



Birmingham City Council

**May 2018 Flooding:
Flood and Water Management Act,
Section 19 Investigation**



August 2019

DATE ISSUED: 30 AUGUST 2019
VERSION: V2.0
STATUS: FINAL

BIRMINGHAM CITY COUNCIL

SECTION 19 INVESTIGATION

MAY 2018 FLOODING

AUGUST 2019

PREPARED BY:

Birmingham City Council – Lead Local Flood Authority

REVIEWED BY:

Birmingham City Council – Leisure

Birmingham City Council – Housing

Birmingham City Council – Bereavement

Birmingham City Council - Education

Severn Trent Water

Environment Agency

Amey – High Maintenance and Management Partner

Midland Heart

Metro PM

Avery Fields Community Sports Trust

APPROVED BY:

Birmingham Strategic Flood Risk Management Board

CONTENTS

EXECUTIVE SUMMARY	1
1 INTRODUCTION	2
1.2 Lead Local Flood Authority.....	2
1.3 Section 19 Requirements	2
1.4 May 2018.....	3
2 TYPES OF FLOODING	7
2.2 Surface Water flooding	7
2.3 River Flooding.....	8
2.4 Sewer Flooding.....	9
2.5 Flooding from Highway Drainage.....	10
3 FLOOD RISK MAPPING	12
3.2 Surface Water Flood risk	12
3.3 Local Information on Surface Water Flood Risk.....	13
3.4 River Flood Risk	14
4 ANALYSIS OF FLOODING LOCATIONS.....	16
4.2 Recommended Actions	16
4.3 Sewer Infrastructure:	16
4.4 Highway Drainage:	16
4.5 Local Drainage:.....	17
4.6 Rivers and Watercourses:	17
4.7 Flood Mitigation:.....	18
4.8 Leaf Fall Management.....	19
5 FLOODED SITES	20
5.1 Acocks Green – Broom Hall Crescent.....	20
5.2 Billesley – Ardencote Road.....	22
5.3 Bournbrook and Selly Park – Hubert Road	24
5.4 Bournbrook and Selly Park – Oakfield Road	26
5.5 Bournbrook and Selly Park – Selly Park North	28
5.6 Bournbrook and Selly Park – Selly Park South	30
5.7 Bournbrook and Selly Park – The Avenues	32
5.8 Bournville and Cotteridge – Laburnum Road.....	34
5.9 Brandwood and Kings Heath – Brandwood Cemetery	36
5.10 Brandwood and Kings Heath – Brandwood Park Road.....	38
5.11 Brandwood and Kings Heath – High Street.....	40

5.12	Brandwood and Kings Heath – Newick Grove/Bryndale Avenue	42
5.13	Druids Heath and Monyhull – Bayston Road/Kinsey Grove	44
5.14	Druids Heath and Monyhull – Bicknell Croft/Saxelby Close	46
5.15	Druids Heath and Monyhull – Garretts Walk.....	48
5.16	Druids Heath and Monyhull – Rowcroft Covert.....	50
5.17	Druids Heath and Monyhull – Sherston Covert	52
5.18	Edgbaston – Barsham Close	54
5.19	Erdington – Spring Lane	56
5.20	Hall Green South – Brookwood Avenue.....	58
5.21	Harborne – Bourn Brook	60
5.22	Harborne – Clarence Road	62
5.23	Harborne – Mill Farm Road/Cadleigh Gardens/Quinton Road.....	64
5.24	Harborne – Weather Oaks	66
5.25	Highters Heath – Arundel Road	68
5.26	Highters Heath – Henlow Road/Sladepool Road	70
5.27	Highters Heath – Mountfield Close.....	72
5.28	Highters Heath – Warstock Road	74
5.29	Moseley – Moor Green	76
5.30	North Edgbaston – Wadhurst Road	78
5.31	Oscott – Queslett Road	80
5.32	Pype Hayes – Tyburn Road.....	82
5.33	Quinton – Amersham Close	84
5.34	Sparkhill.....	86
5.35	Stirchley – Dell Road.....	88
5.36	Stirchley – Pitcairn Close	90
5.37	Sutton Trinity – Wyndley Lane	92
5.38	Sutton Vesey – Boldmere Road and Wakefield Close.....	94
5.39	Druids Heath and Monyhull– Chanston Avenue.....	96
5.40	Druids Heath and Monyhull – Marsham Road.....	98
5.41	Hall Green – Sarehole Road	100
6	CONCLUSION.....	102

EXECUTIVE SUMMARY

When made aware of flooding, Birmingham City Council, in their role as Lead Local Flood Authority, has a duty to investigate the flood to determine the causes of the flooding and appropriate actions that may be undertaken by the relevant Risk Management Authority.

A storm occurred on 27th May 2018 across the West Midlands which impact many areas, including Birmingham. The storm which occurred was typical of summer storms in the UK, being short, intense and highly localised storm. The storm was also extreme in terms of the amount of rainfall that fell during the event.

As a result of this storm, a significant number flooding incidents were reported to Birmingham City Council and its flood risk management partners. 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. 448 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 180 incidents of internal flooding were reported across 41 areas of the City.

Birmingham City Council with the support of the Environment Agency and Severn Trent Water, has undertaken an investigation in each of the 41 areas where internal property flooding was reported, to determine the most likely cause of flooding (surface water flooding, flooding from rivers, flooding from sewer infrastructure and flooding from highway drainage).

For each of the 41 areas, the investigation undertaken has been summarised, outlining the extent of flooding reported, the most likely cause of the flooding and the actions that have been completed, or are proposed to be completed in the future.

1 INTRODUCTION

1.1.1 A significant storm event occurred in Birmingham on 27th May 2018. This storm caused widespread flooding to highways, open spaces and properties across Birmingham and as a result, Birmingham City Council have undertaken investigations in the areas where flooding occurred.

1.1.2 This report is aimed at providing a broad overview of the causes of the May 2018 flooding and identifies the next steps, if any, to be taken.

1.2 Lead Local Flood Authority

1.2.1 Following Royal Assent of the Flood and Water Management Act in 2010 (FWMA), Birmingham City Council became the Lead Local Flood Authority (LLFA). As such, Birmingham City Council is responsible for coordinating the management of surface water flood risk, groundwater flood risk and the flood risk from ordinary watercourses¹.

1.2.2 As LLFA, Birmingham City Council is required to work in partnership with other Risk Management Authorities (RMAs) and agencies to coordinate the management of flood risk. These agencies and authorities include, but are not exclusive to:

- Environment Agency, who hold responsibility for Main Rivers;
- Severn Trent Water, who hold responsibility for the public sewer network;
- Emergency service providers; and,
- Other public agencies and bodies.

1.3 Section 19 Requirements

1.3.1 The FWMA also places a duty on Lead Local Flood Authorities to investigate incidents of flooding. This is set out in Section 19 of the act and the investigations are therefore typically termed '*Section 19 Reports*.' The Act states:

1. On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate
 - a. Which risk management authorities have relevant flood risk management functions, and

¹ An ordinary watercourse is defined as all watercourses not designated as 'Main River,' i.e. watercourse that are not managed by the Environment Agency.

- b. Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.
 2. Where an authority carries out an investigation under subsection 1) it must
 - a. Publish the results of its investigation, and
 - b. Notify any relevant risk management authorities.
- 1.3.2 It should be noted that not all flooding will require a formal investigation and report.
- 1.3.3 Birmingham City Council has, set out in its Local Flood Risk Management Strategy², a three stage process which will be used to determine to what extent it considers is 'necessary or appropriate' to investigate and what constitutes a significant flood event.
- 1.3.4 Stage 1 is an initial assessment, sufficient to ascertain with some confidence the extent of the flooding consequences. The second stage is to carry out a detailed investigation of the sites where it has been deemed necessary and appropriate. Reporting and publishing is the third, and final, stage. These stages may be described as: -
- Stage 1: Initial assessment
 - Stage 2: S19 Investigation
 - Stage 3: S19 Report and publish
- 1.3.5 It follows that there will be requirements for coordination and cooperation between Risk Management Authorities at each stage and, where required, following the outcome of a S19 Investigation. This will be undertaken via day to day officer communication, and through the LLFA's governance process for flood risk management.

1.4 May 2018

- 1.4.1 As a result of the storm on 27th May 2018; widespread flooding occurred across Birmingham. Flooding was reported to Birmingham City Council across 147 areas of the City, ranging from waterlogged gardens, impassable roads and water outflowing from highway gullies to rivers breaching banks, manholes and sewers surcharging and internal property flooding.
- 1.4.2 This report has been based on the reported incidents of flooding; however it is likely that the actual number of incidents of flooding was higher than that reported.

² https://www.birmingham.gov.uk/downloads/file/2556/local_flood_risk_management_strategy

Storm Event

- 1.4.3 The Environment Agency operates a network of rain gauges across the UK which record rainfall data at 15 minute intervals. This recorded data allows for an estimate of the rate of rainfall i.e. its intensity. In contrast, the Met Office uses radar to measure rainfall at 1km grid square resolution which was thereafter sampled by the Environment Agency to a grid of 5km covering the West Midlands.
- 1.4.4 The Environment Agency has conducted an analysis on the rainfall data recorded by the gauges, which has been supplemented with the Met Office rainfall radar data and private rain gauges.
- 1.4.5 From this analysis, the event recorded on the 27th May was of high intensity and highly localised. This was an exceptional storm with depths of rainfall of up to 27mm recorded at rain gauges to the north of the City and depths of rainfall of up to 90mm in the south of the City.
- 1.4.6 The main areas affected by the May 2018 storms are shown in Figure 1.1 below.

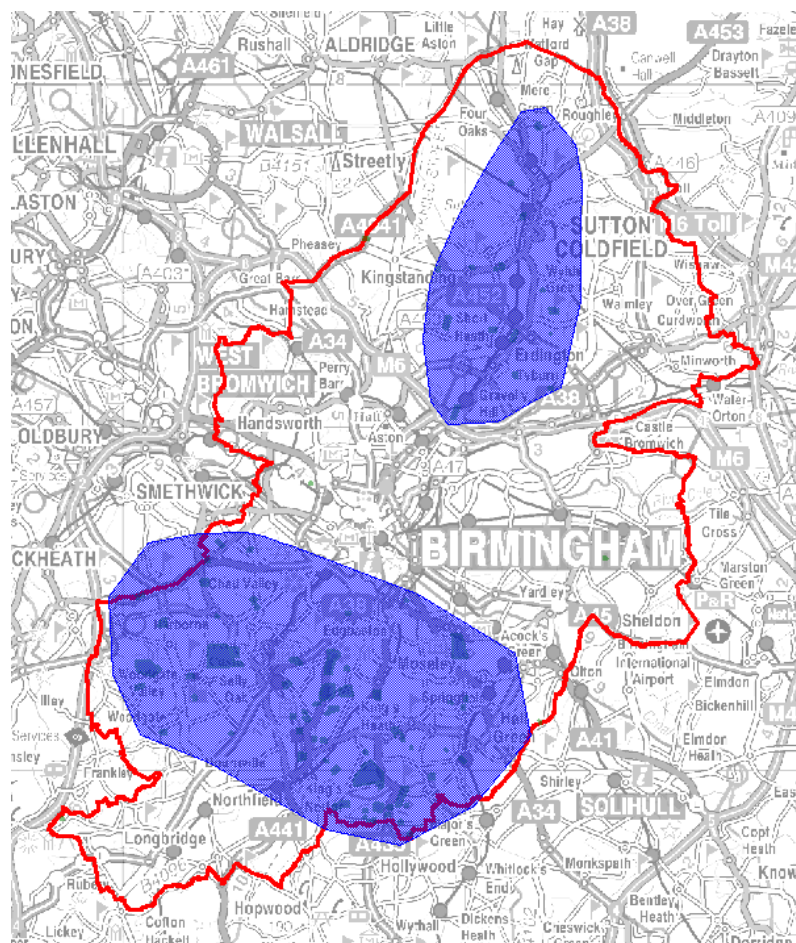


Figure 1.1 – Areas Affected by Flooding May 2018 Storms

Investigation into Flooded Areas

1.4.7 Following the event of May 2018, Birmingham City Council, in their role as LLFA, has undertaken the steps as outlined below:

1.4.8 Step 1: During the Flood Event

- Birmingham City Council received a high number of calls during the event, which reported flooding of properties, gardens and highways.
- During the flood events, the LLFA coordinated with multiple RMAs to ensure that flooding was managed effectively and the risk to people and properties was mitigated as far as reasonably practicable

1.4.9 Step 2: Initial Investigations

- Through the use of call records, email reports, discussions with Ward Councillors, flooding investigation questionnaires and site visits, the LLFA identified 147 locations where flooding occurred and distributed 'Flood Surveys' to over 2000 property owners and residents directly affected by flooding and those within the surrounding area.
- 448 responses were received, providing personal accounts of the flood event including the estimated time, duration, extent and depth with any other information which was felt pertinent.
- Following receipt of the Flood Survey responses, the LLFA identified 41 areas where at least one property experienced internal flooding.
- If the flooding mechanism is already known and understood a detailed investigation will not be undertaken.

1.4.10 Step 3: Detailed Investigation and Analysis

- The LLFA conducted detailed investigation and individual location analysis of each of the 41 areas where a minimum of one property experienced internal flooding. It should be noted that Birmingham City Council have defined internal property flooding as:

'Flooding that occurs in a habitable room within a single property, excluding garages, porches and underfloor ingress of water.'

- These investigations typically included a review of existing infrastructure and topography, identification of predominant flow paths, site visits and local knowledge gathering
- Through a detailed analysis, the LLFA have identified the types of flooding that occurred at each location during the events of May 2018.

- The LLFA does not undertake detailed investigation of external flooding to garages, gardens and highways due to limited resources and funding. Indeed gardens often act as flood storage areas and highways can be designed to convey flood waters reducing the extent/level of internal property flooding.

1.4.11 Step 4: Recommended Actions

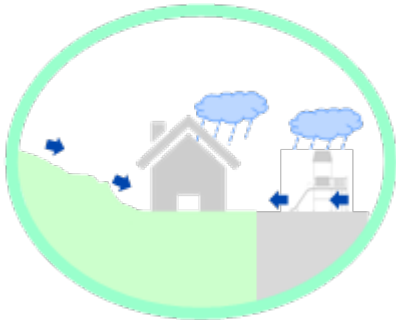
- Following the analysis of the 41 affected areas, the LLFA have worked in collaboration with other RMAs to identify opportunities and options for follow on actions to investigate potential mitigation should a similar rainfall event with result in similar outcomes. These have been summarised as 'Recommended Actions' and a lead RMA has been identified to undertake these actions.

1.4.12 Section 5 of this report provides a summary of the findings from the works undertaken to date with regard to the 41 affected areas.

2 TYPES OF FLOODING

2.1.1 The following section explores the various types of flooding that were experienced during the events in May 2018.

2.2 Surface Water flooding



2.2.1 Surface water is rainwater which is on the surface of the ground and has not soaked into the ground or entered a watercourse, drainage system or sewer. During a storm event, rainfall will land on the ground and depending on the characteristics of the ground it will behave in different ways.

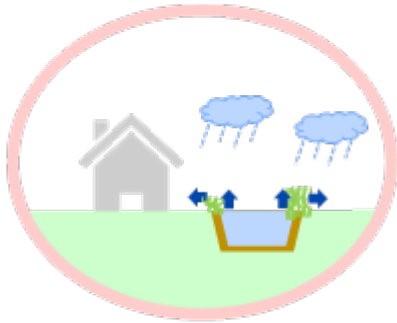
- Soft surfaces, known as permeable surfaces, allow water to soak (infiltrate) into the ground. These are typically in the form of gardens, parks, fields and green spaces.
- Hard surfaces, known as impermeable surfaces, do not allow any rainfall to soak into the ground and this rainfall will become (surface water) runoff. Runoff is usually very quick too. Impermeable surfaces are typically in the form of highways and roads, roofs, car parks and public squares.

2.2.2 Surface water flooding occurs under a number of circumstances, most commonly occurring when:

- There has been a prolonged period of rainfall and the permeable surface becomes saturated therefore no more water can infiltrate into the ground;
- The rainfall intensity is very high, and the rain is falling faster than it can infiltrate into the ground;
- There has been a prolonged warm dry period, the permeable surface may be baked hard and effectively turn the permeable surface into hard impermeable surface;
- It rains on impermeable surfaces, and there is no formal means of managing the rainfall; and
- There is heavy rainfall on impermeable surfaces and surface water cannot enter the drainage system provided to manage rainfall as the system is at capacity.

2.2.3 During most storm events, the rainfall rate is low enough to allow surface water to soak into the ground or drain into formal drainage systems (e.g. gully pots). However, during an extreme event, where the intensity of the rainfall is high or there is an excessive volume of water, it is unable to soak into the ground or enter formal drainage systems and as such it will flow across a surface in an uncontrolled manner.

2.3 River Flooding



2.3.1 River flooding occurs when the amount of water in a river channel exceeds its capacity. This causes the water level in the river channel to rise above the river banks, where water flows from the channel into the surrounding area.

2.3.2 In terms of flood risk management there are two classifications of rivers/watercourses:

- Main River.
- Ordinary Watercourse.

2.3.3 The Environment Agency holds responsibility for the management of flood risk on Main Rivers. All other watercourses, which are not specified as Main Rivers are termed ordinary watercourses. Flood risk management of these watercourses is the responsibility of the LLFA. However in both cases, the riparian owner³, that is anyone who owns land or property next to, or over, a watercourse, is responsible for maintenance of watercourse through their land.

2.3.4 River flooding occurs under a number of circumstances, most commonly occurring when:

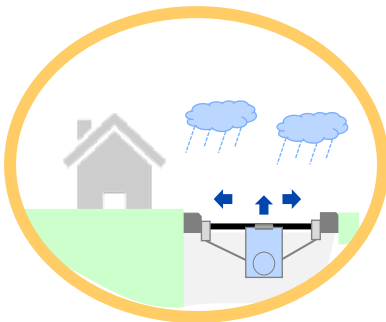
- There has been a prolonged period of rainfall and the river levels have risen due to surface water runoff and inflow from sewer infrastructure;

³ The Environment Agency produce a guide entitled Living on the Edge for riparian owners which outlines their rights and responsibilities.

- There has been a prolonged period of rainfall whereby permeable surface become saturated and the rate of surface water runoff increases thereby reaching the river faster;
- There is heavy rainfall on impermeable surfaces and the provided drainage system conveys water to the river quickly;
- There are high flows within the river which become restricted by structures (e.g. bridges and culverts) which results in water levels upstream rising and spilling from the banks; and
- Sediment and debris building up in the river channel and reduces the capacity of the river channel causing flows to spill from the banks.

2.3.5 During most storm events, rivers are capable of conveying flows within their channels however, during an extreme event where the volume of water may be significant, flows may exceed the channel capacity and spill from the river in an uncontrolled manner.

2.4 Sewer Flooding



2.4.1 Where rainfall falls on an impermeable surface, it will typically be served by a formal drainage system, most commonly this is a sewer. There are different types of sewer, including:

- Surface Water Sewers carry rainfall and surface water away from properties to watercourses;
- Foul Water Sewers carry wastewater away from properties to be treated; and,
- Combined Sewers drain both wastewater from properties along with surface water runoff from highways, roofs, car parks and other sources. These systems were typically constructed up to the 1950s and hence are still found in historic areas of the city.

2.4.2 Flooding from sewer infrastructure occurs under a number of circumstances, most commonly occurring when:

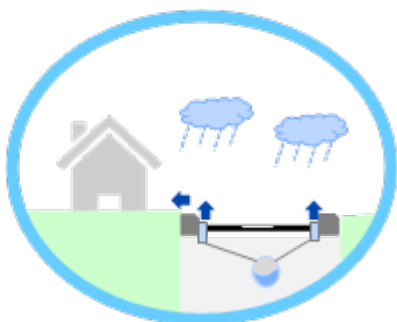
- There is a blockage, or the sewer itself collapses, which restricts or prevents flow within the sewer network. This causes water to back-up through the network and find its way to the surface, typically through a manhole or associated drainage structure.
- There is a period of heavy and/or prolonged rainfall, which results in significant flows that exceed the capacity of the sewer network. This prevents water from entering the sewer network and may result in surface flooding.

2.4.3 Severn Trent Water, as the sewerage undertaker, is responsible for the operation and maintenance of the public sewers within the Birmingham area.

2.4.4 Surface water and foul water sewers are currently designed in accordance with Sewers for Adoption (6th Edition, published 2006). This guidance states that sewers should have to capacity to deal with all runoff from a storm with a 3.33% probability of occurring in any given year and not cause any above ground flooding. This guidance is relatively recent having been brought into effect in the last 10 to 15 years. In addition, improvements in computer aided design and calculations also ensure designs are in agreement with the existing standards.

2.4.5 Therefore, at the time of construction of much of the sewer network across Birmingham, the design standards may have been to accommodate a smaller storm event. The designs will likely have been done by hand and may have used “rules of thumb” to determine the required sizes. As a result, the drainage network is complex with some sewers able to accommodate storms well above current design standards and other sewers much lower. Thus, when a large storm event occurs, the existing drainage network (combined or surface water sewers) may be significantly overwhelmed.

2.5 Flooding from Highway Drainage



2.5.1 Highway drainage consists of gullies, drainage channels and other features which collect and drain rainfall away from the highway. These features are typically located on one, or both, side(s) of the highway where they connect to an underground

highway drainage system which ultimately connects to the public sewer infrastructure.

- 2.5.2 Where rainfall falls onto the highway, this will enter the highway drainage system or flow within the highway channel until a point where it enters the system or ponds on the surface.
- 2.5.3 In new development, it is common practice to use highways to contain and convey heavy rainfall events away from properties, however historically this practice has not happened.
- 2.5.4 Across Birmingham, properties can be seen at or below the level of the adjacent road. This means that should a carriageway not be able to contain the water flowing within it, flow will overtop the kerbs on the highway and spill over adjacent land into properties.
- 2.5.5 Flooding from highway infrastructure occurs under a number of circumstances, most commonly occurring when:
- There is a blockage or build-up of surface debris in the vicinity of a gully, typically trash, leaves and twigs, which prevents, or restricts, the highway runoff from entering the gullies and subsequent highway infrastructure.
 - There is a period of heavy and/or prolonged rainfall, whereby the volume of rainfall falling onto the highway overwhelms the highway drainage features and is unable to be captured. The resulting flows are then conveyed or contained within the highway, until such times as the water level overtops the kerbs and flows overland into properties.
 - The sewer, culvert or watercourse to which the highway drainage is connected is at full capacity and therefore the highway run-off has no-where to drain to.
- 2.5.6 Birmingham City Council, in their role as the local highway authority, is responsible for the highway drainage and gullies across Birmingham. The maintenance of highway assets is currently undertaken by Amey, the Council's Highway Maintenance and Management Partner, under a 25 year PFI contract. This work includes maintenance of the highway drainage including roadside gully pots.

3 FLOOD RISK MAPPING

3.1.1 Flooding is traditionally very difficult to predict, and while there are many local factors that influence flooding, there are a number of publically available, national information tools which can enhance our understanding of the potential flood risks within a local area, more specifically risk of flooding from surface water and from rivers.

3.2 Surface Water Flood risk

3.2.1 In 2013, the Environment Agency, working with LLFAs, produced the Risk of Flooding from Surface Water map⁴. This is the third national surface water map produced by the Environment Agency under their Strategic Overview role and is the first publicly available surface water flood risk map.

3.2.2 Storms are usually given with an annual probability or the chance of occurring in any given year. Typically, smaller storms have a higher probability of occurring in any given year and larger storms have a lower probability of occurring. However, the probability only describes the chance a storm will occur and not when. This means that if a large, low probability storm occurs, it can happen again soon after or can happen a long time after.

3.2.3 This mapping assesses surface water flood risk as a result of the chance of rainfall occurring in any given year, and is categorised into the following three scenarios:

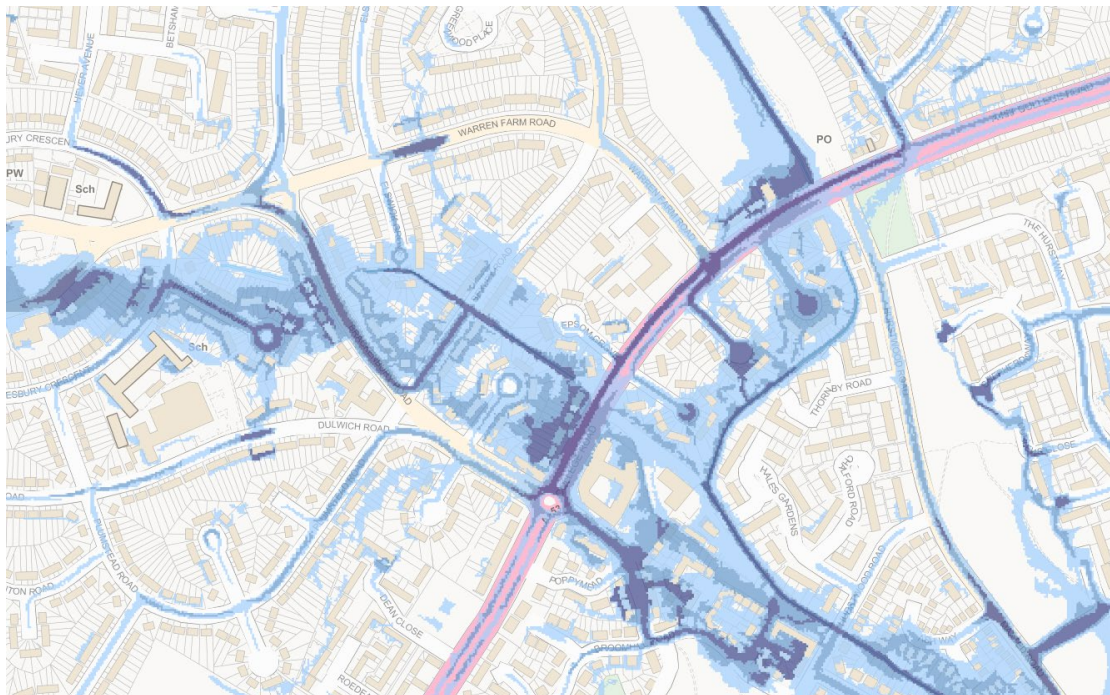
- **High Risk:** Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year or 3.3% chance that the storm will occur in a single year
- **Medium Risk :** Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year
- **Low Risk:** Flooding occurring as a result of rainfall between 1 in 1000 and 1 in 100 chance in any given year or between 0.1% and 1% chance that the storm will occur in a single year
- **Very Low Risk:** Flooding occurring as a result of rainfall with less than 1 in 1000 chance in any given year or less than 0.1% chance that the storm will occur in a single year.

3.2.4 It should be noted that this mapping has been produced at national scale with a number of assumptions and therefore there are some limitations at a local scale and

⁴ <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

is not appropriate for identifying individual property level flood risk. This mapping is publicly available for use, and is available online⁵.

3.2.5 A typical surface water flood map is shown in figure 3.1.



- High Risk
- Medium Risk
- Low Risk
- Very Low Risk

Figure 3.1 - Flood Risk from Surface Water Mapping

3.3 Local Information on Surface Water Flood Risk

3.3.1 In addition, Birmingham City Council has developed maps that indicate the areas shown to be at risk of surface water flooding known as the Surface Water Management Plan Map (SWMP). 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 when the study was published in 2015. This mapping is publicly available for use, and is available online⁶.

⁵ <https://www.gov.uk/government/publications/flood-maps-for-surface-water-how-they-were-produced>

⁶ https://localview.birmingham.gov.uk/My_Local_Information/Sites/Flood/

3.3.2 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.

3.3.3 The Environment Agency guidance on surface water flood risk information recommends that LLFAs 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 City Council's locally agreed surface water information consists of the Flooding from Surface Water maps overlaid by the SWMP maps in areas where detailed studies were carried out.

3.4 River Flood Risk

3.4.1 With regards to river flooding the Environment Agency publish the Flood Risk from Rivers or the Sea map. This shows the flood risk from Environment Agency Main Rivers and from the sea, taking into account any flood defences that may be present.

3.4.2 Storms are usually given with an annual probability or the chance of occurring in any given year. Typically, smaller storms have a higher probability of occurring in any given year and larger storms have a lower probability of occurring. However, the probability only describes the chance a storm will occur and not when. This means that if a large, low probability storm occurs, it can happen again soon after or can happen a long time after.

3.4.3 This mapping assesses flood risk from rivers or the sea as a result of the chance of rainfall occurring in any given year, and is categorised into the following four scenarios:

- **High Risk:** Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year or 3.3% chance that the storm will occur in a single year
- **Medium Risk :** Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year
- **Low Risk:** Flooding occurring as a result of rainfall between 1 in 1000 and 1 in 100 chance in any given year or between 0.1% and 1% chance that the storm will occur in a single year
- **Very Low Risk:** Flooding occurring as a result of rainfall with less than 1 in 1000 chance in any given year or less than 0.1% chance that the storm will occur in a single year.

3.4.4 This modelling is publically available as the Environment Agency’s Flood Risk from Rivers or the Sea map⁷ and is available online.

3.4.5 A typical flood risk from rivers map is shown in figure 3.2.

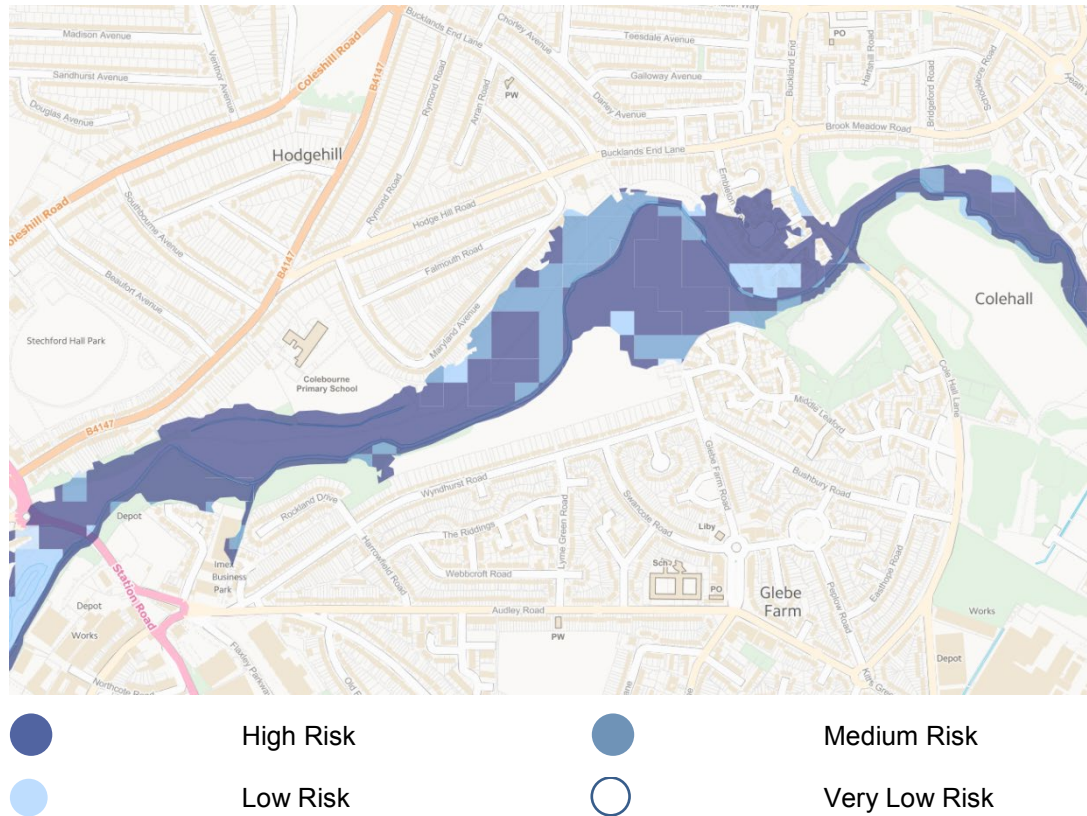


Figure 3.2 - Flood Risk from Rivers or the Sea map

⁷ <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

4 ANALYSIS OF FLOODING LOCATIONS

4.1.1 Section 5 provides a summary of the detailed investigation and analysis undertaken by Birmingham City Council, in their role as LLFA, of the 41 sites that experienced internal property flooding and identifies further actions to 41 sites to be undertaken.

4.2 Recommended Actions

4.2.1 While many of the recommended actions outlined for each location are tailored specifically to the location where the flooding occurred, there are some actions that are applicable in multiple locations. The following section provides a summary of what these actions may entail:

4.3 Sewer Infrastructure:

Assess the condition and capacity of the sewer network

- 4.3.1 The above recommended action may incorporate multiple tasks which may include:
- An assessment of the sewer network, ensuring that the existing infrastructure is capable of draining the catchment effectively
 - Investigation and survey of existing assets, for example using CCTV and in-person inspections, to ensure blockages and flow restrictions (e.g. silt accumulation) are removed
 - Feasibility assessment and optioneering of means to increase capacity of sewer network
 - Review existing maintenance schedules and explore opportunities to increase frequency of maintenance and/or incorporation of additional maintenance tasks
 - Hydraulic modelling and performance analysis.

4.4 Highway Drainage:

Assess the condition and capacity of the highway drainage network

- 4.4.1 The above recommended actions may incorporate multiple tasks which may include:
- Review of the location and condition of existing highway drainage assets, to ensure flows are not impeded and that sufficient gullies are in place to collect flows.
 - Assessment of the capacity of the local highway drainage network to explore opportunities to increase capacity

Review the maintenance schedule of highway assets

4.4.2 The above recommended actions may incorporate multiple tasks which may include:

- Review existing maintenance schedules and explore opportunities to increase frequency of maintenance and/or incorporation of additional maintenance tasks

4.5 Local Drainage:

Assess the condition and capacity of local drainage

4.5.1 The above recommended actions may incorporate multiple tasks which may include:

- Review of the location and condition of existing drainage assets, to ensure flows are not impeded and that sufficient gullies are in place to collect flows.
- Assessment of the capacity of the local drainage network to explore opportunities to increase capacity

Review the maintenance schedule of local drainage assets (e.g. gullies)

4.5.2 The above recommended actions may incorporate multiple tasks which may include:

- Review existing maintenance schedules and explore opportunities to increase frequency of maintenance and/or incorporation of additional maintenance tasks

4.6 Rivers and Watercourses:

Assess the condition and capacity of the watercourse

4.6.1 The above recommended actions may incorporate multiple tasks which may include:

- Site visits and surveys to identify current condition of rivers, watercourses and assets, including culverts, outfalls and structures
- Rehabilitation works including sediment removal, debris removal, clearance of vegetation and restoration of channels where required
- Exploration of opportunities to enhance flow capacity of channels and storage capacity of adjacent floodplains

Review the maintenance regime for the watercourse

4.6.2 The above recommended actions may incorporate multiple tasks which may include:

- Review existing maintenance schedules and explore opportunities to increase frequency of maintenance and/or incorporation of additional maintenance tasks

4.7 Flood Mitigation:

Explore the potential for Property Flood Resilience

4.7.1 The above recommended action may incorporate multiple tasks which may include:

- Site visits and surveys to identify potential flood resilience
- Exploration of property level resilience products to establish if potential resilience measures may be appropriate
- Advice to property owners on potential resilience measures and actions that could be taken by the owner to protect themselves
- Investigation into previously installed or existing property level resilience measures to assess the effectiveness of the installed measures

Explore the potential for community scale flood mitigation

4.7.2 The above recommended action may incorporate multiple tasks which may include:

- Site visits and surveys to identify potential flood mitigation
- Explore community scale solutions including, property flood walls and gates, small flood defence walls/banks, flood routing, local drainage improvements

Explore the potential for catchment wide flood mitigation

4.7.3 The above recommended action may incorporate multiple tasks which may include:

- Site visits and surveys to identify potential flood mitigation
- Construction of computation models to replicate how watercourses and/or sewers behave when subjected to a significant storm to enhance understanding of flooding mechanisms and properties which are most vulnerable
- Explore catchment wide solutions including, flood defence walls/banks, flood storage areas
- Feasibility assessment and optioneering of potential measures that may mitigate flood risk

Implementation of Flood Alleviation Scheme

4.7.4 The above recommended action may include:

- Implementation of an agreed and approved flood alleviation scheme

Assess residual surface water flood risk

4.7.5 The above recommended action may include:

- Investigate residual risk that may exist where a predominantly river or sewer flood alleviation scheme has been implemented

4.8 Leaf Fall Management

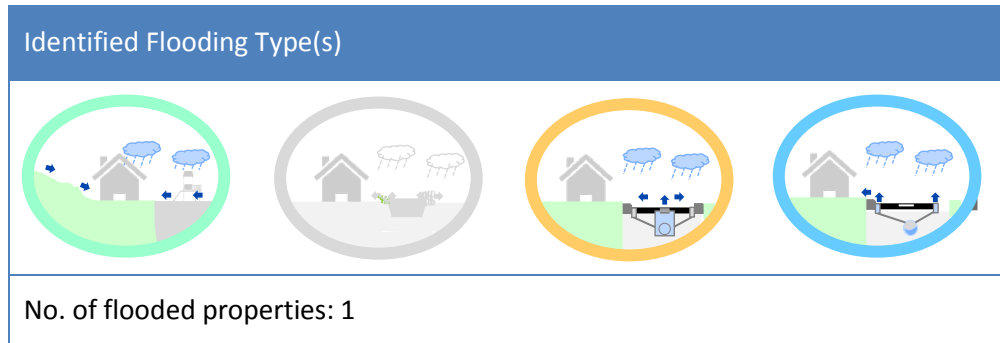
Explore the potential to manage leaf litter

4.8.1 The above recommended action may incorporate multiple tasks which may include:

- Tree canopy reduction to reduce leaf fall
- Review of maintenance regime to explore opportunities to increase frequency or undertake additional street sweeping

5 FLOODED SITES

5.1 Acocks Green – Broom Hall Crescent



What happened?

5.1.1 During the storm event, one incident of internal property flooding was reported in Broom Hall Crescent, with flooding to highways and gardens also reported.

Why did it happen?

5.1.2 The flooding in this area has been identified to be from surface water, sewer flooding and flooding from highway drainage.

5.1.3 The flood flow route is indicated in figure 5.1.



Figure 5.1 - Flood Flow Route

5.1.4 Due to the magnitude of the storm on 27th May 2018, runoff from the surrounding area followed the natural topography via the highway network, ultimately ponding in the low spot in Broom Hall Crescent. As the storm progressed the level of water built up as it couldn't discharge into the drainage system quickly enough. Bow waves from passing vehicles caused water to overtop kerbs and flood into properties that lie lower than the road level.

What has been done?

5.1.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

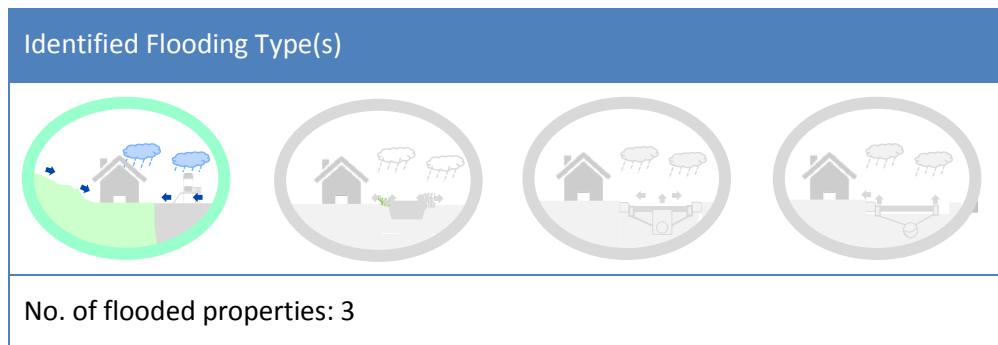
5.1.6 The Highway Maintenance and Management Partner has cleansed the gullies in the area and removed the weir gullies to minimise the risk of blockage.

What next?

5.1.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess condition and capacity of sewer network	Severn Trent Water

5.2 Billesley – Ardencote Road



What happened?

5.2.1 During the storm event, three incidents of internal property flooding were reported in Ardencote Road, with flooding to gardens also reported.

Why did it happen?

5.2.2 The flooding in this area has been identified to be from surface water.

5.2.3 The flood flow route is indicated in figure 5.2.



Figure 5.2 - Flood Flow Route

5.2.4 Due to the magnitude of the storm on 27th May 2018, runoff from the surrounding area followed the natural topography, via the highway network ultimately ponding outside properties. As the storm progressed the level of water built up and overtopped kerbs flowing towards properties which lie lower than the road level.

What has been done?





5.2.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.2.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for community scale flood mitigation	Birmingham City Council (Housing) Birmingham City Council (LLFA)

5.3 Bournbrook and Selly Park – Hubert Road

Identified Flooding Type(s):			
			
No. of flooded properties: 1			

What happened?

5.3.1 During the storm event, one incident of internal property flooding was reported in Hubert Road, with flooding to gardens and the highway also reported.

Why did it happen?

5.3.2 The flooding in this area has been identified to be from surface water.

5.3.3 The flood flow route is indicated in figure 5.3.



Figure 5.3 - Flood Flow Route

5.3.4 Due to the magnitude of the storm on 27th May 2018, runoff from the Heeley Road area followed the natural topography of the land, resulting in flooding to the rear of properties in Hubert Road. Flood water also found its way between properties to cause flooding of the highway in Hubert Road. As the storm progressed the level of water built up, entering properties from the rear.

What has been done?

5.3.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.


What next?

5.3.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore potential for property flood resilience	Birmingham City Council (LLFA) Property Owners
Review maintenance schedule for highway assets	Highway Maintenance and Management Partner

5.4 Bournbrook and Selly Park – Oakfield Road

Identified Flooding Type(s):



No. of flooded properties: 1

What happened?

5.4.1 During the storm event, one incident of internal property flooding was reported in Oakfield Road, with flooding to gardens and the highway also reported.

Why did it happen?

5.4.2 The flooding in this area has been identified to be from surface water.

5.4.3 The flood flow route is indicated in figure 5.4.

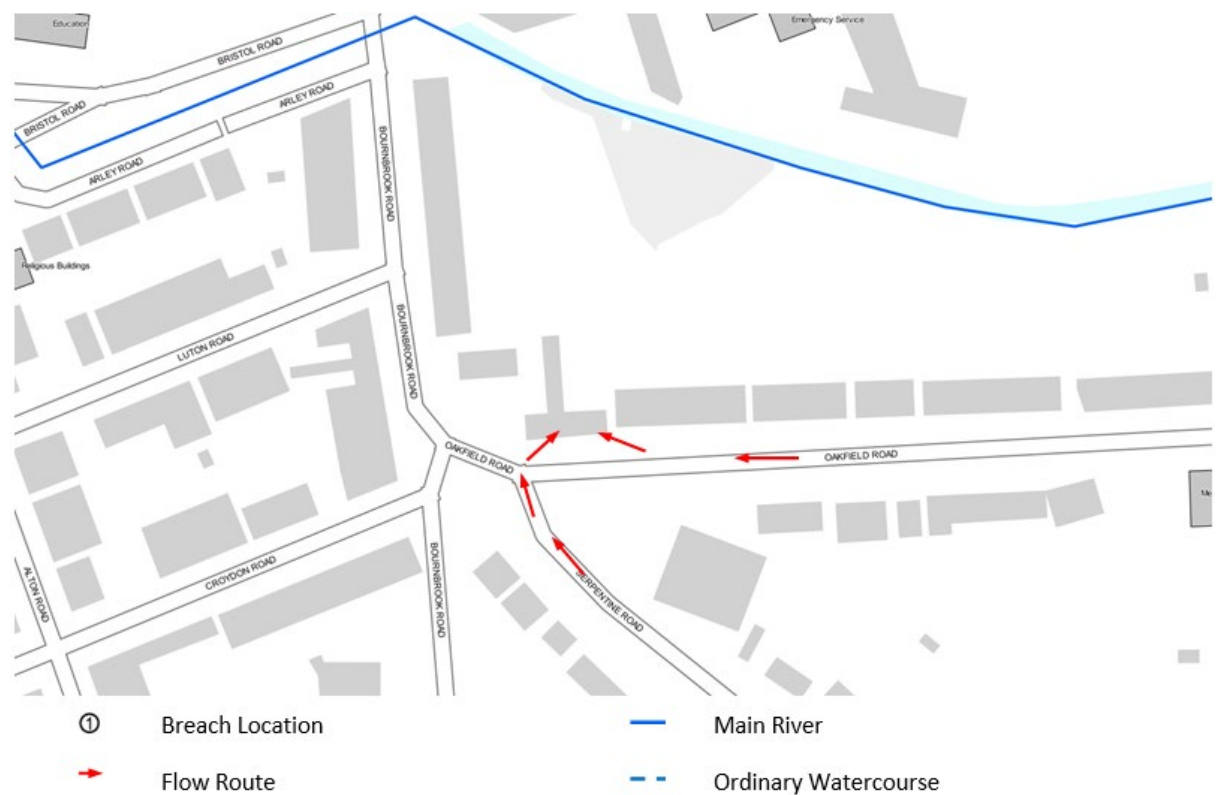


Figure 5.4 - Flood Flow Route

5.4.4 Due to the magnitude of the storm on 27th May 2018, runoff from highway catchment draining Oakfield Road and Serpentine Road followed the natural topography of the land via the highway network to the low spot in Oakfield Road. As the storm progressed the volume of water overtopped kerbs and flowed towards the properties. Flooding occurred as the affected property does not have a raised threshold.

What has been done?

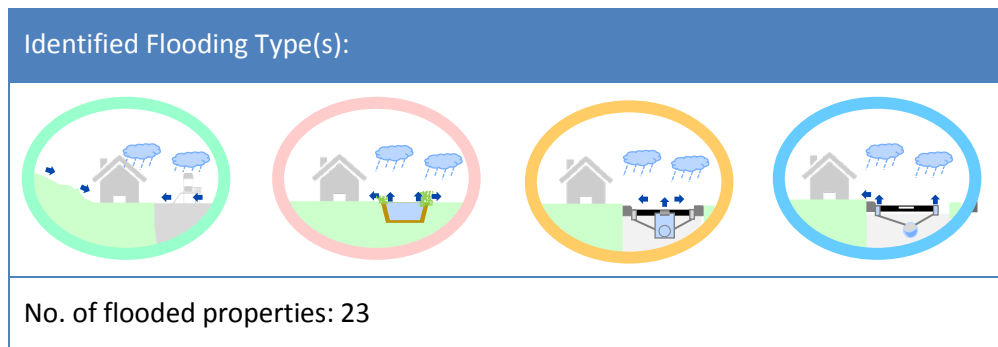
5.4.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.4.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore potential for property flood resilience	Birmingham City Council (LLFA) Property Owners

5.5 Bournbrook and Selly Park – Selly Park North



What happened?

5.5.1 During the storm event, twenty three incidents of internal property flooding were reported in Third Avenue, Fourth Avenue, Riverside Drive, Pershore Road and Sir Johns Road. Flooding to gardens and the highway was also reported.

Why did it happen?

5.5.2 The flooding in this area has been identified to be from rivers, surface water, sewers and highway drainage.

5.5.3 The flood flow route is indicated in figure 5.5.

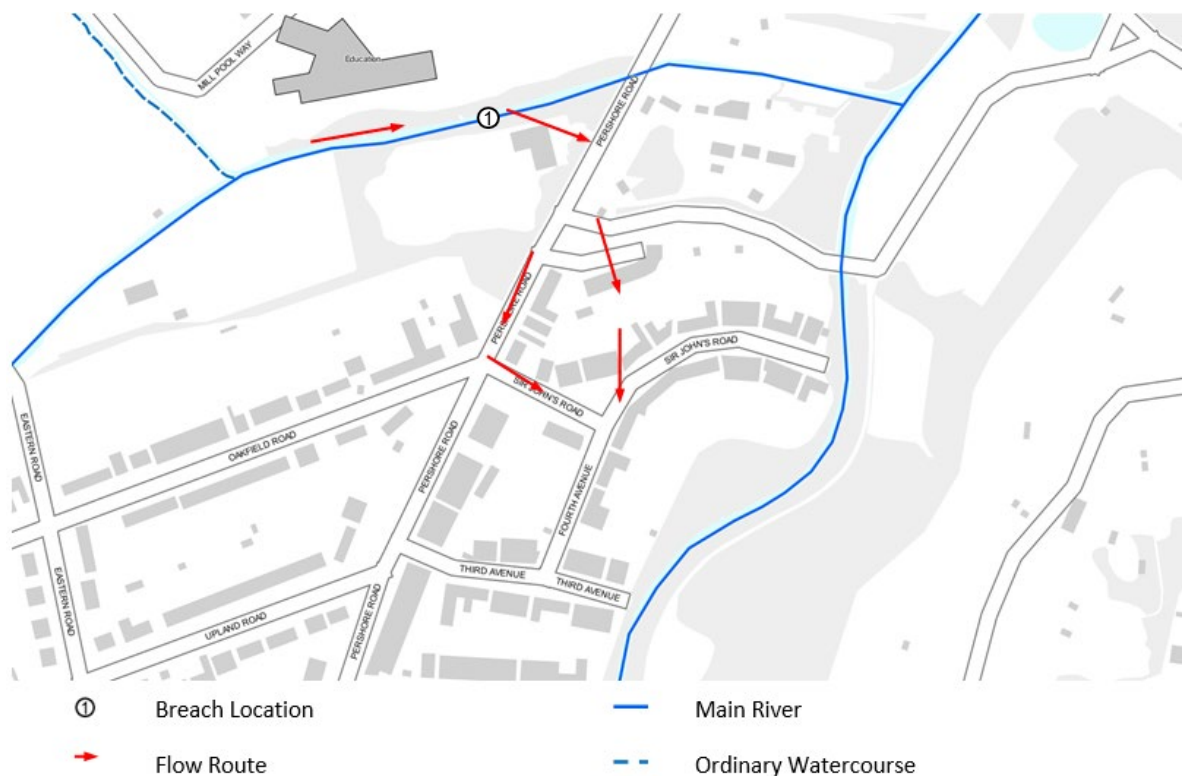


Figure 5.5 - Flood Flow Route

5.5.4 Due to the magnitude of the storm, the capacity of the Bourn Brook was overwhelmed and it is understood to have breached resulting in water flowing across Pershore Road into the front of properties fronting onto Riverside Drive. The topography of the land and network directed surface water runoff into St John's Road, via Pershore Road, and from there into Fourth Avenue and Third Avenue.

What has been done?

5.5.5 Following the flood event, Birmingham City Council (LLFA) and the Environment Agency have undertaken a site walkover of the affected areas

5.5.6 A community meeting was held with local residents following the flood event.

5.5.7 The remaining wall at the end of Sir Johns Road has been removed and dropped kerbs have been installed to allow flood water into the River Rea.

5.5.8 Severn Trent Water have undertaken surveys and modelling of the sewers in the area.

5.5.9 Birmingham City Council and Severn Trent Water have raised concerns regarding residual surface water flood risk following completion of the river flooding scheme.

What next?

5.5.10 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Implementation of flood alleviation scheme	Environment Agency
Review residual flood risk from surface water	Environment Agency
Assess capacity of existing drainage infrastructure	Highway Maintenance and Management Partner
Assess condition and capacity of sewer network	Severn Trent Water

5.6 Bournbrook and Selly Park – Selly Park South

Identified Flooding Type(s):

No. of flooded properties: 1

What happened?

5.6.1 During the storm event, one incident of internal property flooding was reported in Fashoda Road. Flooding to gardens and the highway was also reported in Kitchener Road and Moor Green Lane

Why did it happen?

5.6.2 The flooding in this area has been identified to be from surface water.

5.6.3 The flood flow route is indicated in figure 5.6.

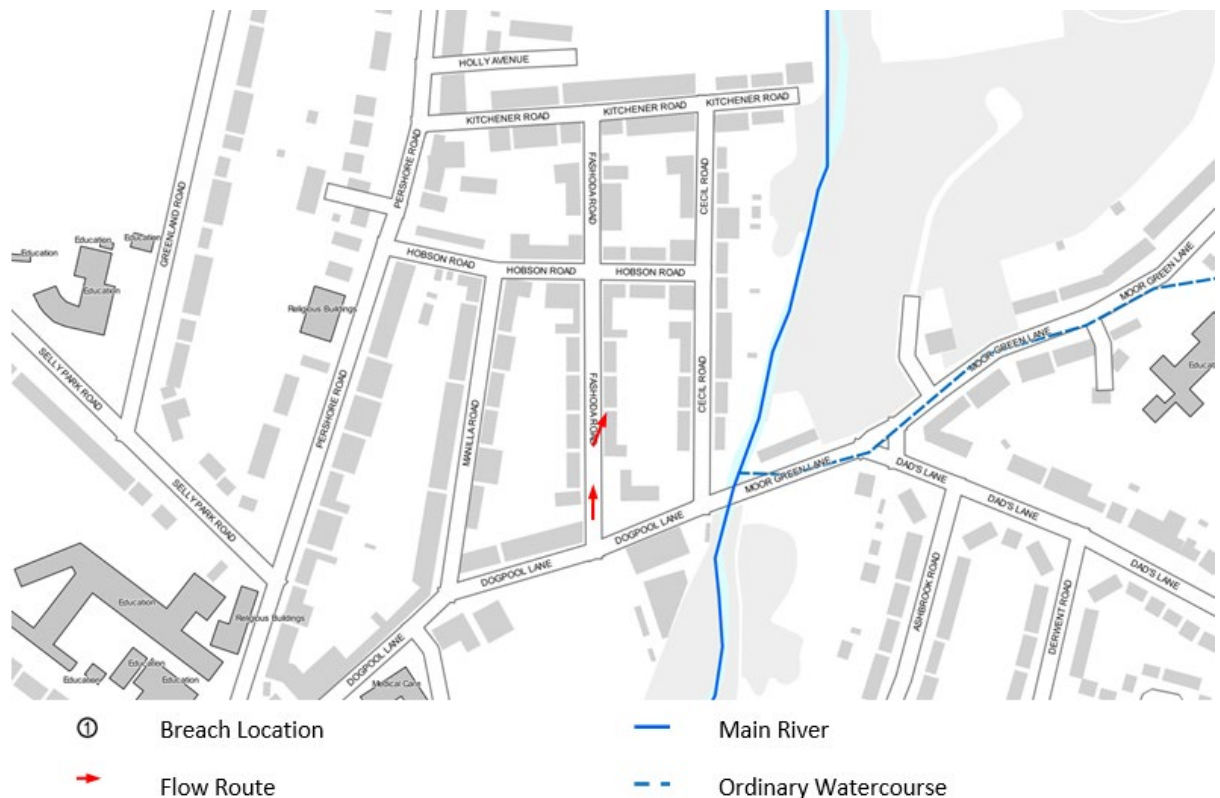


Figure 5.6 - Flood Flow Route

5.6.4 Due to the magnitude of the storm, surface water runoff flowed from Dogpool lane, following the natural topography of the area, via the highway network into Fashoda Road. Once in Fashoda Road it collected in a low spot before overtopping the kerbs and eventually flooding into the lowest lying properties.

What has been done?

5.6.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

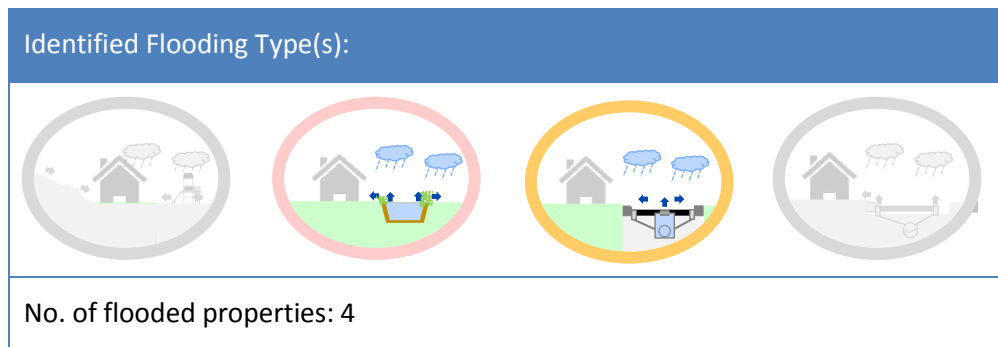
5.6.6 Birmingham City Council has raised concerns regarding residual surface water flood risk following completion of the river flooding scheme.

What next?

5.6.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for property flood resilience	Environment Agency Property Owners

5.7 Bournbrook and Selly Park – The Avenues



What happened?

5.7.1 During the storm event, four incidents of internal property flooding were reported in Pershore Avenue. Flooding to gardens also occurred. Flooding to the public open space in the adjacent playing field was also reported.

Why did it happen?

5.7.2 The flooding in this area has been identified to be from sewers and rivers.

5.7.3 The flood flow route is indicated in figure 5.7.

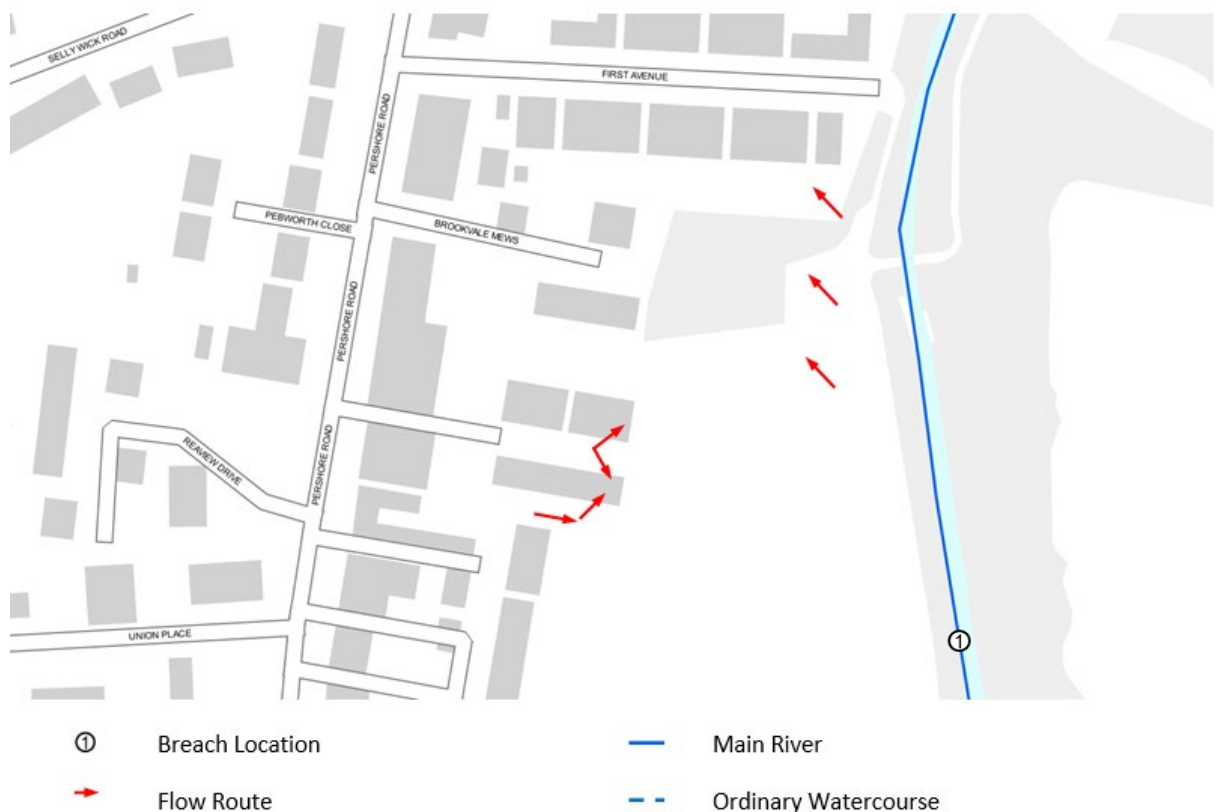


Figure 5.7 - Flood Flow Route

5.7.4 Due to the magnitude of the storm, sewers and the local drainage system were overwhelmed and water backed up flowing out of gullies and into properties. In addition to this the river rea broke its banks and flowed across the adjacent playing fields toward the rear of properties in First Avenue.

What has been done?

5.7.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

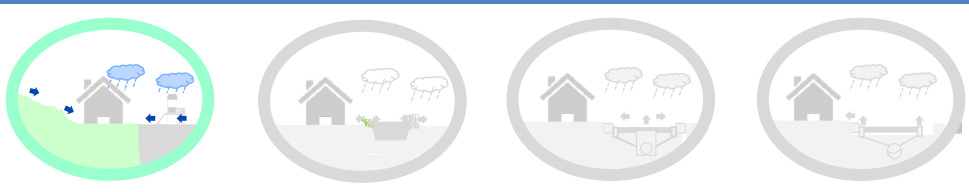
What next?

5.7.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess condition and capacity of local drainage	Property Owners
Explore the potential for community scale mitigation	Environment Agency
Assess condition and capacity of sewer network	Severn Trent Water

5.8 Bournville and Cotteridge – Laburnum Road

Identified Flooding Type(s):



No. of flooded properties: 1

What happened?

5.8.1 During the storm event, one incident of internal property flooding was reported in Laburnum Road. Flooding to gardens also occurred.

Why did it happen?

5.8.2 The flooding in this area has been identified to be from surface water,

5.8.3 The flood flow route is indicated in figure 5.8.



Figure 5.8 - Flood Flow Route

5.8.4 Due to the magnitude of the storm, runoff from the surrounding area followed the natural topography via the highway network, ultimately ponding in the low spot in Laburnum Road. As the storm progressed the level of water built up as it couldn't discharge into the drainage system quickly enough and overtop kerbs and flooded into properties that lie lower than the road level.

What has been done?

5.8.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.8.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for community scale mitigation	Birmingham City Council (LLFA)

5.9 Brandwood and Kings Heath – Brandwood Cemetery

Identified Flooding Type(s):

No. of flooded properties: 5

What happened?

5.9.1 During the storm event, five incidents of internal property flooding were reported in Broad Lane, Greenwood Close and Sunderton Road. Flooding to gardens also occurred in these road as well as Whittington Close.

Why did it happen?

5.9.2 The flooding in this area has been identified to be from surface water.

5.9.3 The flood flow route is indicated in figure 5.9.



Figure 5.9 - Flood Flow Route

5.9.4 Due to the magnitude of the storm, surface water runoff from Brandwood Cemetery overwhelmed the cemetery drainage and flowed into the rear of properties, following the natural topography of the land.

What has been done?

5.9.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure. Some drainage in the cemetery was found to be blocked during this site walkover.

What next?

5.9.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of local drainage	Birmingham City Council (Bereavement)
Review of maintenance schedule for local drainage assets	Birmingham City Council (Bereavement)
Explore the potential for community scale mitigation	Birmingham City Council (Bereavement)

5.10 Brandwood and Kings Heath – Brandwood Park Road

Identified Flooding Type(s):

No. of flooded properties: 3

What happened?

5.10.1 During the storm event, three incidents of internal property flooding were reported in Brandwood Park Road. Flooding to gardens and the highway also occurred.

Why did it happen?

5.10.2 The flooding in this area has been identified to be from rivers, surface water and highway drainage.

5.10.3 The flood flow route is indicated in figure 5.10.

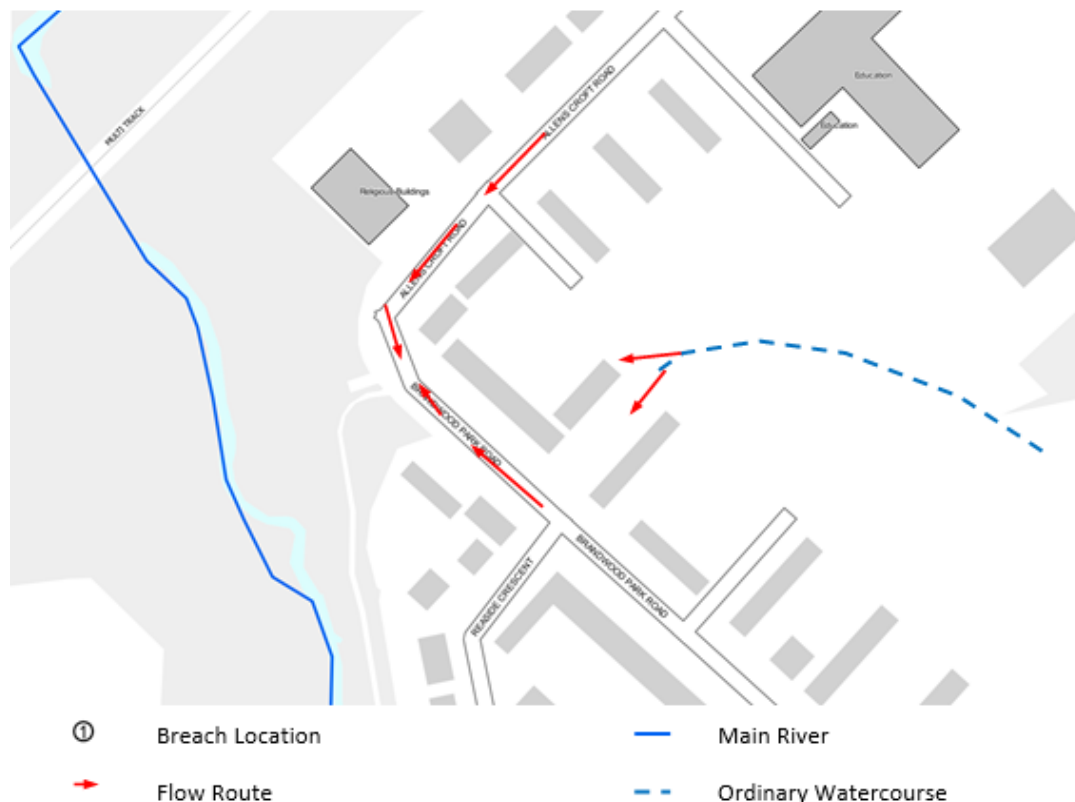


Figure 5.10 - Flood Flow Route

5.10.4 Due to the magnitude of the storm, the capacity of the watercourse in Dawberry Fields was exceeded, flow overtopped the channel and flooded across surrounding land into the rear of properties in Brandwood Park Road. Blockage of the trash screen may have exacerbated the problem. In addition to this runoff from the surrounding area followed the natural topography of the highway network, ultimately ponding in the low spot in Brandwood Park Road.

What has been done?

5.10.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.10.6 The trash screen on the watercourse in Dawberry Fields was found to be blocked, Birmingham City Council (Leisure) have undertaken clearance of this trash screen.

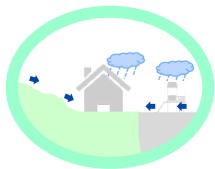
What next?


5.10.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for community scale mitigation	Birmingham City Council (Housing)
Assess the condition and capacity of highway drainage network	Highway Maintenance and Management Partner
Assess the condition and capacity of the watercourse	Birmingham City Council (Leisure)
Review the maintenance regime of the watercourse	Birmingham City Council (Leisure)

5.11 Brandwood and Kings Heath – High Street

Identified Flooding Type(s):






No. of flooded properties: 2 (commercial)

What happened?

5.11.1 During the storm event, two incidents of internal property flooding were reported in High Street, both of these incidents affected commercial properties. Flooding to the highway also occurred.

Why did it happen?

5.11.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.11.3 The flood flow route is indicated in figure 5.11.



Figure 5.11 - Flood Flow Route

5.11.4 Due to the magnitude of the storm, runoff from the surrounding area followed the natural topography via the highway network, ultimately ponding in the low spot in High Street. As the storm progressed the level of water built up as it couldn't discharge into the drainage system quickly enough and overtop kerbs and flooded into properties.

What has been done?

5.11.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.




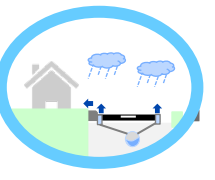
What next?

5.11.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for property flood resilience	Birmingham City Council (LLFA) Property Owners
Assess condition and capacity of the highway drainage network	Highway Maintenance and Management Partner

5.12 Brandwood and Kings Heath – Newick Grove/Bryndale Avenue

Identified Flooding Type(s):

No. of flooded properties: 2

What happened?

5.12.1 During the storm event, two incidents of internal property flooding were reported in Newick Grove and Bryndale Avenue. Flooding to the gardens and the highway also occurred.

Why did it happen?

5.12.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.12.3 The flood flow route is indicated in figure 5.12.



Figure 5.12 - Flood Flow Route

5.12.4 Due to the magnitude of the storm, runoff from the surrounding area followed the natural topography via the highway network, ultimately ponding in the low spot in Bryndale Avenue. As the storm progressed the level of water built up as it couldn't discharge into the drainage system quickly enough and overtopped kerbs and flooded into the property. From here water made its way between the properties in Bryndale Road emerging in Newick Grove. Due to the topography of Newick Grove, water overtopped the kerbs and flowed into the property which sites lower than the road.

What has been done?

5.12.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.12.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for community scale flood mitigation	Birmingham City Council (LLFA)
Assess condition and capacity of the highway drainage network	Highway Maintenance and Management Partner

5.13 Druids Heath and Monyhull – Bayston Road/Kinsey Grove

Identified Flooding Type(s):

No. of flooded properties: 4

What happened?

5.13.1 During the storm event, four incidents of internal property flooding were reported in Bayston Road and Kinsey Grove. Flooding to the gardens also occurred.

Why did it happen?

5.13.2 The flooding in this area has been identified to be from surface water.

5.13.3 The flood flow route is indicated in figure 5.13.



Figure 5.13 - Flood Flow Route

5.13.4 Due to the magnitude of the storm, surface water runoff from the allotment gardens flowed into the rear of properties, following the natural topography of the land.

What has been done?

5.13.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.13.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for community scale flood mitigation	Birmingham City Council (Leisure)

5.14 Druids Heath and Monyhull – Bicknell Croft/Saxelby Close

Identified Flooding Type(s):

No. of flooded properties: 11

What happened?

5.14.1 During the storm event, eleven incidents of internal property flooding were reported in Bicknell Croft and Saxelby Close. Flooding to the gardens, footpaths and the highway also occurred.

Why did it happen?

5.14.2 The flooding in this area has been identified to be from surface water.

5.14.3 The flood flow route is indicated in figure 5.14.

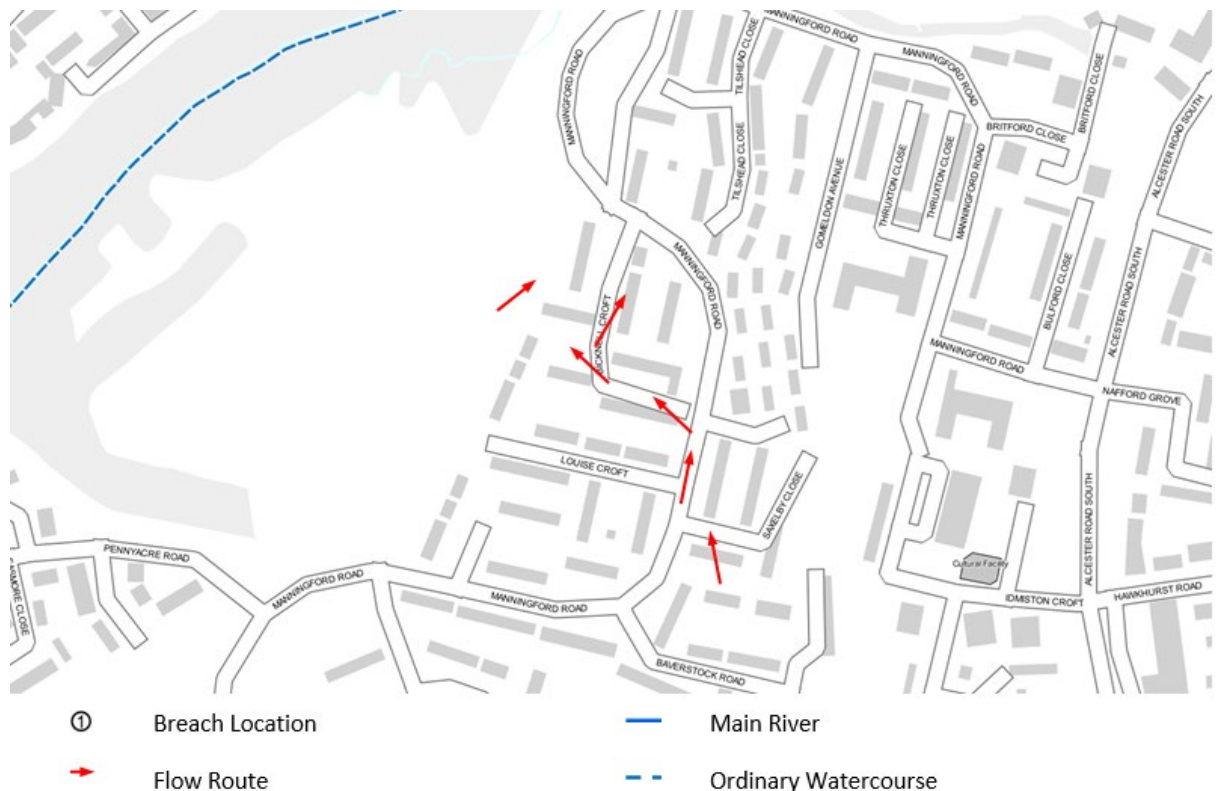


Figure 5.14 - Flood Flow Route

5.14.4 Due to the magnitude of the storm, runoff from the surrounding catchment, followed the natural topography of the area flowing from high land to low land. The main flow route was through properties in Saxelby Close, into Manningford Road where it followed the highway network before flowing into Bicknell Croft. A further flow route emanated from the public open space to the west, flowing into properties in Bicknell Croft.

What has been done?

5.14.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

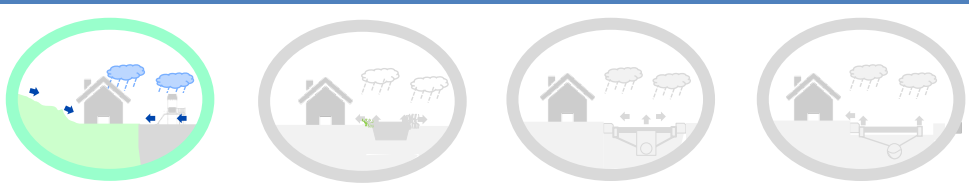
What next?

5.14.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for catchment wide flood mitigation	Birmingham City Council (LLFA) Birmingham City Council (Housing)

5.15 Druids Heath and Monyhull – Garretts Walk

Identified Flooding Type(s):



No. of flooded properties: 1

What happened?

5.15.1 During the storm event, one incidents of internal property flooding was reported in Garretts Walk. Flooding to the gardens and footpaths also occurred.

Why did it happen?

5.15.2 The flooding in this area has been identified to be from surface water.

5.15.3 The flood flow route is indicated in figure 5.15.



Figure 5.15 - Flood Flow Route

5.15.4 Due to the magnitude of the storm, runoff from the footpaths and gardens followed the natural topography of the area and flowed into the property that sits on lower lying land.

What has been done?

5.15.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.15.6 The site visit identified that the property owner has reprofiled their boundary to deflect flows along the footpath and away from the property.

What next?

5.15.7 No further actions are recommended for this area.

5.16 Druids Heath and Monyhull – Rowcroft Covert

Identified Flooding Type(s):

No. of flooded properties: 2

What happened?

5.16.1 During the storm event, two incidents of internal property flooding were reported in Rowcroft Covert. Flooding to the gardens and the highway also occurred.

Why did it happen?

5.16.2 The flooding in this area has been identified to be from surface water.

5.16.3 The flood flow route is indicated in figure 5.16.



Figure 5.16 - Flood Flow Route

5.16.4 Due to the magnitude of the storm, runoff from the surrounding public open space followed the natural topography of the area flowing towards the rear of the properties. Existing drainage adjacent to the properties was overwhelmed and water levels rose and entered properties from the rear.

What has been done?

5.16.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.16.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for community scale flood mitigation	Birmingham City Council (Housing) Birmingham City Council (LLFA)
Assess condition and capacity of local drainage	Birmingham City Council (Housing)
Review maintenance schedule of local drainage assets	Birmingham City Council (Housing)

5.17 Druids Heath and Monyhull – Sherston Covert

Identified Flooding Type(s):

No. of flooded properties: 2

What happened?

5.17.1 During the storm event, one incident of internal property flooding was reported in Sherston Covert. Flooding to the gardens also occurred.

Why did it happen?

5.17.2 The flooding in this area has been identified to be from surface water.

5.17.3 The flood flow route is indicated in figure 5.17.

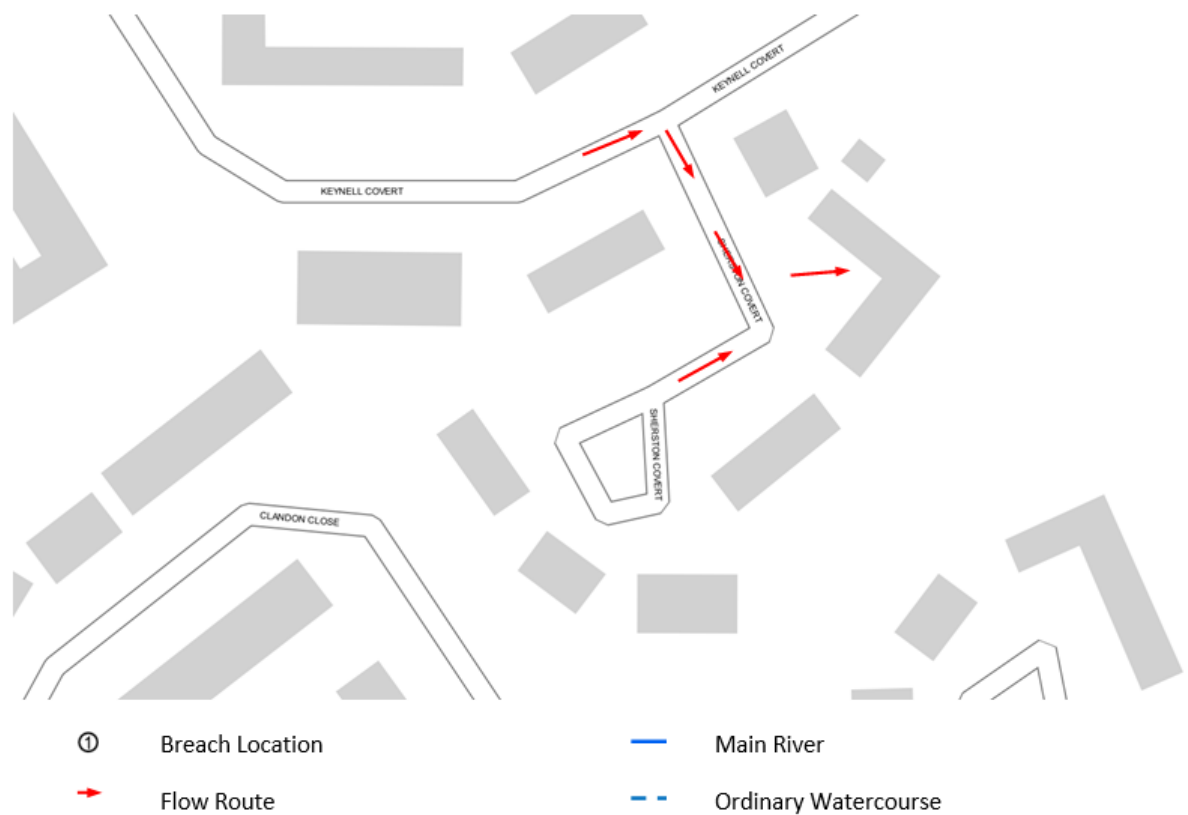


Figure 5.17 - Flood Flow Route

5.17.4 Due to the magnitude of the storm, runoff from the surrounding area followed the natural topography of the land via the highway network and ponded at the low spot in Sherston Covert. Water levels built up and water flowed into low lying property.

What has been done?

5.17.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.17.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for property flood resilience	Birmingham City Council (Housing) Birmingham City Council (LLFA)

5.18 Edgbaston – Barsham Close

Identified Flooding Type(s):

No. of flooded properties: 2

What happened?

5.18.1 During the storm event, two incidents of internal property flooding were reported in Barsham Close. Flooding to the gardens, open spaces and the highway also occurred.

Why did it happen?

5.18.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.18.3 The flood flow route is indicated in figure 5.18.



Figure 5.18 - Flood Flow Route

5.18.4 Due to the magnitude of the storm, runoff from the surrounding area followed the natural topography of the land via the highway network and ponded at the low spot in Barsham Close. Water levels built up and water flowed into low lying property. As Barsham Close is a private road, the highway drainage is the responsibility of Birmingham City Council Housing.

What has been done?

5.18.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.18.6 Some drainage in Barsham Close was found to be blocked during this site walkover and was reported to Birmingham City Council Housing who arranged for the gullies to be cleared.



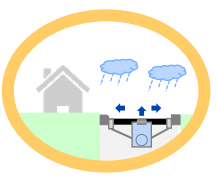

What next?

5.18.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess condition and capacity of local drainage	Birmingham City Council (Housing)
Review maintenance schedule of local drainage assets	Birmingham City Council (Housing)

5.19 Erdington – Spring Lane

Identified Flooding Type(s):

No. of flooded properties: 1

What happened?

5.19.1 During the storm event, one incident of internal property flooding was reported in Spring Lane. Flooding to the gardens and the highway also occurred.

Why did it happen?

5.19.2 The flooding in this area has been identified to be from surface water and sewer flooding.

5.19.3 The flood flow route is indicated in figure 5.19.



Figure 5.19 - Flood Flow Route

5.19.4 Due to the magnitude of the storm, runoff from Spring Lane and Fern Road followed the natural topography of the land via the highway network and ponded at the low spot in Spring Lane. The surface water sewers may have been at full capacity and therefore the highway gullies were unable to discharge into the sewer. Flood water overtopped dropped kerbs and flooded into lower lying property.

What has been done?

5.19.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

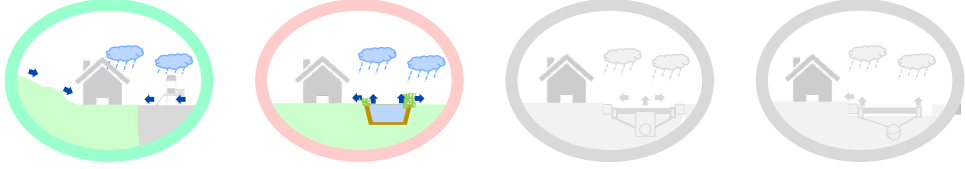
What next?

5.19.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess condition and capacity of the sewer network	Severn Trent Water

5.20 Hall Green South – Brookwood Avenue

Identified Flooding Type(s):



No. of flooded properties: 1

What happened?

5.20.1 During the storm event, one incident of internal property flooding was reported in Brookwood Close. Flooding to the gardens and the highway also occurred.

Why did it happen?

5.20.2 The flooding in this area has been identified to be from surface water and fluvial flooding.

5.20.3 The flood flow route is indicated in figure 5.20.



Figure 5.20 - Flood Flow Route

5.20.4 Due to the magnitude of the storm, runoff from the surrounding catchment followed the natural topography of the land via the highway network and ponded at the low spot in Brookwood Close. Water was unable to disperse through the highway gullies due to the high river level in the River Cole. Blockages in the River Cole may have exacerbated the problem by increasing river levels.

What has been done?

5.20.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.20.6 Birmingham City Council has undertaken work to remove blockages and debris from the River Cole channel.

What next?

5.20.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess condition and capacity of the watercourse	Birmingham City Council (LLFA)

5.21 Harborne – Bourn Brook

Identified Flooding Type(s):

No. of flooded properties: 8

What happened?

5.21.1 During the storm event, eight incidents of internal property flooding were reported in Reservoir Road, Quinton Road and Beaumont Drive. Flooding to the gardens and the highway also occurred in these roads together with Mellors Close, Ferncliffe Road and Omaston Road.

Why did it happen?

5.21.2 The flooding in this area has been identified to be from fluvial flooding.

5.21.3 The flood flow route is indicated in figure 5.21.

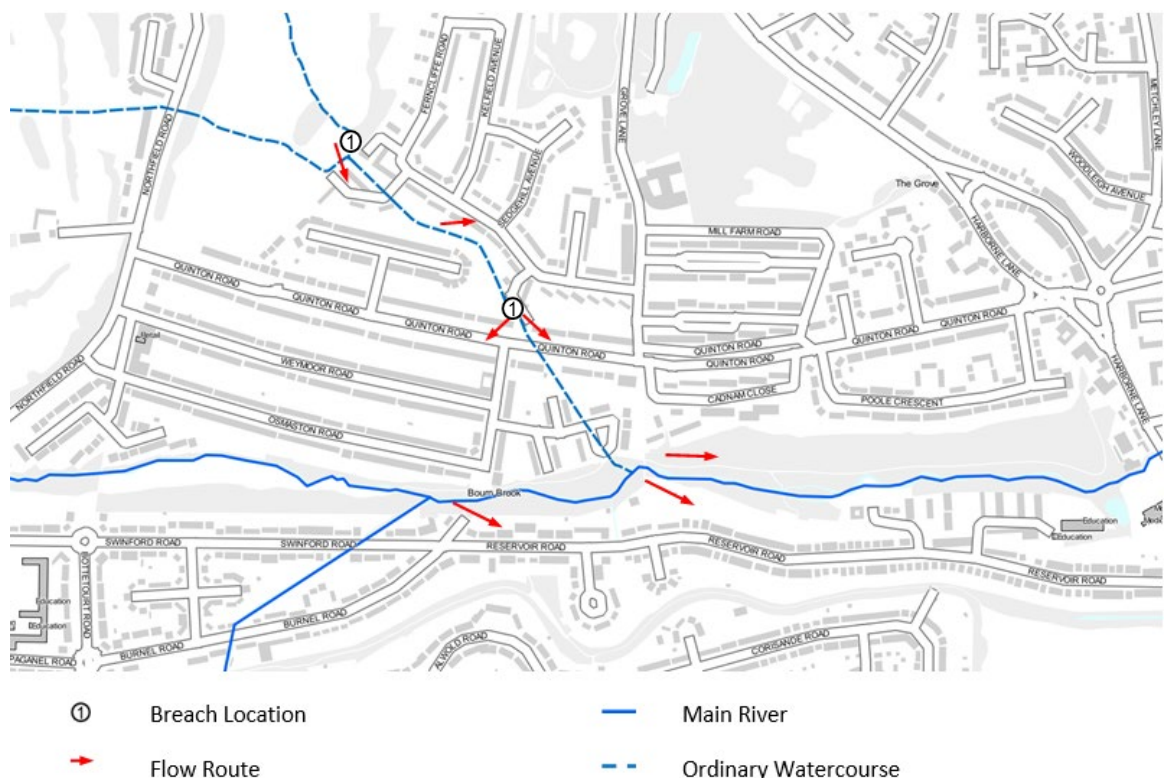


Figure 5.21 - Flood Flow Route

5.21.4 Due to the magnitude of the storm, the capacity of Harts Green Brook and Bourn Brook was exceeded and the flow overtopped the channel and flooded into adjacent property. Flooding was exacerbated by blockages along Harts Green Brook due to accumulations of debris and fallen trees. Restrictions due to accumulations of silt were also reported in Bourn Brook, possibly as a result of reductions in maintenance.

What has been done?

5.21.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.21.6 A community event was held to discuss the flooding.

5.21.7 Birmingham City Council has undertaken work to remove blockages and debris from the Harts Green Brook channel.

5.21.8 The Environment Agency, Severn Trent Water and Birmingham City Council have continued to work on a study to assess flood risk in the upper Bourn Brook catchment.

What next?

5.21.9 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess condition and capacity of the watercourse	Birmingham City Council (Leisure) Birmingham City Council (Housing)
Review maintenance regime for the watercourse	Birmingham City Council (Leisure) Birmingham City Council (Housing)
Explore the potential for catchment wide flood mitigation	Environment Agency Birmingham City Council (LLFA) Severn Trent Water

5.22 Harborne – Clarence Road

Identified Flooding Type(s):

No. of flooded properties: 4

What happened?

5.22.1 During the storm event, four incidents of internal property flooding were reported in Clarence Road. Flooding to the gardens and the highway also occurred in Harts Close

Why did it happen?

5.22.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.22.3 The flood flow route is indicated in figure 5.22.



Figure 5.22 - Flood Flow Route

5.22.4 Due to the magnitude of the storm runoff from the surrounding catchment made its way towards the properties via the highway network causing flooding from two mechanisms:

- Runoff from Harts Close, accumulated at the low spot in road before overtopping kerbs and flowing into back gardens and into properties. At this point Harts Close is a private road maintained by Midland Heart
- Runoff from High Street flowed via St Johns Street to the low point in Clarence Road where levels built up and entered properties.

What has been done?

5.22.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.22.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of the highway drainage network	Highway Maintenance and Management Partner
Assess the condition and capacity of local drainage	Midland Heart
Explore the potential for property flood resilience	Birmingham City Council (LLFA) Property Owners

5.23 Harborne – Mill Farm Road/Cadleigh Gardens/Quinton Road

Identified Flooding Type(s):

No. of flooded properties: 8

What happened?

5.23.1 During the storm event, eight incidents of internal property flooding were reported in Mill Farm Road, Cadleigh Gardens and Quinton Road. Flooding to the gardens, footpaths, public open space and the highway also occurred.

Why did it happen?

5.23.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.23.3 The flood flow route is indicated in figure 5.23.



Figure 5.23 - Flood Flow Route

5.23.4 Due to the magnitude of the storm runoff from the surrounding catchment made its way towards the properties from two mechanisms:

- Runoff from Grove Park, overtopping the flood bund and flooding into properties in Mill Farm Close which are situated lower than the road. This flood water then passed between the houses into Cadleigh Gardens and Quinton Road causing further flooding.
- Runoff from the highway catchment serving Cadleigh Gardens, overtopping kerbs and flooding into lower lying properties. This mechanism was exacerbated by inadequate drainage serving the highway, footpaths and public open space.

What has been done?

5.23.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.23.6 Defective highway gully gratings have been replaced by the Highway Maintenance and Management Partner.

What next?

5.23.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of local drainage	Birmingham City Council (Housing)
Explore the potential for community scale flood mitigation	Birmingham City Council (Leisure) Birmingham City Council (LLFA)
Explore the potential to minimise leaf litter	Birmingham City Council (Housing)
Explore the potential for catchment wide flood mitigation	Environment Agency Birmingham City Council (LLFA) Severn Trent Water

5.24 Harborne – Weather Oaks

Identified Flooding Type(s):

No. of flooded properties: 2

What happened?

5.24.1 During the storm event, two incidents of internal property flooding were reported in Weather Oaks. Flooding to footpaths and gardens also occurred.

Why did it happen?

5.24.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.24.3 The flood flow route is indicated in figure 5.24.



Figure 5.24 - Flood Flow Route

5.24.4 Due to the magnitude of the storm, runoff from the surrounding catchment followed the natural topography of the land via the highway network and ponded at the low spot in Weather Oaks. Water was unable to disperse through the highway gullies, possibly due to blockage and water overtopped the kerbs and flowed across gardens/footpaths and into the lower lying properties.

What has been done?

5.24.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

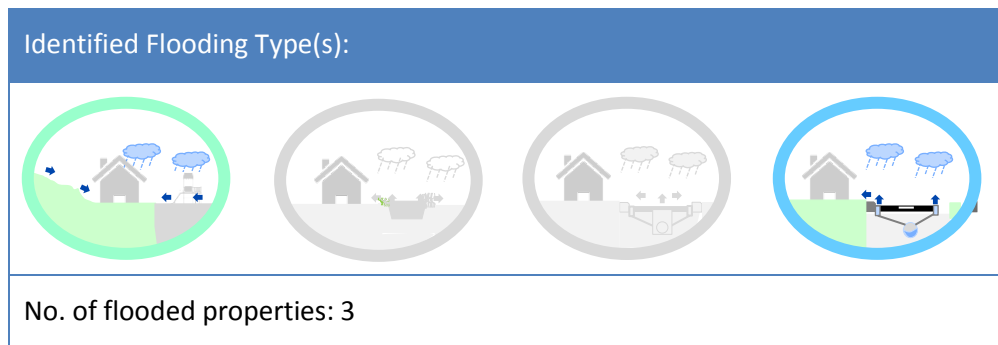
5.24.6 During the site visit a considerable accumulation of leaf litter was noted together with a number of blocked gullies.

What next?

5.24.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of local drainage	Private Road Owner via management company MetroPM
Review of maintenance regime schedule of local drainage assets	Private Road Owner via management company MetroPM
Explore the potential to minimise leaf litter	Private Road Owner via management company MetroPM
Assess the condition and capacity of local drainage	Birmingham City Council (Housing)

5.25 Highters Heath – Arundel Road



What happened?

5.25.1 During the storm event, three incidents of internal property flooding were reported in Arundel Road and Maypole Lane. Flooding to the highway, footpaths and gardens also occurred.

Why did it happen?

5.25.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.25.3 The flood flow route is indicated in figure 5.25.



Figure 5.25 - Flood Flow Route

5.25.4 Due to the magnitude of the storm, runoff from the surrounding catchment followed the natural topography of the land via the highway network and ponded at the low spot in Arundel Road. Due to the volume of runoff water was unable to disperse through the highway gullies, and water overtopped the dropped kerbs and flowed into the lower lying properties. Runoff also ran between properties flooding properties in Maypole Lane for the rear.

What has been done?

5.25.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

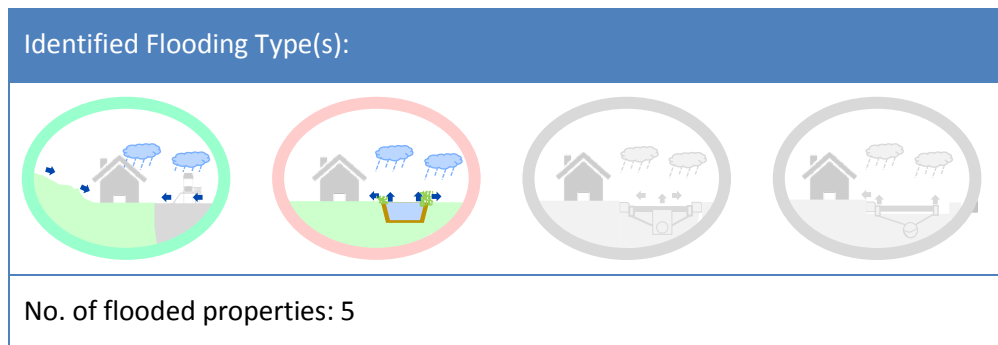
5.25.6 The Highway Maintenance and Management Partner has checked and cleansed the existing highway gullies.

What next?

5.25.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the capacity of the highway drainage network	Highway Maintenance and Management Partner
Explore the potential for property flood resilience	Birmingham City Council (LLFA) Property Owners

5.26 Highters Heath – Henlow Road/Sladepool Road



What happened?

5.26.1 During the storm event, five incidents of internal property flooding were reported in Henlow Road and Sladepool Road. Flooding to the highway, footpaths, gardens and allotments also occurred.

Why did it happen?

5.26.2 The flooding in this area has been identified to be from rivers and surface water.

5.26.3 The flood flow route is indicated in figure 5.26.



Figure 5.26 - Flood Flow Route

5.26.4 Due to the magnitude of the storm, runoff from the surrounding catchment followed the natural topography of the land via the highway network and ponded at the low spot in Henlow Road. Due to the volume of runoff water was unable to disperse through the highway gullies, and water overtopped the dropped kerbs and flowed into properties from the front. In addition to exceedance runoff from watercourse in the allotments flowed into the rear of properties.

What has been done?

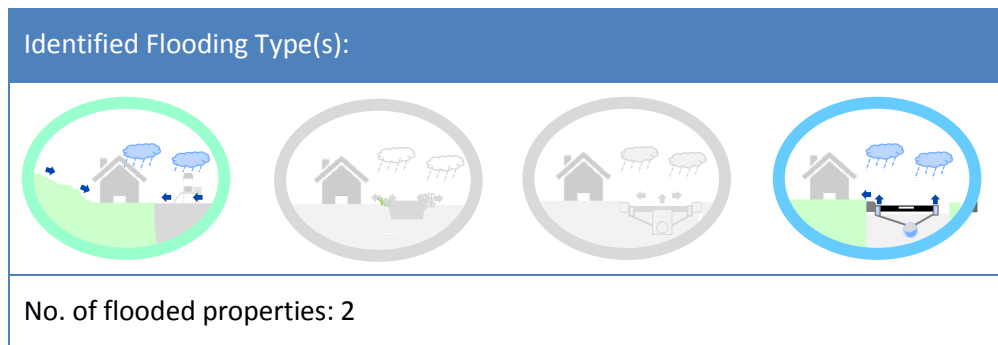
5.26.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.26.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of the highway drainage network	Highway Maintenance and Management Partner
Explore the potential for property flood resilience	Birmingham City Council (LLFA) Property Owners
Explore the potential for community scale flood mitigation	Birmingham City Council (Leisure)

5.27 Highters Heath – Mountfield Close



What happened?

5.27.1 During the storm event, two incidents of internal property flooding were reported in Mountfield Close.

Why did it happen?

5.27.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.27.3 The flood flow route is indicated in figure 5.27.



Figure 5.27 - Flood Flow Route

5.27.4 Due to the magnitude of the storm, runoff from the surrounding catchment followed the natural topography of the land via the highway network and ponded at the low spot in Mountfield Close and in the garage area off Glenavon Road. Due to the volume of runoff water was unable to disperse through the gullies, and water overtopped the kerbs and flowed into the lower lying properties.

What has been done?

5.27.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.27.6 Highway gullies have been cleansed by the Highway Maintenance and Management Partner and a significant accumulation of leaf fall was noted.

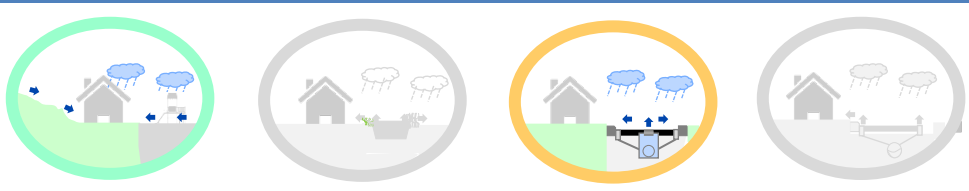
What next?

5.27.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Review maintenance schedule of highway assets	Highway Maintenance and Management Partner
Assess the condition and capacity of local drainage	Birmingham City Council (Housing)

5.28 Highters Heath – Warstock Road

Identified Flooding Type(s):



No. of flooded properties: 3 (including 1 commercial)

What happened?

5.28.1 During the storm event, three incidents of internal property flooding were reported in Warstock Road. One of the affected properties was a commercial property. Flooding to the highway also occurred in Warstock Road and Grendon Road.

Why did it happen?

5.28.2 The flooding in this area has been identified to be from surface water and sewer flooding.

5.28.3 The flood flow route is indicated in figure 5.28.

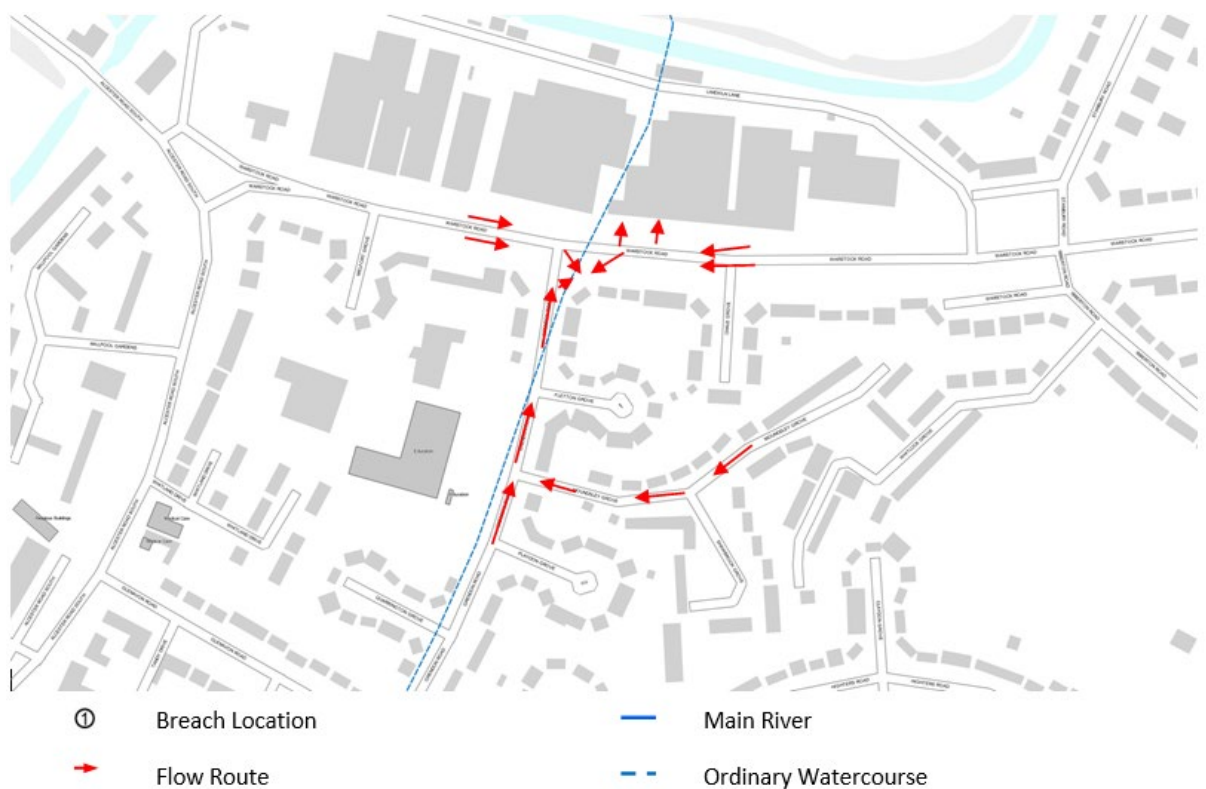


Figure 5.28 - Flood Flow Route

5.28.4 Due to the magnitude of the storm, runoff from the surrounding catchment followed the natural topography of the land via the highway network and ponded at the low spot in Warstock Road/Grendon Avenue Road. At this location, a pump on the sewer network became blocked while trying to pump away the volume of silt and dirt that had washed down in the storm, resulting in surface water runoff being unable to enter the sewer system and hence water levels rose, overtopping kerbs and resulting in flooding to properties which are located lower than the road.

What has been done?

5.28.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.28.6 Severn Trent Water have undertaken an inspection of their infrastructure and identified a heavy build-up of silt in the pumping station, the has been cleansed


What next?

5.28.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of the sewer network	Severn Trent Water

5.29 Moseley – Moor Green

Identified Flooding Type(s):



No. of flooded properties: 9 (including 1 school)

What happened?

5.29.1 During the storm event, nine incidents of internal property flooding were reported in Cadine Gardens, Moor Green Lane, Seaton Grove and Shutlock Lane. One of the affected properties was a school. Flooding to the highway and gardens also occurred in these roads as well as Tilbury Grove.

Why did it happen?

5.29.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.29.3 The flood flow route is indicated in figure 5.29.

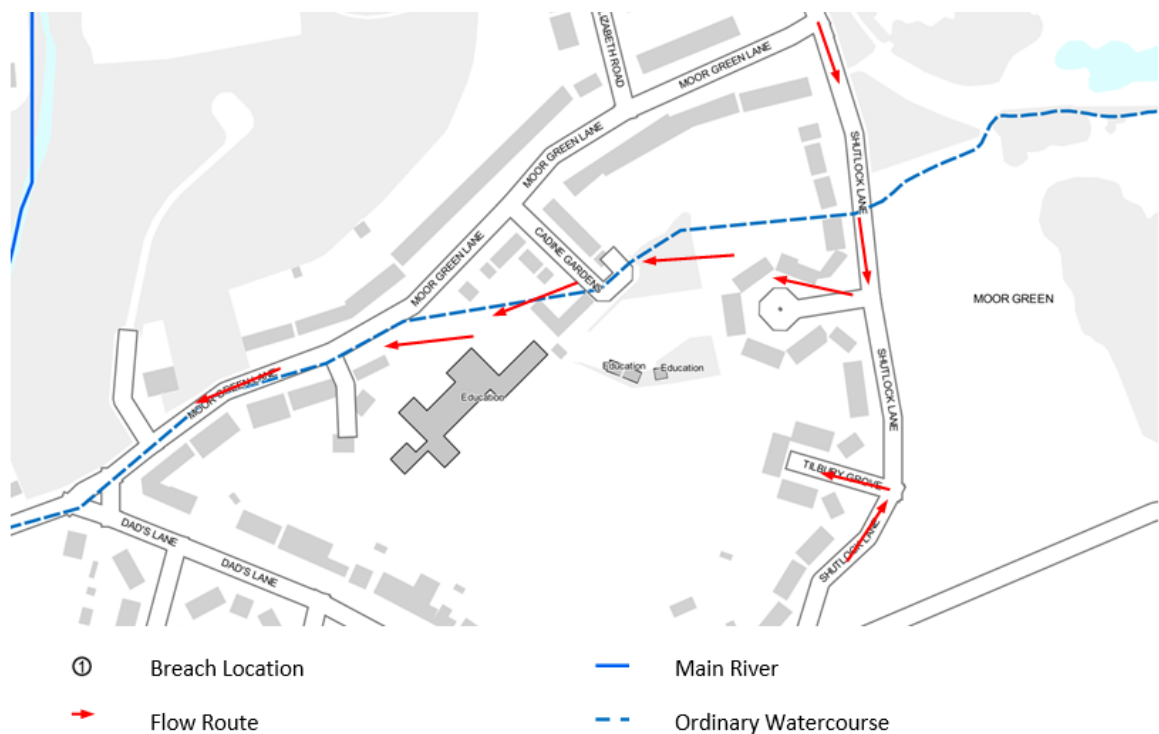


Figure 5.29 - Flood Flow Route

5.29.4 Due to the magnitude of the storm, runoff from Highbury Park and the surrounding highway catchment followed the natural topography of the land via the highway network into Seaton Grove, where it overtopped into lower lying property and made its way between houses into Cadine Gardens and Moor Green Lane flooding properties along this route.

What has been done?





5.29.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.29.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of the highway drainage network	Highway Maintenance and Management Partner Birmingham City Council (Leisure)
Explore the potential for community scale flood mitigation	Birmingham City Council (Leisure)

5.30 North Edgbaston – Wadhurst Road

Identified Flooding Type(s):			
			
No. of flooded properties: 11			

What happened?

5.30.1 During the storm event, 11 incidents of internal property flooding were reported in Wadhurst Road. Flooding to the highway and gardens also occurred.

Why did it happen?

5.30.2 The flooding in this area has been identified to be from surface water.

5.30.3 The flood flow route is indicated in figure 5.30.

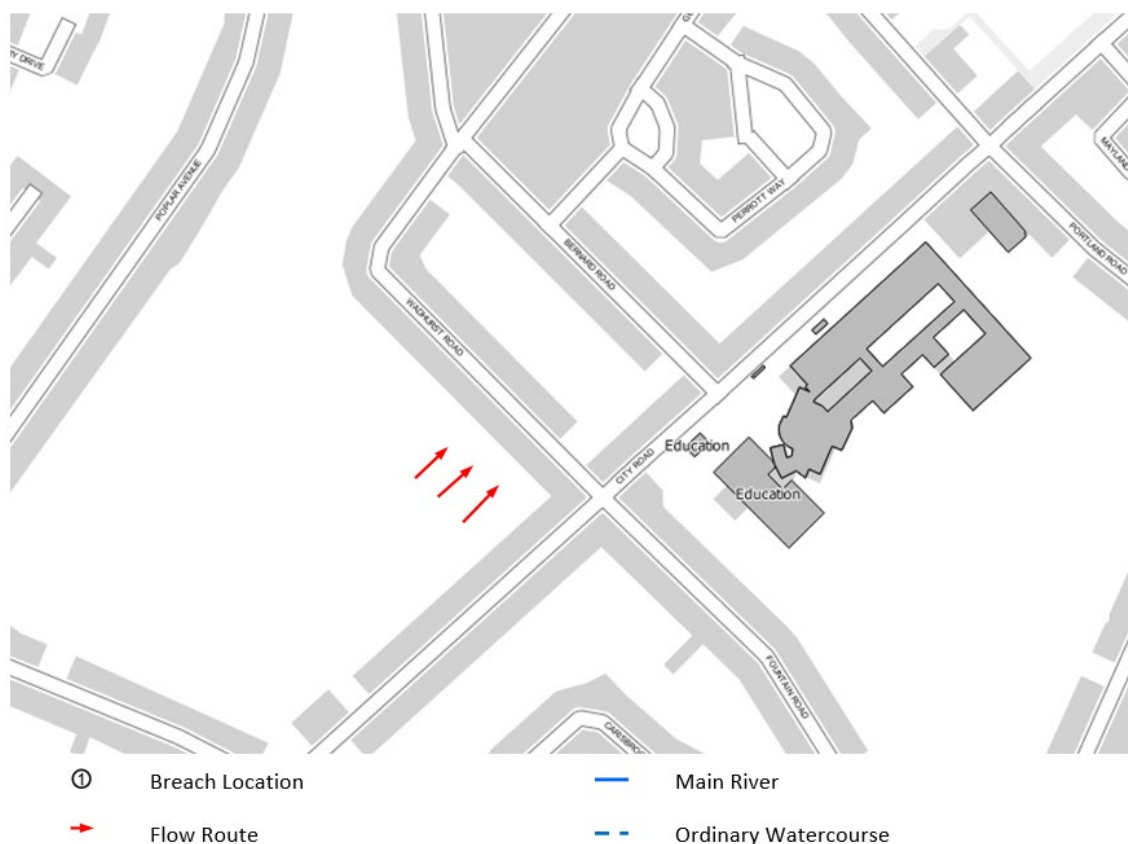


Figure 5.30 - Flood Flow Route

5.30.4 Due to the magnitude of the storm, runoff from the field at the rear of the properties which was under development into sports pitches followed the topography of the land and into the rear of properties in Wadhurst Road. From here it made its way between properties and on to the highway entering properties on the opposite side of the road.

What has been done?

5.30.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.30.6 Work was undertaken on the sports pitch development prior to the drainage conditions of the planning application being met. Discussions have been held and are continuing with the residents, planning officers and the developer, Avery Fields Community Sports Trust.

5.30.7 A discharge of condition application has been submitted to the Council and Avery Fields Community Sports Trust have started work on flood mitigation works.

5.30.8 The Highway Maintenance and Management Provider has cleansed all of the gullies, these were all found to be functioning fully.





What next?

5.30.9 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Planning to agree a way forward with developers	Birmingham City Council (Planning) Avery Fields Community Sports Trust

5.31 Oscott – Queslett Road

Identified Flooding Type(s):

No. of flooded properties: 1

What happened?

5.31.1 During the storm event, one incident of internal property flooding was reported in Queslett Road. Flooding to gardens also occurred.

Why did it happen?

5.31.2 The flooding in this area has been identified to be from surface water.

5.31.3 The flood flow route is indicated in figure 5.31.



Figure 5.31 - Flood Flow Route

5.31.4 Due to the magnitude of the storm, runoff from the adjacent Sundridge Primary School car park exceeded the capacity of the local drainage and followed the natural topography of the land, flooding into lower lying property.

What has been done?

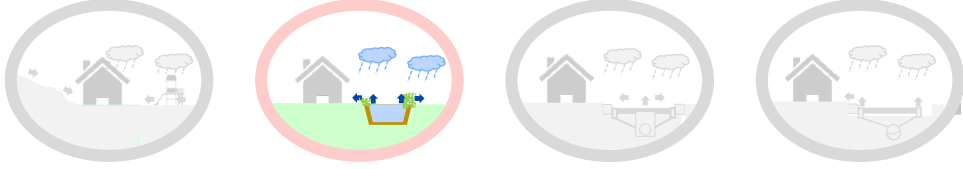
5.31.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.31.6 Birmingham City Council (Education) have undertaken maintenance work to clear all drainage on the school carpark. In addition to this a wall and additional drainage has been installed to alleviate runoff from the playground area.

What next?

5.31.7 No further actions are recommended for this area.

5.32 Pye Hayes – Tyburn Road

Identified Flooding Type(s):

No. of flooded properties: 1 (commercial)

What happened?

5.32.1 During the storm event, one incidents of internal property flooding was reported in Tyburn Road. The affected property was a commercial business. Flooding to the adjacent allotments and gardens also occurred.

Why did it happen?

5.32.2 The flooding in this area has been identified to be from rivers.

5.32.3 The flood flow route is indicated in figure 5.32.

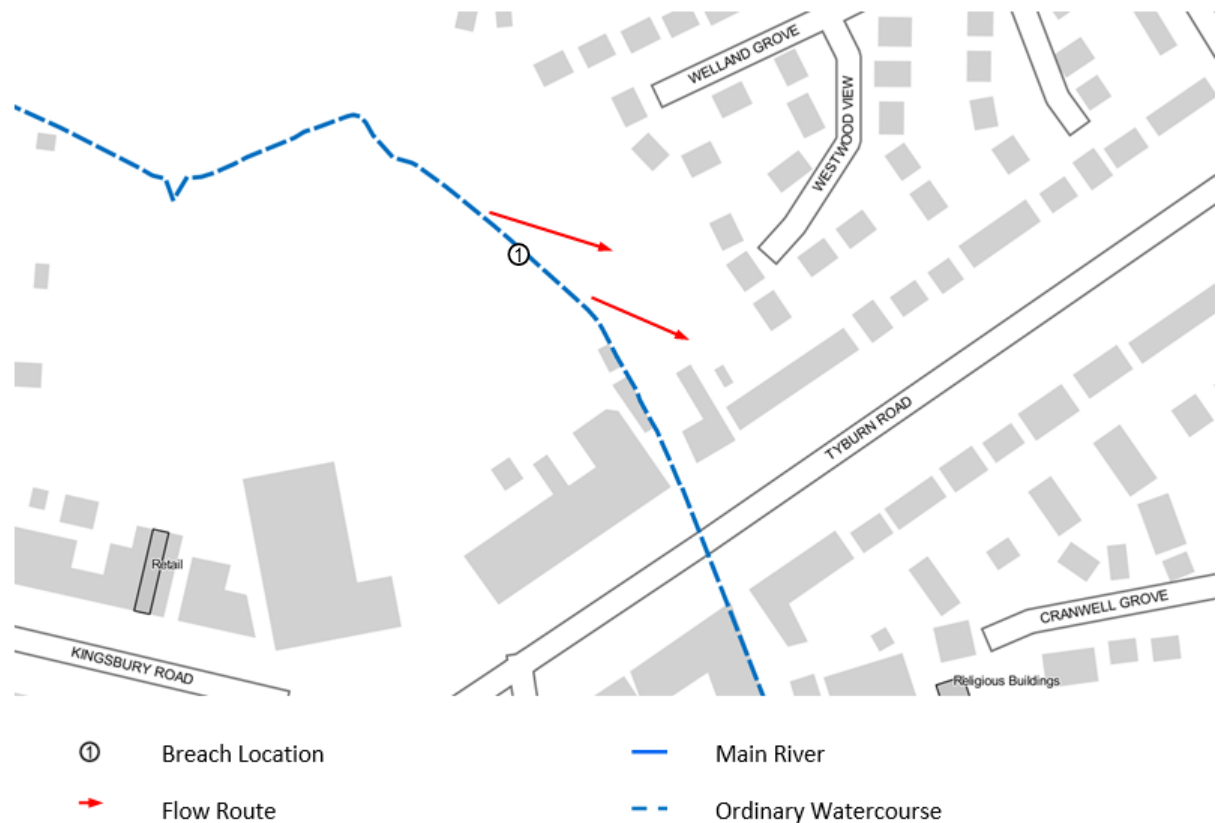


Figure 5.32 - Flood Flow Route

5.32.4 Due to the magnitude of the storm, the capacity of Erdington Brook was exceeded, and the flow overtopped the channel and flooded into adjacent property from the rear.

What has been done?

5.32.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.





What next?

5.32.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Review maintenance regime for the watercourse	Birmingham City Council (Leisure) Birmingham City Council (LLFA)
Explore the potential for property level flood resilience	Birmingham City Council (LLFA) Property Owners

5.33 Quinton – Amersham Close

Identified Flooding Type(s):

No. of flooded properties: 2

What happened?

5.33.1 During the storm event, two incidents of internal property flooding were reported in Amersham Close. Flooding to the derelict land to the rear of the properties and gardens was also reported.

Why did it happen?

5.33.2 The flooding in this area has been identified to be from surface water.

5.33.3 The flood flow route is indicated in figure 5.33.



Figure 5.33 - Flood Flow Route

5.33.4 Due to the magnitude of the storm, runoff from the derelict land to the rear of the properties followed the natural topography of the land and flowed into the rear of lower lying property. A block of garages on the derelict land has recently been demolished, previously this was deflecting flows around the properties and into the highway network.

What has been done?

5.33.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.


What next?

5.33.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of the local drainage	Birmingham City Council (Housing)
Explore the potential for community scale flood mitigation	Birmingham City Council (Housing)

5.34 Sparkhill

Identified Flooding Type(s):



No. of flooded properties: 31 (including 3 commercial properties)

What happened?

5.34.1 During the storm event, thirty one incidents of internal property flooding were reported in Formans Road, Avondale Road, Percy Road and Pentos Drive. Three of the affected properties were commercial businesses. Flooding to open space, gardens and the highway was also reported.

Why did it happen?

5.34.2 The flooding in this area has been identified to be from rivers.

5.34.3 The flood flow route is indicated in figure 5.34.

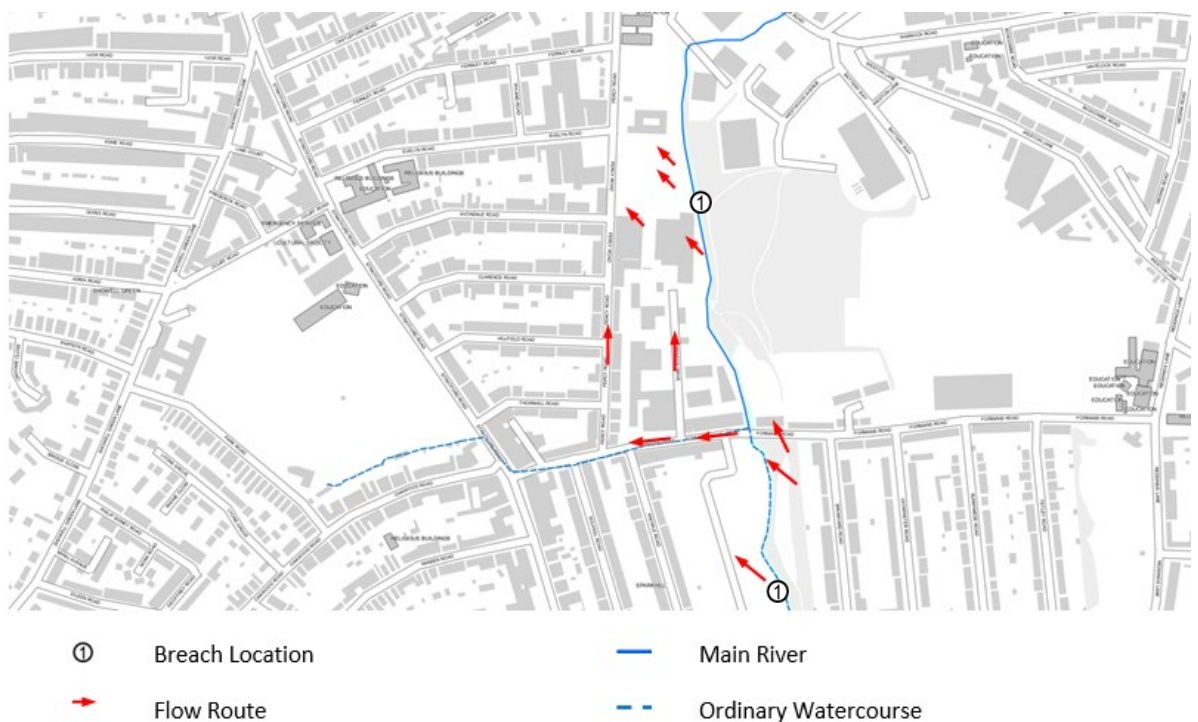


Figure 5.34 - Flood Flow Route

5.34.4 Due to the magnitude of the storm, the capacity of the River Cole was exceeded, flow overtopped the channel and flooded across surrounding land and highways into properties.

What has been done?

5.34.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.34.6 A community meeting with local residents was held following the flooding event.

5.34.7 All highway drainage has been cleaned and defective gullies replaced.

5.34.8 Birmingham City Council and the Environment Agency have undertaken work to remove blockages and debris from the River Cole channel.


What next?

5.34.9 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for catchment wide flood mitigation	Environment Agency Birmingham City Council (LLFA) Solihull Metropolitan Borough Council (LLFA) Worcestershire County Council (LLFA)

5.35 Stirchley – Dell Road

Identified Flooding Type(s):



No. of flooded properties: 1

What happened?

5.35.1 During the storm event, one incident of internal property flooding was reported in Dell Road. Flooding to gardens and the highway was also reported.

Why did it happen?

5.35.2 The flooding in this area has been identified to be from surface water and sewer flooding.

5.35.3 The flood flow route is indicated in figure 5.35.

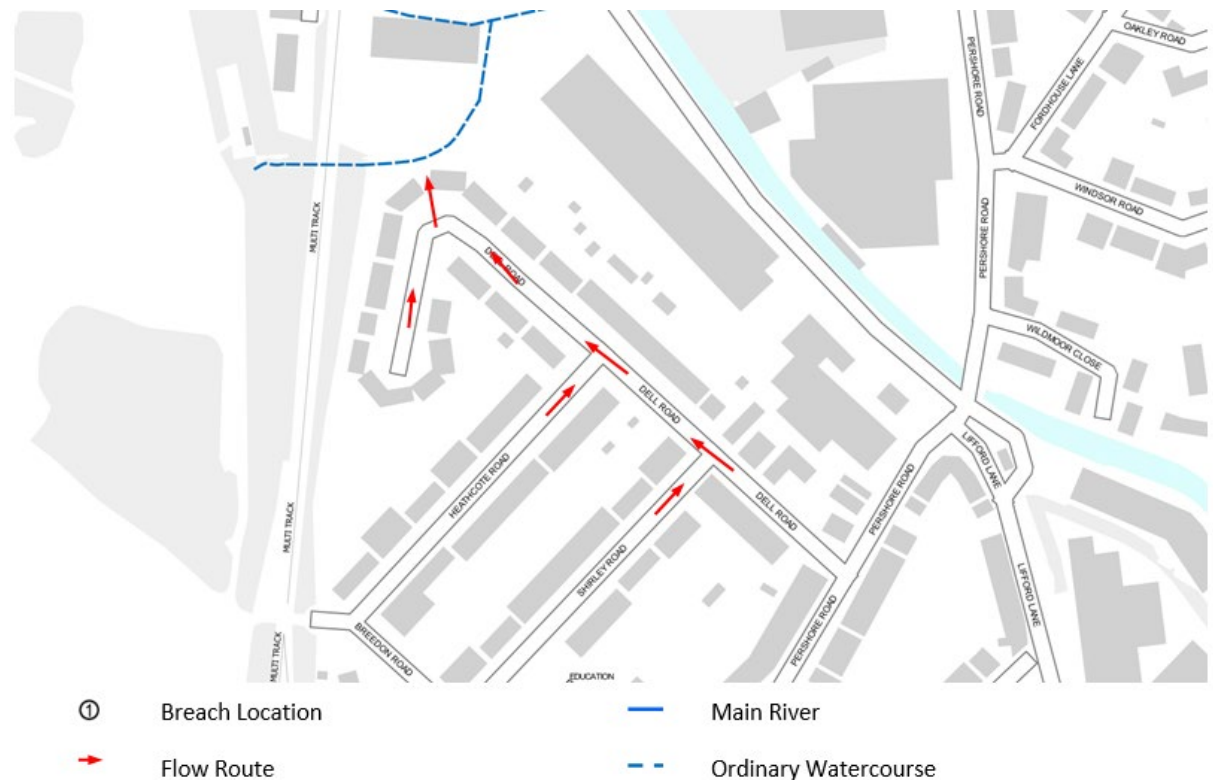


Figure 5.35 - Flood Flow Route

5.35.4 Due to the magnitude of the storm, runoff from surrounding highway catchment was conveyed via the highway to the low point in Dell Road. Due to the elevated water level in the Cotteridge Brook which runs to the rear of the properties and the alignment of the sewer, the surface water sewer and hence gullies may have been unable to discharge into the brook. Therefore, flood water overtopped highway and followed low lying land through the property to the watercourse in the rear garden.

What has been done?

5.35.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.





What next?

5.35.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of the sewer network	Severn Trent Water Birmingham City Council (LLFA)

5.36 Stirchley – Pitcairn Close

Identified Flooding Type(s):

No. of flooded properties: 3

What happened?

5.36.1 During the storm event, three incidents of internal property flooding were reported in Pitcairn Close. Flooding to gardens, the highway and a block of garages was also reported.

Why did it happen?

5.36.2 The flooding in this area has been identified to be from surface water.

5.36.3 The flood flow route is indicated in figure 5.36.



Figure 5.36 - Flood Flow Route

5.36.4 Due to the magnitude of the storm, runoff from surrounding catchment was conveyed via the highway network to the lowspot in Pitcairn Close. As the storm progressed the level of water built up as it couldn't discharge into the drainage system quickly enough, eventually overtopping kerbs and flooding into properties that lie lower than the road level.

What has been done?

5.36.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.36.6 A site meeting was held with local residents and ward councillor to discuss the issues.

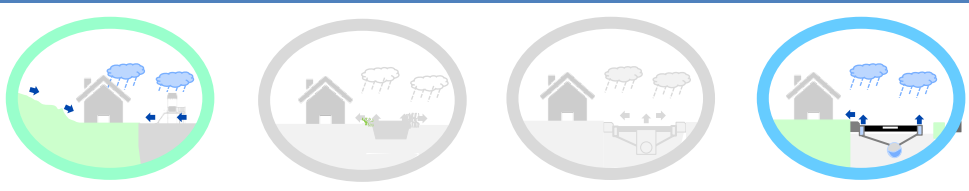
What next?

5.36.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for community scale flood mitigation	Birmingham City Council (LLFA)

5.37 Sutton Trinity – Wyndley Lane

Identified Flooding Type(s):



No. of flooded properties: 2

What happened?

5.37.1 During the storm event, two incidents of internal property flooding were reported in Wyndley Lane. Flooding to gardens and the highway was also reported.

Why did it happen?

5.37.2 The flooding in this area has been identified to be from surface water and highway drainage.

5.37.3 The flood flow route is indicated in figure 5.37.



Figure 5.37 - Flood Flow Route

5.37.4 Due to the magnitude of the storm, runoff from surrounding catchment was conveyed via the highway network to the low spot in Wyndley Lane from where it flowed into lower lying property. The flooding was reported to be caused as a result of blocked highway drainage.

What has been done?

5.37.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.37.6 Blocked gullies have been cleared by the land manager (Leisure Centre Management).

What next?

5.37.7 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Review maintenance schedule of highway assets	Leisure Centre Management

5.38 Sutton Vesey – Boldmere Road and Wakefield Close

Identified Flooding Type(s):

No. of flooded properties: 5 (2 commercial)

What happened?

5.38.1 During the storm event, five incidents of internal property flooding were reported in Boldmere Road and Wakefield Close. Two of the affected properties are commercial businesses. Flooding to the highway was also reported.

Why did it happen?

5.38.2 The flooding in this area has been identified to be from surface water and sewer flooding.

5.38.3 The flood flow route is indicated in figure 5.38.



Figure 5.38 - Flood Flow Route

5.38.4 Due to the magnitude of the storm, runoff from Boldmere Road, Gate Lane, Wakefield Road and the surrounding catchment overwhelmed the surface water sewers and gullies in the area. Water was conveyed along Boldmere Road down to the low side of Boldmere Road where bow waves from passing vehicles caused flood water to enter properties. Runoff from Gate Lane, followed the natural topography of the land into the rear gardens of properties and flowed into the buildings in Wakefield Close.

What has been done?

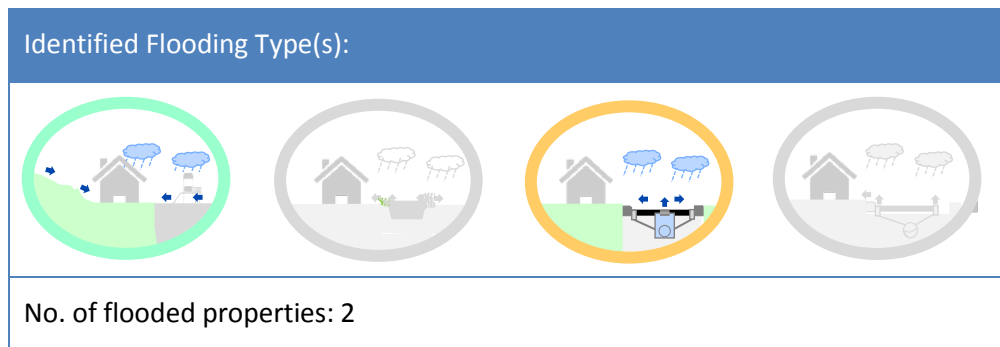
5.38.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.38.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess condition and capacity of the sewer network	Severn Trent Water
Assess condition and capacity of local drainage	Highway Maintenance and Management Partner

5.39 Druids Heath and Monyhull– Chanston Avenue



What happened?

5.39.1 During the storm event, two incidents of internal property flooding were reported in Chanston Avenue. Flooding to gardens and the highway was also reported.

Why did it happen?

5.39.2 The flooding in this area has been identified to be from surface water and sewers.

5.39.3 The flood flow route is indicated in figure 5.39.

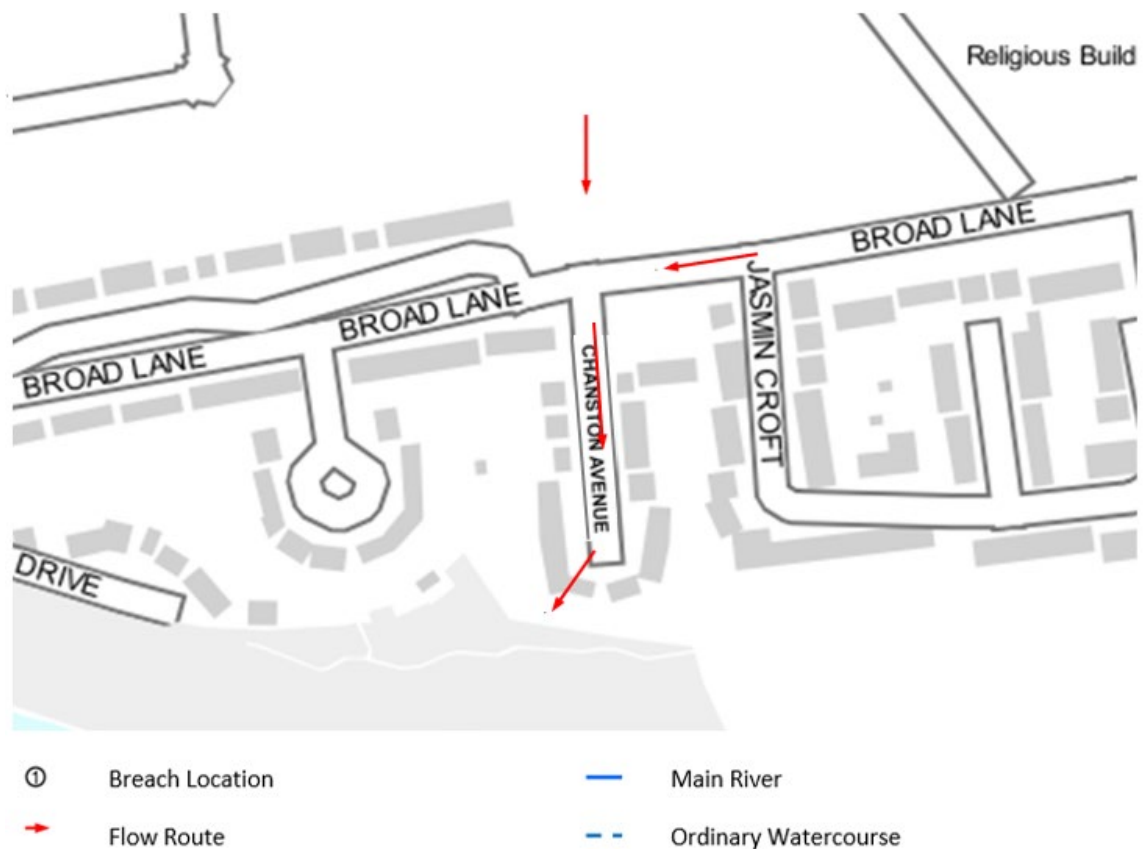


Figure 5.39 - Flood Flow Route

5.39.4 Due to the magnitude of the storm, runoff from Brandwood Cemetery overwhelmed the cemetery drainage and flowed out onto Broad Lane, this then combined with runoff from the surrounding highway network and flowed down Chanston Avenue following the natural topography of the land. As the storm progressed the level of water built up as it couldn't discharge into the drainage system quickly enough, overtopping kerbs and flooding into properties that lie lower than the road level. It is understood that the combined sewer system serving the area may have been at full capacity as there were reports of water coming out of manholes and therefore the highway gullies were unable to discharge into the sewer.

What has been done?

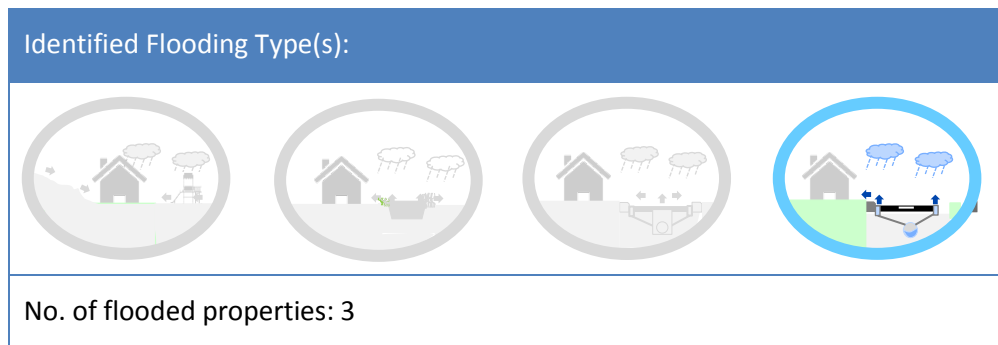
5.39.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

What next?

5.39.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Explore the potential for community scale mitigation	Birmingham City Council (Bereavement)
Explore the potential for property level flood resilience	Birmingham City Council (LLFA) Property Owners
Assess condition and capacity of the sewer network	Severn Trent Water

5.40 Druids Heath and Monyhull – Marsham Road



What happened?

5.40.1 During the storm event, three incidents of internal property flooding were reported in Marsham Road. Flooding to gardens and garages was also reported.

Why did it happen?

5.40.2 The flooding in this area has been identified to be from highway drainage.

5.40.3 The flood flow route is indicated in figure 5.40.

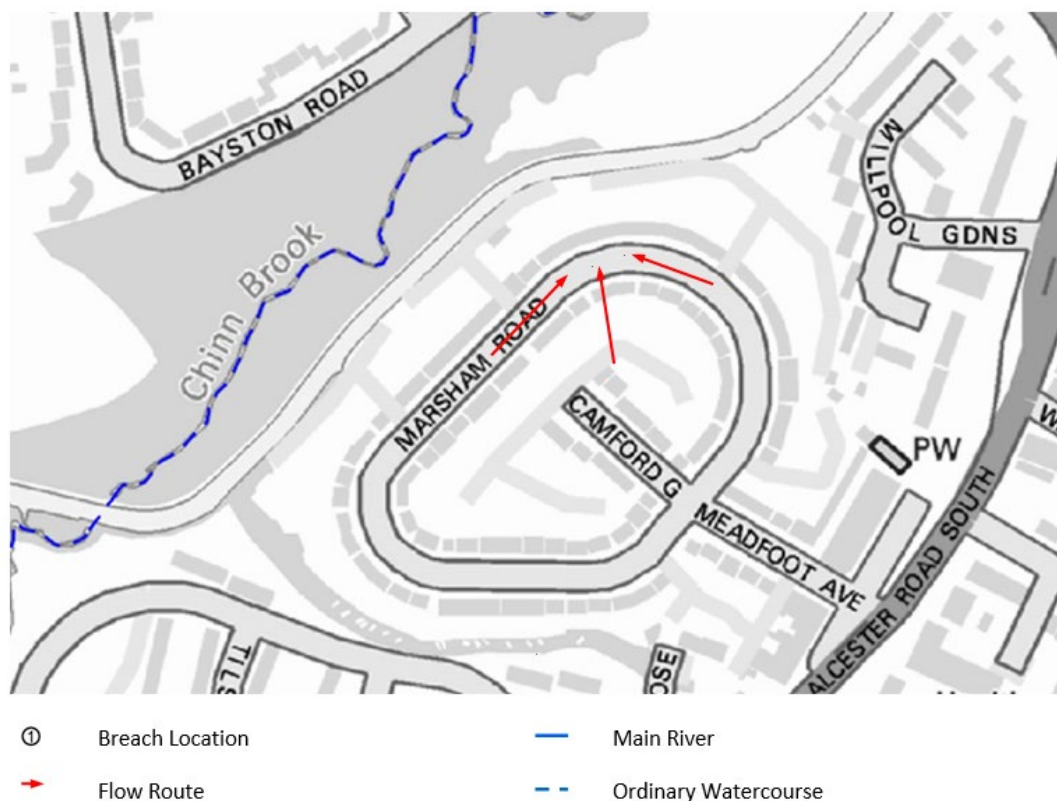


Figure 5.40 - Flood Flow Route

5.40.4 Due to the magnitude of the storm, runoff from the surrounding catchment was conveyed via the highway to the low spot Marsham Road. As the storm progressed the level of water built up and couldn't discharge into the drainage system quickly enough, eventually overtopping kerbs and flooding into properties that lie lower than the road level. Some reports suggest that blockage highway gullies may have exacerbated the problem,

What has been done?

5.40.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.


What next?

5.40.6 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess condition and capacity of highway drainage network	Highway Maintenance and Management Partner

5.41 Hall Green – Sarehole Road

Identified Flooding Type(s):



No. of flooded properties: 3

What happened?

5.41.1 During the storm event, three incidents of internal property flooding were reported in Sarehole Road. Flooding to gardens and public open space was also reported.

Why did it happen?

5.41.2 The flooding in this area has been identified to be from rivers.

5.41.3 The flood flow route is indicated in figure 5.41.

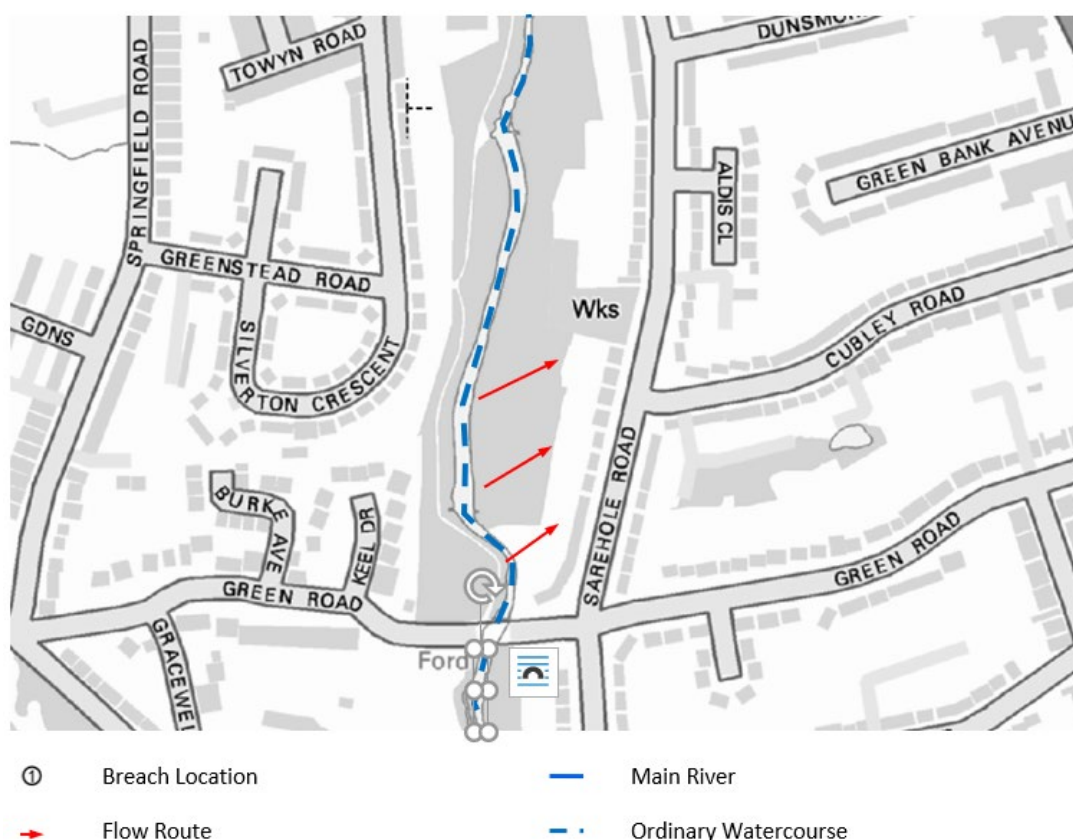


Figure 5.41 - Flood Flow Route

5.41.4 Due to the magnitude of the storm, the capacity of the River Cole was exceeded, flow overtopped the channel and flooded across surrounding land into properties. The flood level was exacerbated as a section of the floodplain was occupied by artificially raised ground formed of urban debris, knitted vegetation and earth.

What has been done?

5.41.5 Following the flood event, Birmingham City Council (LLFA) has undertaken a site walkover of the affected areas and has conducted an initial review of the existing drainage infrastructure.

5.41.6 Birmingham City Council (LLFA) and the Environment Agency have undertaken work to remove blockages and debris from the River Cole channel.

5.41.7 Birmingham City Council (Leisure) has undertaken clearance of urban debris, knitted vegetation and earth to reinstate the floodplain to its full capacity.

What next?

5.41.8 The following table outlines the recommended actions for this area to be undertaken by the appropriately identified RMA.

Recommended Actions	Identified Party / RMA
Assess the condition and capacity of the watercourse	Birmingham City Council (Leisure)

6 CONCLUSION

- 6.1.1 Following the storm event in May 2018, flooding was reported in 147 areas of the City which included internal property flooding, external flooding to gardens and flooding to highways and other areas. Following these reports, over 2000 flood surveys were distributed to owners and residents directly affected by flooding and those within the surrounding area. Over 448 responses were received, with 180 incidents of internal property flooding reported across 41 areas.
- 6.1.2 Four types of flooding have been identified as causes for the instances of reported flooding. These include surface water flooding, flooding from rivers, flooding from sewer infrastructure and flooding from highway drainage. The predominant type of flooding was surface water, which is most likely due to the intensity of the storms.
- 6.1.3 In many locations, surface water runoff was channelled by highways ultimately ponding in low point in the road. Across the reported areas, it was noted the affected properties were usually at or below the level of the adjacent highway. Therefore surface water runoff ponded within the low points of the highway and when the highway could not contain any more surface water, it would spill from the highway into properties.
- 6.1.4 The surface water flooding was then further exacerbated by the other three types of flooding. In some areas, the flow in watercourses exceeded the available capacity, particularly where watercourses entered a culvert. This resulted in a constriction of flows, causing water to back up, overtopping the river banks and spilling from the river channel.
- 6.1.5 In some areas, the capacity of the Severn Trent Water sewer infrastructure was overwhelmed causing water to be issued out of the sewer manholes and highway gullies. This has been further exacerbated due to highway gullies being unable to adequately capture the surface water runoff, particularly on steep catchments where the intensity of the rainfall, and volume of runoff, was such that it flowed over or around a gully pot.
- 6.1.6 For each of the 41 areas, a set of actions have been proposed. The actions that have been proposed are related to the identified cause of the flooding, the severity of the flooding and identified constraints.
- 6.1.7 Birmingham City Council, in their role as Lead Local Flood Authority, are continuing to work in partnership with all other relevant Risk Management Authorities; such as the

Environment Agency, Severn Trent Water and Birmingham City Council (Highways) and other relevant stakeholders to manage and mitigate the flood risk as far as reasonably practicable.