to their vulnerability to flood risk. Table 3 of the NPPF identifies which land uses are appropriate for which flood zones. It sets the requirement for more vulnerable development in Flood Zone 3 to pass the Exception Test. It also shows that all types of development other than water compatible uses and essential infrastructure (subject to the Exception Test) should not be permitted in Flood Zone 3b. Table 1 below summarizes this information:

Table 1 – Flood Risk Vulnerability Classification and Flood Zones

Flood Risk Vulnerability Classification	**Types of Development**	**Appropriate flood risk zone**
Essential Infrastructure	▪ Essential transport infrastructure which has to cross the area at risk; ▪ Essential utility infrastructure which has to be located in a flood risk area for operational reasons and water treatment works that need to remain operational https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-3-Flood-risk-vulnerabilityin times of flood; ▪ Wind turbines	Appropriate in Zone 1 & 2. Exception Test required in Zone 3a and 3b (development in zone 3b should remain operational and safe for users in times of flood; result in no net loss of floodplain storage; not impede water flows and not increase flood risk elsewhere).
Highly Vulnerable	▪ Policy and Ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. ▪ Emergency dispersal points ▪ Basement dwellings ▪ Caravans, mobile homes and park homes intended for permanent residential use.	Appropriate in Zone 1. Exception test required in Zone 2. Not appropriate in Zone 3a and 3b.
More Vulnerable	▪ Hospitals ▪ Residential institutions ▪ Dwelling houses, student halls of residence, drinking	Appropriate in Zone 1 and Zone 2. Exception test

Flood Risk Vulnerability Classification	Types of Development	Appropriate flood risk zone
	establishments, nightclubs and hotels. ▪ Non-residential uses for health services, nurseries and educational establishments	required in Zone 3a. Not appropriate in Zone 3b.
Less Vulnerable	▪ Police, ambulance and fire stations which are not required to be operational during flooding ▪ Buildings used for shops, financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class and assembly and leisure. ▪ Land and buildings used for agriculture and forestry.	Appropriate in Zones 1, 2 and 3a. Not appropriate in Zone 3b.
Water Compatible	▪ Flood control infrastructure. ▪ Water transmission infrastructure and pumping stations. ▪ Sewage transmission infrastructure and pumping stations. ▪ Sand and gravel working. ▪ Ministry of Defence installations. ▪ Water-based recreation (excluding sleeping accommodation). ▪ Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. ▪ Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.	Appropriate in all zones (development in zone 3b should remain operational and safe for users in times of flood; result in no net loss of floodplain storage; not impede water flows and not increase flood risk elsewhere).

Source: Planning Practice Guidance on Flood Risk and Coastal Change

The Greater Manchester Spatial Framework

2.14 Once adopted, the Greater Manchester Spatial Framework (GMSF) will form an integral part of Bury's wider development plan. Consultation on the first draft GMSF ended in January 2017 and there are proposals to issue a second draft for consultation shortly.

2.15 One of the key purposes of the GMSF is to ensure that Greater Manchester increases its resilience, including taking a catchment-based approach to managing flood risk.

2.16 This could be achieved through measures such as locating and designing new development in order to minimise the risk and impacts of flooding; supporting the relocation of vulnerable uses away from areas at risk of flooding; managing surface water run-off; utilising sustainable urban drainage systems; and promoting flood defences and additional water storage capacity.

Other Plans and Strategies

DEFRA's National Adaptation Programme

2.17 DEFRA's National Adaptation Programme includes Objective 2 – "To provide a clear local planning framework to enable all participants in the planning system to deliver sustainable new development including infrastructure that minimises vulnerability and provides resilience to the impact of climate change.

Bury Local Flood Risk Management Strategy and Action Plan

2.18 The Bury Local Flood Risk Management Strategy (LFRMS), 2018 focuses on local flood risk from surface water, groundwater and ordinary watercourses but also considers flooding from rivers. The Strategy includes an Action Plan which presents an overview of flood management activities within the Borough.

2.19 The objectives of the Strategy are to:

- Gain a strategic understanding of flood risk from all sources in Bury;
- Manage the likelihood of flooding within the Borough;
- Help Bury residents to manage their own risk;
- Ensure that new development in Bury reduces rather than increases flood risk;
- Improve flood preparation, warning and post flood recovery;
- Endeavour to balance environmental, social and economic benefits

Strategic Flood Risk Assessment

2.20 There are two types of Strategic Flood Risk Assessments (SFRAs) – Level 1 and Level 2, which refer to the amount of detail in the assessment. A **Level 1** SFRA is a desktop study which summarises the risks of flooding to a study area. It collates existing flood risk data into one document. It is sufficient enough to apply the Sequential Test to guide development to land outside of Flood Zone 3 (high probability of river flooding) and Flood Zone 2 (medium probability of flooding). Where Flood Zone 1 (low probability) cannot accommodate all new development, more detailed flood risk assessment work is required to determine if new development can be made safe from flooding in higher flood risk areas. This more detailed work is a **Level 2** assessment and it informs the Exception Test.

2.21 A Greater Manchester Level 1 SFRA was produced in 2008. A Level 2 SFRA was produced in 2009 for Bury, Rochdale and Oldham. This work concluded that the main source of fluvial flood risk in the Borough is from the River Irwell and its tributaries, including Holcombe Brook, Pigslee Brook, Kirklees Brook and the River Roch. Using these assessments the Sequential and Exception Tests were applied to land that was proposed for new development several years ago and which now forms part of the existing supply of residential and employment land in the Borough.

2.22 A Level 1 2018 SFRA is being produced for the 10 Greater Manchester districts as part of the evidence base for the Greater Manchester Spatial Framework. The outputs from this are expected in December 2018.

Surface Water Management Plan

2.23 The Greater Manchester Surface Water Management Plan (SWMP), 2012, assesses surface water flood risk across the sub-region.

2.24 The Plan was split into two stages, **Stage 1** provided a strategic assessment of surface water flood risk and identified potential areas of significant risk, referred to as 'surface water hotspots'. **Stage 2** carried out a technical assessment of each surface water hotspot.

2.25 37 hotspot areas were identified in Bury, this represented 8% of the GM total. Hotspots help to identify the areas at risk, focussing on the receptors rather than where the flood water has come from. This means that whilst the hotspots help identify the effect of flooding in one district, the surface water could originate in another.

2.26 Within each hotspot, an assessment was made of the scale of surface water flood risk against other sources (e.g. from rivers) in order to assess whether surface water risks are the key issue.

2.27 In Bury, three key hotspot areas were identified as requiring further investigation:

Table 2 – SWMP Hotspot Areas

Location	SWMP Key Issues	2018 Update
Water Street, Radcliffe	Surface water and sewer modelling results identifies large areas of flooding surrounding residential property and commercial units. Mitigation measures have been implemented to prevent internal flooding, however highway and external flooding still may occur.	Additional storage in the sewer network has resolved flooding issues to date. United Utilities continue to monitor.
Gypsy Brook, Bury	Surface water modelling results identifies significant flooding along Gypsy Brook, not shown in the main river flood zones. There is the potential for significant consequences if such flooding occurs. There are also sections of the Brook with multiple riparian owners, which has resulted in poor maintenance.	The Environment Agency (EA) and Highways England (HE) have both implemented flood mitigation works to Gypsy Brook. EA and HE continue to monitor.
Ramsbottom	Surface water modelling results identify run off from rural land flowing into Ramsbottom from the east and flowing towards the River Irwell at the bottom of the valley. Surface water flooding is a known issue in the area, particularly along the A56, causing disruption to commuters. Some mitigation work has been completed but problems still exist.	A Grant in Aid (GiA) bid was submitted (June 2018) to government for funding to investigate the surface water flood risk issues in Ramsbottom and identify possible solutions. An outcome is expected in late 2018.

Source: SWMP, 2012

3 Local Profile

3.1 This section sets out a broad profile of the Borough in terms of flood risk. It provides an examination of the main influences on, and challenges associated with flood risk in order to assist in identifying the key issues that the Local Plan will need to address. The most fundamental and challenging features are considered to centre around the following:

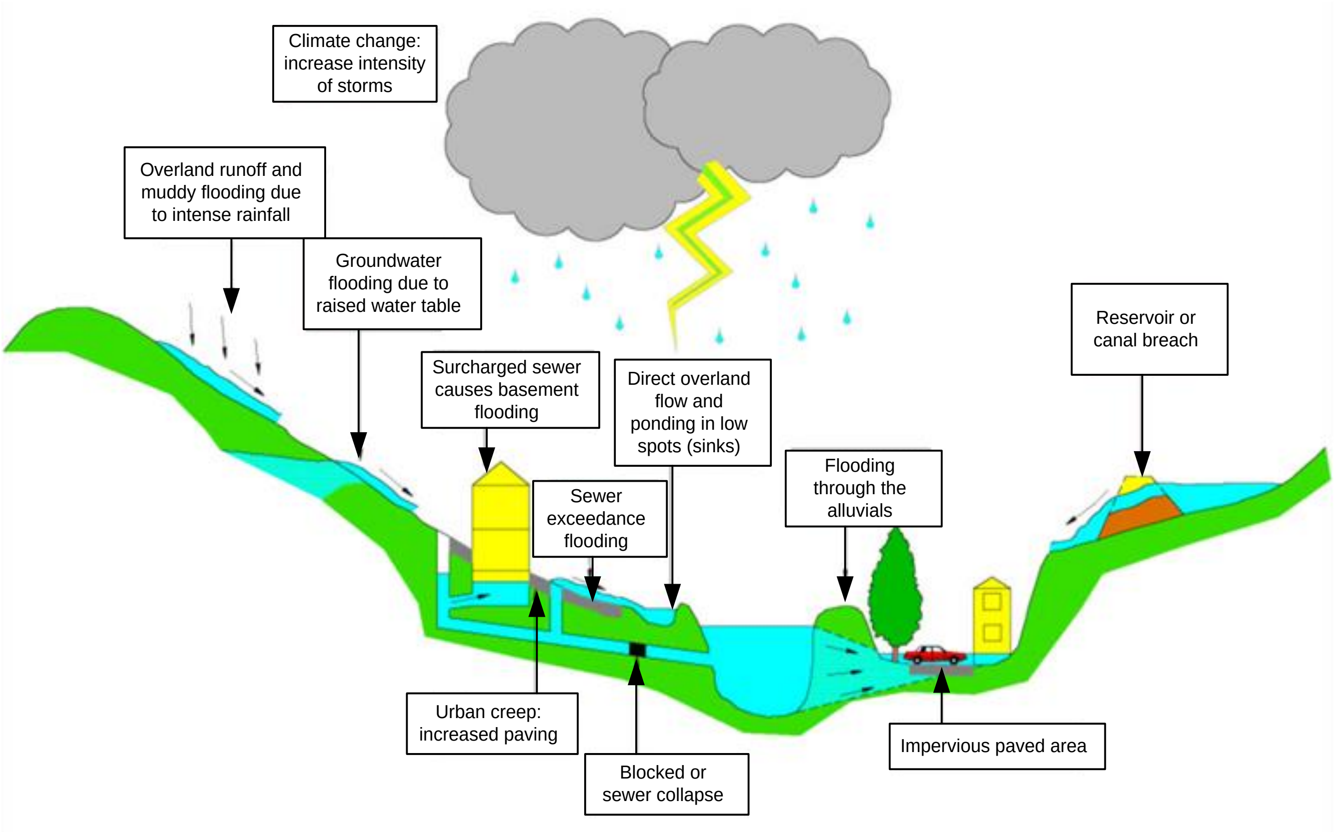
- River (Fluvial) Flooding
- Surface Water (Pluvial) Flooding
- Ground Water Flooding
- Sewer Flooding
- Canal Flooding
- Reservoir Flooding
- Future Influences on Flooding
- Flood Risk Management

3.2 Bury is located within the centre of the River Irwell catchment area where river gradients are less but the landscape is still hilly. Much of the Bury area grew rapidly during the industrial revolution with the development of mill buildings and commercial and residential properties on the floodplain. Today, most of the watercourses are heavily modified and contain a large number of culverts and weirs.

3.3 The major watercourses in the Borough are the River Irwell and River Roch which originate outside the administrative boundary. Smaller watercourses such as the Rivers Beal and Spodden, or other tributaries of the River Roch originate within Rochdale and Oldham and flow into the Borough.

3.4 Flooding can occur from a range of sources as highlighted in Figure 1 below. Often a flood event is caused by a combination of sources, highlighting the complex nature of flooding and the importance of understanding the risk of flooding.

Figure 1 – Sources of Flooding



Source: Strategic Flood Risk Assessment, 2009

River Flooding

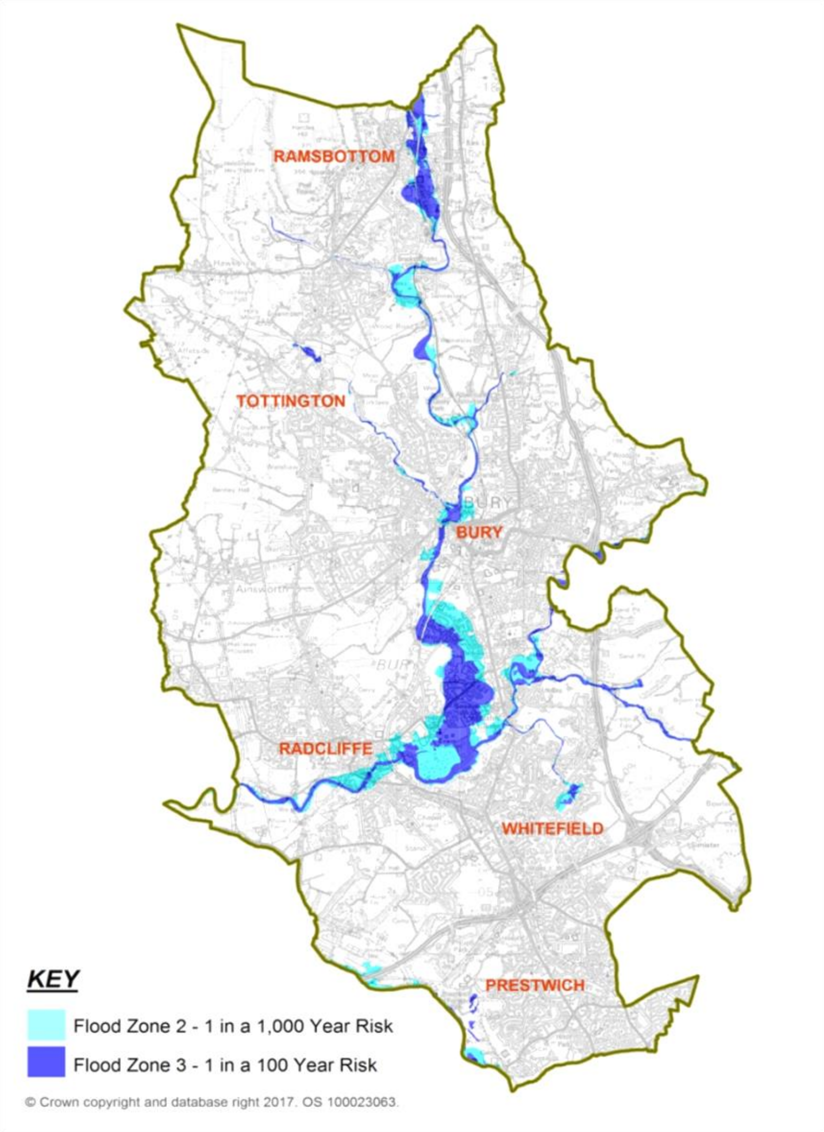
3.5 River flooding occurs when the capacity of the river or stream is reached, causing water to spill out of the channel into nearby areas – for example when heavy rain falls on ground that is already water logged and the watercourse cannot cope with the water draining into it from the surrounding land. In some areas the surrounding floodplain of the river may be undeveloped or have flood compatible uses, but in some areas development has occurred within these floodplains.

3.6 The main source of fluvial flood risk in the Borough is from the River Irwell and its tributaries, including Holcombe Brook, Pigslee Brook, Kirklees Brook and the River Roch.

3.7 Due to the urbanised nature of the Borough, many of the main river channels have been straightened and canalised to accelerate the flow of water and have been culverted over significant lengths. Many now have a limited hydraulic capacity and are prone to blockages which can lead to flooding. These blockages are often caused by silt deposition from the rural upstream sections of the Borough, vegetation falling into the watercourse and through fly tipping where debris is dumped into the river channels.

3.8 The Environment Agency is responsible for managing the risk of flooding from rivers. To assist with this, the agency produce a Flood Map for Planning (Rivers and Sea), which identify flood zones[2]. These zones refer to the probability of river and sea flooding, ignoring the presence of defences[3].

Figure 2 – Environment Agency Flood Zones



3.9 Figure 2 identifies that the following areas are particularly at risk of flooding from the river:

Ramsbottom
- Stubbins Lane, Kenyon Street, Athos Street, Crow Lane;
- Nuttall Park, Ramsbottom Cricket Ground and Football Club

[2] For more detail on Flood Zones, see paragraphs 2.12 and 2.13 and Table 1.
[3] The flood zones on the EA's Flood Map do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

Summerseat

<u>Bury</u>

- Bury Ground
- Bridge Trading Estate

<u>Redvales</u>

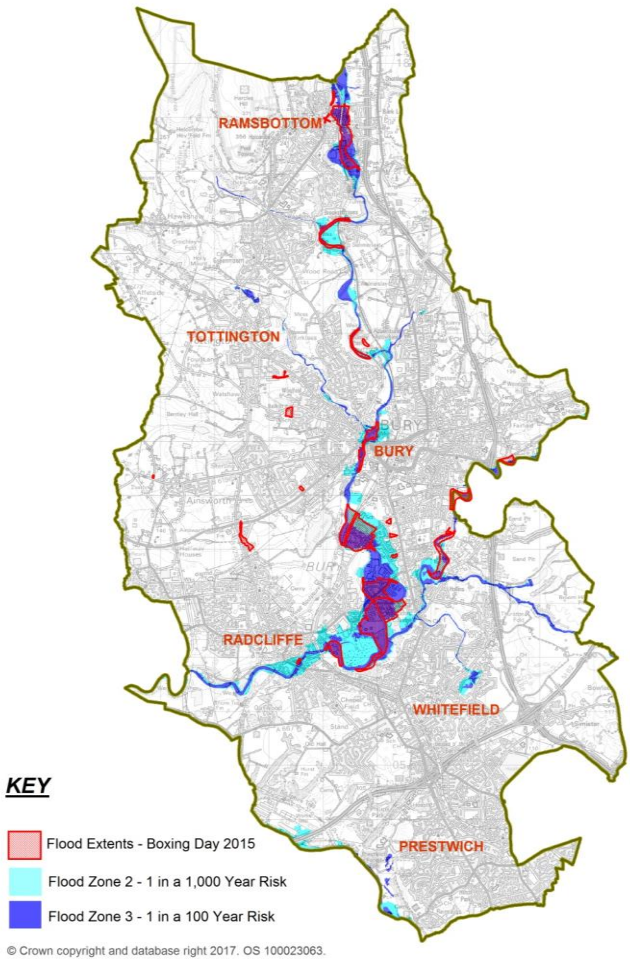
- Warth Industrial Park
- Warth Road, Openshaw Fold Road, Bealey Drive, Inglewhite Close, Ribchester Drive
- Radcliffe Road, Central Avenue, Keswick Drive

<u>Radcliffe</u>

- York Street, Ripon Close, Selby Close, Seddon Avenue, Borough Avenue
- Dumers Lane, Morris Street
- Close Park, Parkside Close, Riverside Road, Waterside Close
- United Utilities Sewage Works
- Pioneer Mills

3.10 The severe flooding experienced on Boxing Day 2015 verified these modelled flood extents as identified in Figure 3.

Figure 3 – Known Extent of Boxing Day Flooding



Note: Map 3 only presents those areas where the flood risk was reported to the Council, either during the evening or afterwards.

Surface Water Flooding

3.11 Surface water flooding is caused by overland flow during period of sustained or heavy rainfall, causing ponding of water where it becomes obstructed or collects in low lying areas. Local drainage capacity and infiltration is unable to cope with the volume of water experienced. The risk of surface water flooding increases as the amount of built up area and the volume of impermeable hard surfacing increases within the Borough.

3.12 Due to the steep topography of Bury, the Borough has narrow and shallow surface water flow paths. This has the potential to lead to rapid inundation with higher velocities and hazards.

3.13 A number of flow paths have been identified in Borough as surface water flows off the hillsides, collecting in small drains, before flowing to the valley bottom. Run off directly from rural land is also an issue particularly in Ramsbottom, causing flooding to major road networks and individual properties.

3.14 There are also many modified small streams, brooks and culverts which are hidden below ground and their condition is deteriorating, they have become blocked with debris and are the cause of much localised flooding following heavy rain.

3.15 Highway drains connect the highway gullies to surface water sewers. In some instances, the highway drains outfall into a watercourse such as rivers, ponds, soakaways etc. Heavy rainfall can often result in more water on the road than the highway gullies can cope with. During a severe rainfall event, the capacity of drainage system can be overwhelmed by the amount of water trying to run off from the road and flooding can occur.

3.16 Bury Council, as Lead Local Flood Authority is responsible for identifying and managing flood risk from surface water. To assist with this, the Environment Agency produce surface water flood maps, which identify areas at risk from surface water flooding. However, operational staff within the Council know where to target resources in the event of heavy rainfall, in an effort to reduce surface water flooding.

3.17 Figure 4 identifies the main areas within the Borough which suffer from surface water flooding. These include:

<u>Ramsbottom</u>

- Manchester Road/Whitelow Brow, Crow Lane, Carr Street, Moor Road, Branch Road, Longsight Road

<u>Summerseat</u>

- Railway Street, Wood Road Lane

Tottington/Greenmount

- Watling Street, Turton Road, Harwood Road, Bradshaw Road, Holcombe Road (Old Kays Park), Hollymount Lane, Moorside Road, Sunnybower Street, Scobell Street,

Bury

- Ferngrove, A58 Bolton Road (Three Arrows)

Radcliffe

- Higher Ainsworth Road, St Andres Close, Close Park, Parkside Close, Riverside Road, Waterside Close, Openshaw Fold, Ripon Close, Bealey's Goit

Whitefield

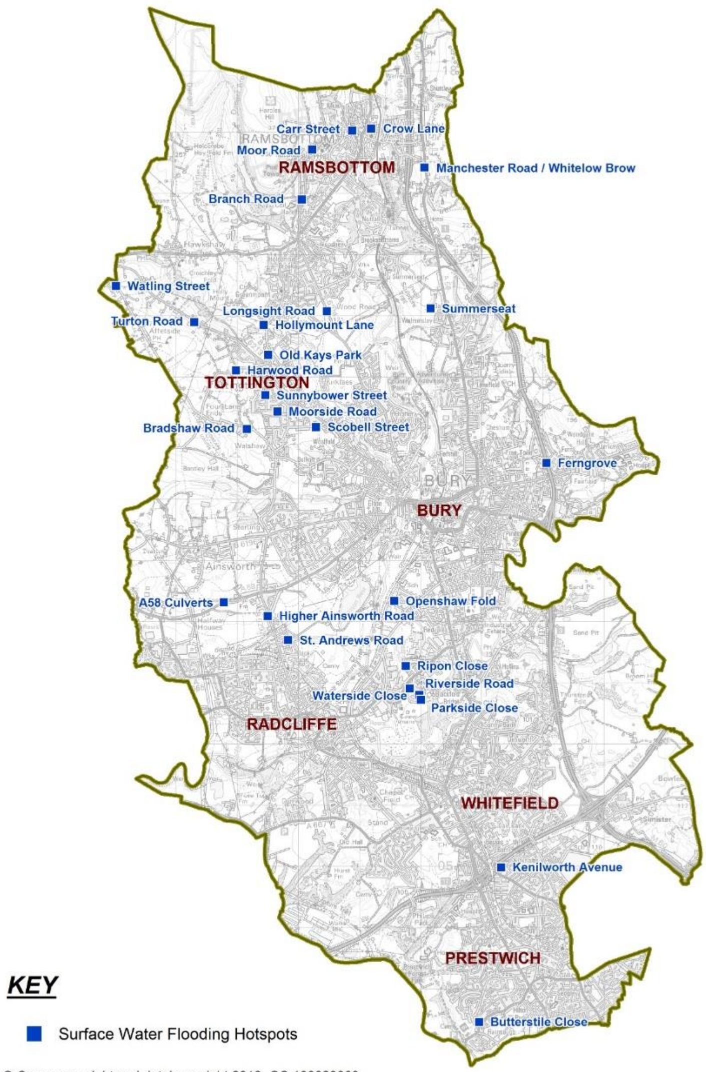
- Kenilworth Avenue

Prestwich

- Agecrost Road West, Butterstile Close

Significant areas of the Borough are at risk of river and surface water flooding.

Figure 4 – Surface Water Flooding

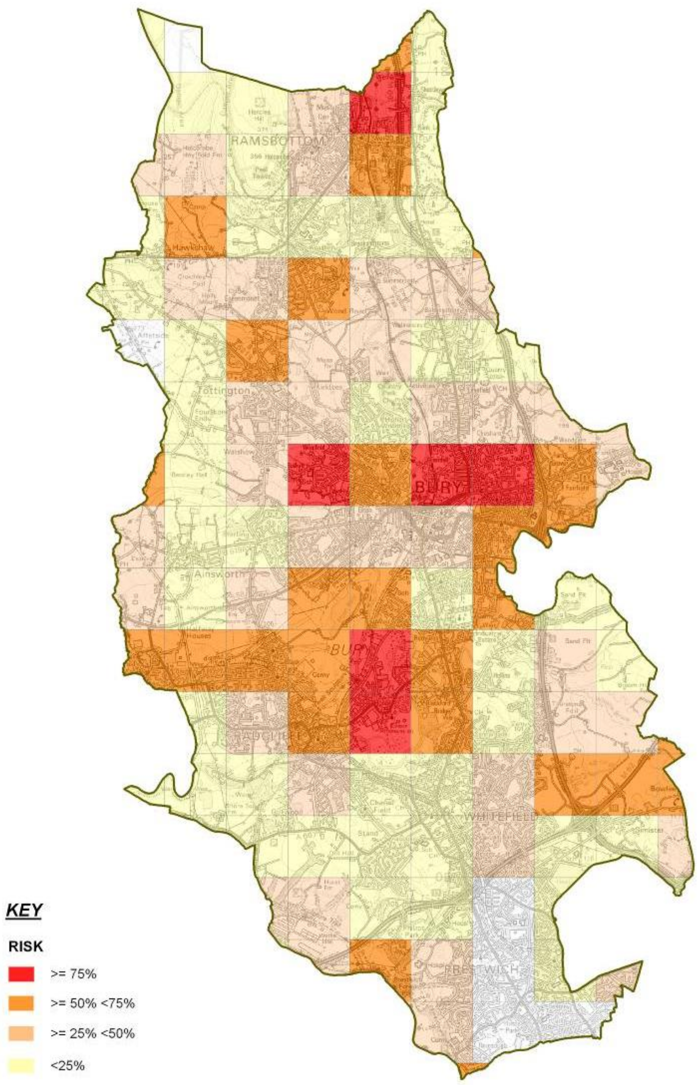


Groundwater Flooding

3.18 Groundwater flooding occurs when the water held underground rises to a level where it breaks the surface in areas away from usual channels and drainage pathways. It is generally as a result of exceptional extended periods of heavy rain, but can also occur as a result of reduced abstraction, underground leaks or the displacement of underground flows. Once groundwater flooding has occurred, the water can be in situ for a lengthy period of time.

3.19 Local knowledge of groundwater flooding is limited and often groundwater is not identified as a distinct event. The Environment Agency's national dataset, 'Areas Susceptible to Groundwater Flooding (AStGWF), provides a limited basis for assessing flood risk from groundwater.

Figure 5 – Ground Water Flooding



3.20 Bury lies over an aquifer with geology consisting predominately of sands and gravels which have high permeability. There are a number of flood defences along the River Irwell through Ramsbottom which elevate river levels above the flood plain. There is the possibility that alluvial groundwater flooding could occur in these areas. However, there are relatively few reported incidents of groundwater flooding in Bury.

Sewer Flooding

3.21 Sewer flooding is caused by excess surface water entering the sewer network, exceeding available capacity or when a blockage occurs. This generally occurs during periods of heavy rainfall when the drainage network becomes overwhelmed. Land and property can be flooded with water contained with raw sewage as a result. Sewers that overflow can also pollute rivers.

3.22 United Utilities has provided data on instances of flooding for use in this Topic Paper. It must be noted that the information is just a 'snap shot' in history at the time it was supplied and does not identify individual properties.

3.23 The latest data identifies the following:

External Flooding:

- 135 properties are listed, 33 properties have suffered external hydraulic flooding to date in this Asset Management Plan (AMP) period (2015-2020)

Internal Flooding:

- 69 properties are recorded as having hydraulic flooding, 16 properties have suffered internal hydraulic flooding to date in this AMP period.

3.24 A number of these properties are located in and around Prestwich, Ramsbottom and Tottington.

3.25 More useful indicators of risk are associated with the data generated using hydraulic sewer network models. Parts of Tottington, Gigg, Greenmount and Radcliffe have hydraulic issues which are currently being investigated.

Insufficient capacity of the sewer and drainage networks to accommodate increasing amounts of surface water.

Canal Flooding

3.26 Canals are rivers or manmade channels that were originally developed for transport. Canal flooding is caused by overtopping or breach of the canal network when the canal cannot cope with the water entering it or when a wall or embankment collapses.

3.27 The Manchester, Bury and Bolton Canal once started in Bury, running southwards through Radcliffe, before joining the River Irwell in Salford. The canal was closed in 1961 and is disused and discontinuous north of Salford.

3.28 The Preliminary Flood Risk Assessment (June 2011) identified a historic risk of broad canal flooding, however there is no modelled flood risk data available. Furthermore a number of factors suggest that the flood risk on the Manchester, Bury and Bolton Canal is low:

- Embankments are generally low and made from clay;
- The canal is discontinuous;
- The last major breach and location of many breaches was at Nob End downstream of Radcliffe in 1936. This stretch of the canal was not restored;
- Previous canal failures were caused by mining subsidence. It is assumed that mining activity in the area has now ceased, although some risk does still remain; and
- The canal intercepts some surface water from the catchments to the west. However, no detailed modelling has been undertaken and the impact of this is largely unknown.

Reservoir Flooding

3.29 Reservoirs hold large volumes of water above ground level and are contained by walls or dams. Reservoir flooding occurs when a reservoir structure is overtopped or fails due to damage or collapse.

3.30 The Environment Agency maintains a Public Register of Large Raised Reservoirs. Table 3 identifies the reservoirs within Bury. The chance of reservoir failure is very unlikely as reservoirs are regularly inspected and there is an extremely good safety record in the UK with no loss of life due to reservoir flooding since 1925.

3.31 Elton Reservoir is considerably bigger than any other reservoir within the Borough.

3.32 The Generic Reservoir Off-Site Plan (reviewed November 2016) outlines the Greater Manchester emergency response to any reservoir failure. In addition, there are Specific Reservoir Off-Site Plans for those reservoirs within Greater Manchester which are in the top 100 reservoirs with the most serious consequences in a failure. Bury does not host any of these reservoirs, but a considerable number would impact upon the Borough, should they fail. The Generic and Specific plans have been tested at strategic, tactical and operational levels in the Borough and at a Greater Manchester level.

3.33 United Utilities has a programme of pro-active reduction which is reducing the risk of reservoir failure even further, on a year by year basis. The reservoirs operated by United Utilities in Bury are water storage reservoirs which are filled from the water mains. They are therefore not affected by river flooding, and are intrinsically lower risk structures than the majority of reservoirs.

Table 3 – Reservoirs in Bury

Reservoir	Physical Status	Construction	Year Built	Capacity	Surface Area
Elton	In Operation	Earthfill	1808	923,000	217,000
Elton Vale Lower	In Operation	Earthfill	1860	56,000	24,000
Lowercroft Lower	In Operation	Earthfill		40,000	16,000
Lowercroft Middle	In Operation	Earthfill	1800	127,000	28,300
Lowercroft Upper	In Operation	Earthfill	1890	183,000	30,000
Pilsworth Reservoir	In Operation	Earthfill		25,000	30,000
Woodgate Hill 1	In Operation	Other	1958	64,000	11,000
Woodgate Hill 2	In Operation	Other	1961	269,000	47,000

Source: Greater Manchester Civil Contingencies, 2017

4 Future Influences on Flooding

Climate Change

4.1 Climate change is expected to significantly change rainfall patterns in the United Kingdom. This means that flooding in the UK is expected to be more frequent, to a greater extent, deeper and faster. In February 2016, the Environment Agency updated their advice4 on climate change allowances for river flow modelling for planning. The new advice states, for the North West, river flows could increase by up to 35% and 70% in the long term. The Environment Agency previously advised that river flows may increase by 20% as a result of climate change.

4.2 The Bury, Oldham and Rochdale Level 2 SFRA (2009) projected the likely extent of a flood zone 3 under a climate change scenario (which assumed a 20% increase in the extent of the EA flood zone 3). In this scenario, Radcliffe overall appeared to be more affected by climate change, whilst Ramsbottom appeared to be more sensitive during more extreme rainfall events.

4.3 In the Surface Water Management Plan (January 2013), an assumption was made that climate change will lead to a 30% increase in rainfall intensities for the 1 in 200 year flood event. The modelling indicated that Ramsbottom, Bury Town Centre and Radcliffe will continue to be locations where future surface water flooding is likely to occur.

4.4 The floods experienced on Boxing Day 2015 confirmed this pattern less than 10 years after these reports were produced.

New Development

4.5 The location of future developments and flood defences within a catchment can heavily influence flood risk within an area and has the potential to further increase flood risk at areas downstream of such developments. Impacts could include the lowering of the Standard of Protection offered by flood defences and the capacity of culverts, drains, sewers and watercourse channels. This potentially leads to areas being at risk of flooding that were

> Increasing conflict and pressures between climate change scenarios and future development aspirations.

[4] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowance

previously not at risk and highlights' the increasing conflicts and pressures that are emerging between climate change scenarios and future development aspirations.

4.6 There is also a risk that an increase in hard standing and impermeable surfaces associated with new development will increase surface water run-off and hence the risk of flooding.

5 Flood Risk Management

5.1 Flood Risk Management aims to reduce the likelihood or impact of flooding. Often the most effective approach is through a combination of the following measures:

Structural Measures

5.2 Flood walls or embankments are designed to form physical barriers to stop water overflowing into the surrounding areas. Where flood banks are used, it is usually possible to incorporate footpaths or cycle paths along the top and link into a wider green infrastructure network.

Natural Flood Management Measures

5.3 Work such as tree planting or changes to land or river management can slow or reduce how much water runs off the hills upstream, which can sometimes help reduce flood risk in downstream locations. This is known as Natural Flood Management and can help to increase society's resilience to floods.

5.4 However, natural flood management is not appropriate in every case and these measures can take a long time to establish and produce a change in river flows, so are usually only used in combination with other measures.

5.5 Natural flood management measures may include:

- Restoring/creating functioning habitats such as upland peat moorlands and woodlands to store and filter floodwater.
- Installing/retaining large woody material in the upper reaches of rivers to hold water back;
- Re-meandering rivers and restoring floodplain meadows;
- Encouraging land use changes to slow water;
- Rural and urban sustainable drainage systems (SUDS).

Flood Water Storage Areas

5.6 Flood water storage areas/basins are designed to hold back excess water during a flood. This would reduce the amount of water travelling downstream and reduce the risk of the river overflowing in downstream locations.

5.7 The starting point for identifying areas of possible flood storage is to look at potential green infrastructure because land that could slow water drainage could also have multiple benefits such as, improving water quality,

> Land is required for new flood defences, natural flood management measures and flood water storage.

wildlife and habitat conservation, recreation and carbon storage.

Radcliffe and Redvales Flood Management Scheme

5.8 The Radcliffe and Redvales Flood Management Scheme is a partnership scheme between the Environment Agency and Bury Council. A series of embankments and walls are proposed along the River Irwell between Warth Fold and Close Park with flood water storage around Swan Lodge. It proposed to replace Hardy's Gate Bridge on Dumers Lane with a single span structure and natural flood management measures are proposed for land north of Warth Fold. These works are expected to remove 884 properties from Flood Zone 3 and are due to be completed by March 2021.

Sustainable Urban Drainage Systems (SUDS)

5.9 Paragraph 165 of the NPPF states that "major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate". Decisions on whether a sustainable drainage system would be inappropriate is a matter of judgement, based on guidance and advice from the Lead Local Flood Authority who will consider what type of sustainable drainage is reasonably practicable for a site.

5.10 SUDS are often viewed as taking up large areas of land within development sites. This is not necessarily the case, as there are a number of different SUDS components that can be used. The following hierarchical approach should be used when considering drainage options:

- Into the ground (infiltration);
- To a surface water body;
- To a surface water sewer, highway drain, or other drainage system;
- To a combined sewer.

5.11 Planning applications proposing not to drain surface water in accordance with the above hierarchy, and wishing to connect directly to the public sewerage system will require evidence as part of any submission to demonstrate why other options are not feasible. This will be reviewed by the Lead Local Flood Authority who will determine whether the proposals are acceptable.

5.12 SUDS have the opportunity to deliver multiple benefits in terms of high quality landscape design, opportunities for biodiversity and to improve water quality.

6 Summary of Key Issues

6.1 The Flood Risk Topic Paper has highlighted a number of Key Issues that need to be considered in taking the Local Plan forward. These Key Issues are considered to be as follows:

Key Issues for Flood Risk:

- Significant areas of the Borough are at risk of river and surface water flooding;
- Insufficient capacity in the sewer and drainage network to accommodate increasing amounts of surface water.
- Increasing conflict and pressures between climate change scenarios and future development aspirations.
- Land is required for new flood defences, natural flood management measures and flood water storage;