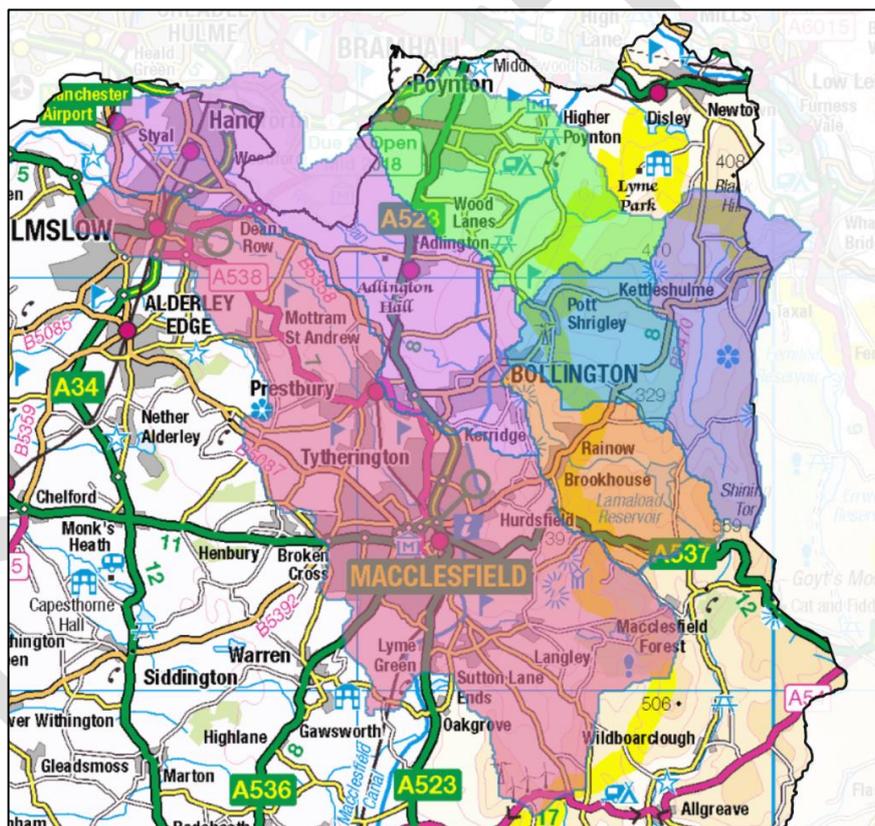


S19 Flood Investigation Report

July 2019 Flood Event



Flood Risk Management Team Cheshire East Council – Lead Local Flood Authority

Flood Date: 28-31/07/2019

Catchments of: Poynton Brook, River Dean, River Bollin, Harrop Brook and tributary of Todd Brook

Flood Investigation Reference Number: 2019/002

Version: Draft 6 – Council Review

OFFICIAL

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Although every effort has been taken to ensure the accuracy of the information contained within the pages of this report, we cannot guarantee that the contents will always be current, accurate or complete.

This report has been prepared as part of Council's responsibilities under the Flood and Water Management Act (2010) as Lead Local Flood Authority (LLFA).

The findings of this report are based on a subjective assessment of the information available to those undertaking the investigation and therefore may not include all relevant information. Therefore it shouldn't be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event.

The opinions, conclusions and any recommendations in this report are based on our assumptions when preparing this report, including, but not limited to those key assumptions noted in the reports, including reliance on information provided by third parties.

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Revision schedule: 2019/002/001 Flood Investigation

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Contents

1	Introduction	7
1.1	Flooded Areas	7
1.2	Flood Risk	8
1.3	Previous Flood Events	8
2	Legislative Background	9
2.1	Section 19 of the FWMA 2010	9
2.2	CEC Local Flood Risk Management Strategy (LFRMS)	9
2.3	Risk Management Authorities	10
2.3.1	Risk Management Authorities in Cheshire East	10
2.3.2	Environment Agency	10
2.3.3	Cheshire East Council	10
2.3.4	Highways England	11
2.3.5	Water Companies	11
2.3.6	Other Stakeholders	11
3	28th - 31st July 2019 Weather Event	12
3.1	Antecedent conditions	12
3.1.1	Antecedent Rainfall	12
3.1.2	Antecedent River Levels and Flows	12
3.1.3	Antecedent Soil Moisture deficient	12
3.1.4	Antecedent Groundwater	13
3.2	Recorded Event Data	14
3.2.1	Recorded Rainfall	15
3.2.2	Calculation of reoccurrence interval	15
3.2.3	Recorded Hyrad data	16
3.3	Recorded River Levels	17
3.4	Recorded River Flows	18
3.5	Canal Discharges	19
3.6	Environment Agency Flood Warning Areas	20
4	28th- 31st July 2019 Flooding – Catchment responses	21
4.1	Poynton Brook Catchment	22
4.1.1	Summary description of surface water and sewer flooding in Poynton Brook catchment	23
4.1.2	Summary description of surface water and highway flooding in Poynton Brook catchment	23
4.1.3	Description of Main River flooding for Poynton Brook catchment (Booth Green and Poynton Brook)	23
4.1.4	Description of flooding for Booth Green Brook (Main River, in Poynton Brook catchment)	24
4.1.5	Description of flooding for Poynton Brook (Main River, in Poynton Brook catchment)	24
4.1.6	Description of flooding for Park Lane Stream (ordinary watercourse) (including Higher Poynton)	30
4.1.7	Description of flooding for Coppice Stream (ordinary watercourse)	40
4.1.8	Description of flooding for unnamed ordinary watercourses around Poynton Pool	44
4.1.9	Description of flooding for Norbury Brook (Main River) within Cheshire East	46

4.1.10	Poynton Brook - RMA Responses	47
4.1.11	Poynton Brook Catchment - Site Specific Recommendations	48
4.2	Todd Brook Catchment	50
4.2.1	Description of flooding in Kettleshulme (ordinary watercourse and surface water):.....	51
4.2.2	Todd Brook Catchment - RMA Responses	53
4.2.3	Kettleshulme, Todd Brook Catchment - Site Specific Recommendations.....	54
4.3	Harrop Brook Catchment	55
4.3.1	Description of flooding at Bollington (Ingersley Road) (Ordinary Watercourse flooding)	56
4.3.2	Description of flooding at Pott Shrigley	57
4.3.3	Harrop Brook Catchment – RMA responses.....	57
4.3.4	Harrop Brook Catchment - Site Specific Recommendations	57
4.4	River Dean Catchment	58
4.4.1	Description of flooding at River Dean (Main River)	59
4.4.2	Description of Main River flooding near Lower Mill/Oldham Street, Bollington.	59
4.4.3	Description of flooding at Princess Street (surface water/ordinary watercourse).....	61
4.4.4	Description of flooding in Wilmslow:	62
4.4.5	Description of flooding in Handforth:.....	62
4.4.6	River Dean Catchment - RMA Responses	63
4.4.7	River Dean Catchment - Site Specific Recommendations.....	63
4.5	River Bollin Catchment	64
4.5.1	Description of flooding at Prestbury	65
4.5.2	Woodlea Drive (surface water)	66
4.5.3	River Bollin Catchment - RMA Responses	67
4.5.4	River Bollin Catchment - Site Specific Recommendations.....	67
4.6	Other Impacts	68
4.6.1	Borough Road Closures	68
4.6.2	Rail Closures	68
5	General actions by Risk management Authorities across Cheshire East during/post flooding 28th July onwards.....	69
6	Generic Recommendations for all Risk management Authorities and local communities.....	70
7	Conclusion	72
	Appendix A – Contacts and useful websites.....	73
	Appendix B - Glossary	75

Figures

Figure 1 Affected River Catchments	7
Figure 2 Groundwater levels for indicator sites at the end of June 2019 and July 2019	13
Figure 3 Location of Environment Agency Gauges.....	14
Figure 4 Rainfall Recorded (mm) at Cat and Fiddle.....	15
Figure 5 Hyrad data at times between 11am and 17:30 on Wednesday 31 st July 2019	16
Figure 6 Measured River Level at Poynton Brook	17
Figure 7 Main River levels (m)	18
Figure 8 Main River Flows (cubic metres per second / cumecs).....	18
Figure 9 Macclesfield Canal Interactions with natural drainage paths	19
Figure 10 Flood Warning areas associated with River Bollin and Poynton Brook.....	20
Figure 11 Flooded Locations	21
Figure 12 Indicative catchment of Poynton Brook.....	22
Figure 13 Canal Interactions with Poynton catchment.....	24
Figure 14 Flood risk at Poynton Brook near Aqueduct	25
Figure 15 Fluvial Flood Risk near Wards End Bridge, Poynton Brook.....	26
Figure 16 Flood risk* along Poynton Brook between Ward End bridge and industrial estate	27
Figure 17 Poynton Brook Floodzones 2 & 3 (Industrial Estate)	28
Figure 18 Poynton Brook Floodzones 2 & 3 (Wigwam Wood)	29
Figure 19 Poynton Brook Flood zones 2 & 3 (Confluence with Norbury Brook).....	29
Figure 20 Indicative natural catchment of Park Lane Stream	30
Figure 21 Flood Risk Map Middlewood Way area	31
Figure 22 Flood Risk Map Middlewood Road / Anson Road area	32
Figure 23 Flood Risk Map Park Lane area	33
Figure 24 Flood Risk Map Park Lane / Clumber Road area	34
Figure 25 Flood Risk Map Poynton Sports Club area.....	35
Figure 26 Bifurcation of Park Lane stream towards Poynton Pool.....	36
Figure 27 Ordinary watercourses near Glastonbury Drive	37
Figure 28 Flood risk near Glastonbury Drive	38
Figure 29 Flood routes to Poynton Brook north of Glastonbury Drive.....	39
Figure 30 Indicative natural catchment of Coppice Stream.....	40
Figure 31 Coppice Stream, Waterloo Road, Worth Primary School area	41
Figure 32 Coppice Stream, Ivy Road, Holly Road, Clumber Close area.....	42
Figure 33 Coppice Stream indicative path shown as blue line.....	43
Figure 34 General arrangements at Poynton Pool Reservoir	44
Figure 35 Flood Risk maps and ordinary watercourses around Poynton Pool.....	45
Figure 36 Norbury Brook Floodzones 2 & 3 (Land shaded orange falls within Stockport Borough Council).....	46
Figure 37 Todd Brook Catchment	50
Figure 38 Indicative catchment of tributary of Todd Brook.....	51
Figure 39 Indicative catchment of Todd Brook tributary through Kettlethulme	52
Figure 40 Flood risk for Kettlethulme	53
Figure 41 Harrop Brook Catchment	55
Figure 42 Risk map for Ingersley Road, Bollington	56
Figure 43 River Dean Catchment	58
Figure 44 Canal Interactions with Dean catchment	59
Figure 45 Lower Mill, River Dean, Bollington	60
Figure 46 Flood risk at Princess Street, Bollington	61
Figure 47 Finsbury Way, River Dean	62
Figure 48 The River Bollin Catchment	64
Figure 49 Spencer Brook, Prestbury.....	65
Figure 50 River Dean, Woodlea Drive	66

Tables

Table 1 Previous flood reports	8
Table 2 Risk Management Authorities	10
Table 3 Number of properties reported* flooding in Poynton	22
Table 4 Response Timeline Poynton Brook Catchment	47
Table 5 Recommended actions for the Poynton Brook Catchment	48
Table 6 Number of properties reported* flooding in Kettlethulme:.....	50
Table 7 Response Timeline for Todd Brook Catchment	53
Table 8 Recommended actions for Todd Brook Catchment	54
Table 9 Number of properties reported* flooding in Harrop Brook Catchment	55
Table 10 Response Timeline Harrop Brook – July 2019.....	57
Table 11 Recommended actions for Harrop Brook.....	57
Table 12 Number of properties reported* flooding in River Dean Catchment:	58
Table 13 Response Timeline River Dean Catchment	63
Table 14 Recommended actions for River Dean Catchment	63
Table 15 Number of properties reported* flooding in River Bollin Catchment	64
Table 16 Response Timeline River Bollin Catchment	67
Table 17 Recommended actions for the River Bollin Catchment.....	67

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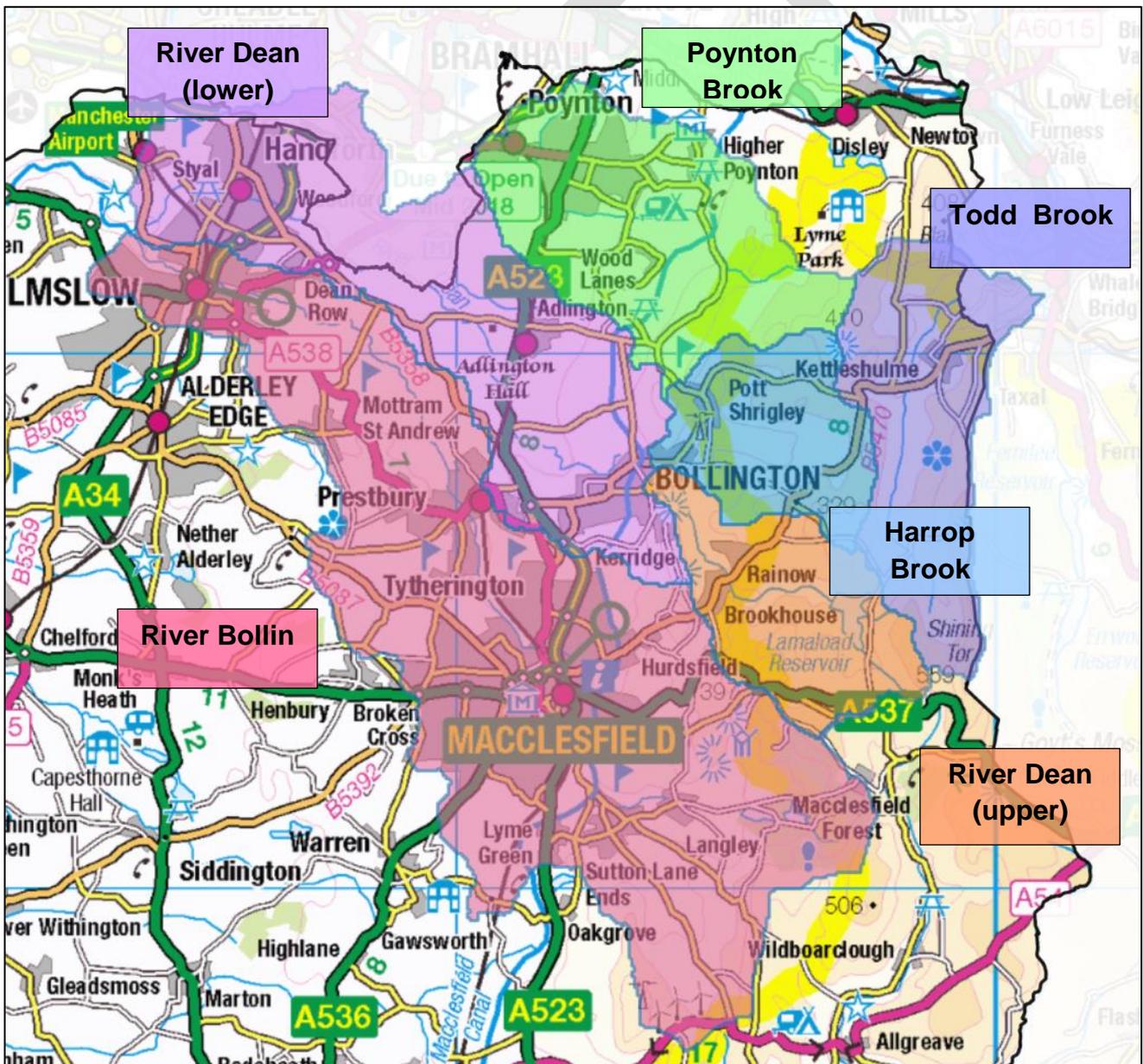
1 Introduction

1.1 Flooded Areas

The description of flooding and responses of individual Risk Management Authorities to the event are listed by catchment area. This scale was chosen as a result of the scale of this incident. Individual properties are not listed or identified in this study, to avoid property blight.

The report details flooding that has been reported to or by the flood risk management agencies; Cheshire East Council as Lead Local Flood Authority and Highways department, the Environment Agency, United Utilities, Cheshire Police and Cheshire Fire and Rescue. As category one and two responders' agreements are in place that allow the transfer of sensitive information, that other parties may not be able to share due to general data protection regulations (GDPR). This data will not be disclosed or shared with any other parties.

Figure 1 Affected River Catchments



1.2 Flood Risk

Detailed flood risk mapping is available online, hosted by the Environment Agency; they are available to the public and can be searched by either address or postcode. To understand the flood risks at your property please consult both surface water and fluvial flood risk maps.

Surface Water Flood Risk <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

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

Based on the latest research extreme weather events in the UK are likely to increase with rising temperatures, causing:

- heavier rainfall events – with increased risk of flooding
- higher sea levels – with larger storm waves putting a strain on the UK’s coastal defences
- more and longer-lasting heat waves

<https://www.gov.uk/guidance/climate-change-explained>

1.3 Previous Flood Events

Flooding within the following locations have recently been reported:

Table 1 Previous flood reports

Catchment	Location	Year
Poynton Brook	Poynton	2019
Poynton Brook	Poynton	2016
Poynton Brook	Poynton	2011
Poynton Brook	Poynton	2010
Poynton Brook	Poynton	2002
Poynton Brook	Poynton	1994
Poynton Brook	Poynton	1976
Todd Brook	Kettleshulme	2019
Todd Brook	Kettleshulme	2011
Todd Brook	Kettleshulme	1989
Upper Bollin	Macclesfield	1872
Upper Bollin	Macclesfield	1882
River Bollin	Bollington, Wilmslow	2012
River Bollin	Princess Street, Bollington	2011
River Dean	Oldham Street, Bollington	1998

Following the 2016 flood event in Poynton a Section 19 report was published:

<https://www.cheshireEast.gov.uk/planning/flooding/floods-and-flood-risk/flood-investigations.aspx>

Details of the flood actions by the risk management authorities in response to the recommendations of this report have been shared with the community, Poynton Flood Action Group and Poynton Town Council at various meetings and at a public meeting held in Poynton Civic Hall 16th May 2019 (1pm – 7pm).

2 Legislative Background

2.1 Section 19 of the FWMA 2010

The Flood and Water Management Act 2010 (FWMA 2010) places a number of duties on Lead Local Flood Authorities (LLFAs) in relation to local flood risk management. One of the principal duties of the LLFAs, as laid out in the Act, is the responsibility to record and investigate flooding incidents within their area.

This document has been prepared by Cheshire East Council, as the Lead Local Flood Authority (LLFA) in the Cheshire East Borough for the specific purpose of meeting the requirements of Section 19 (1) and (2) of the Flood and Water Management Act (2010) which 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*
 - (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.*

The Flood and Water Management Act 2010, will be referred to as “the Act” in the remainder of this document

2.2 CEC Local Flood Risk Management Strategy (LFRMS)

The LFRMS for Cheshire East sets out how the Council intends to manage risk from local sources of flooding. This includes how the Council will implement the number of legal duties and responsibilities placed upon them under the Act, including the duty to investigate and report on flooding incidents that occur in their area.

Based on the number of properties which suffered internal flooding and the impact on critical infrastructure (e.g. A roads, rail links, bridges etc), the flooding events in the reported locations are classified as ‘significant’ under local policy and require a full investigation.

A full copy of the document is available online at: http://www.cheshireEast.gov.uk/highways_and_roads/highway-services/flood-risk-management/flood-risk-management.aspx

2.3 Risk Management Authorities

The following organisations are defined as RMAs under the Act and have the following flood risk management functions. Table 2 lists each RMA and the source of flooding for which they take responsibility for.

Table 2 Risk Management Authorities

Flood Source	Environment Agency	LLFA	District/Unitary Council	Water Company	Highway Authority (Local & National)
Main River*	X				
Ordinary Watercourse*		X	X		
Surface water from highway					X
Surface water from other sources		X			
Sewer flooding				X	
The sea			X		
Groundwater flooding		X			
Water supply infrastructure				X	

*Main Rivers have been designated as such by the Environment Agency. These tend to be major rivers or rivers with a high flood risk. Ordinary watercourses are all other rivers and streams not classified as a Main River.

2.3.1 Risk Management Authorities in Cheshire East

2.3.2 Environment Agency

The Environment Agency (EA) has a strategic overview of all sources of flooding and coastal erosion (as defined in the Act). It is also responsible for flood and coastal erosion risk management activities on Main Rivers and the coast, regulating reservoir safety, and working in partnership with the Met Office to provide flood forecasts and warnings.

2.3.3 Cheshire East Council

Cheshire East Council (CEC) has a joint risk management role in its capacity as unitary council, highway authority and LLFA. The Council as a highway authority has a duty under the Highways Act 1980 to maintain highways that are maintainable at public expense. This requires attention to the drainage requirements of the public highway. As Lead Local Flood Authority the Council has a number of duties and powers as laid out under the Flood and Water Management Act, 2010, in addition to the duty to investigate flooding; the LFRMS describes these in more detail. Cheshire East Council also takes an overseeing role to ensure that RMAs and landowners are fulfilling their responsibilities adequately.

2.3.4 Highways England

Highways England has responsibility as a highway authority for the motorways in Cheshire. It shares similar duties to flood risk management as Cheshire East Council has as a highway authority.

2.3.5 Water Companies

Water companies have a duty under Section 94 of the Water Industry Act 1991 to provide and maintain sewers for the drainage of buildings and associated paved areas within property boundaries. They are also now responsible for those private sewers and lateral drains covered by the 2011 Private Drains and Sewers act, which communicate with the public sewers.

United Utilities (UU) are the local regional water company covering the Poynton area, and the other affected catchments. With regards to local flood risk management, they are responsible for any flooding which is directly caused by its assets – i.e. its water or sewerage pipes, and must maintain a register of properties that have flooded due to hydraulic incapacity of the sewerage network, and have a duty to cooperate with other relevant authorities.

2.3.6 Other Stakeholders

Riparian landowners are those who own land adjoining or containing a watercourse (including culverted, underground watercourses). They have certain rights and responsibilities, including the maintenance of watercourses and assets within their ownership to ensure flood risks are not increased upstream or downstream of their land.

Residents who are concerned they may be at risk of flooding should take appropriate action to protect themselves and their property. These actions should include registering with the Environment Agency to receive flood warnings, obtaining a personal supply of sandbags, and moving valuable items to higher ground. Individuals should also consider more resilient and permanent property protection measures including water resistant doors, air brick covers, floodgates, raised electrical sockets and the fitting of non-return valves on pipes.

The Canal & River Trust are not a Risk Management Authority under the Flood and Water Management Act 2010. The responsibilities of the Canal and River Trust relate to its function as a navigation authority. It is not funded for flood risk management except in the context of maintaining the canals and their feeder streams, by-passes and discharge weirs fit for purpose.

3 28th - 31st July 2019 Weather Event

3.1 Antecedent conditions

The following information has been used to help provide an overall picture of the conditions that led to the flooding events in Poynton, 31st July 2019:

- **Environment Agency (EA), Water Situation report, July 2019** - The EA issues monthly water situation reports for England, which provide an overview of various hydrological information including rainfall, soil moisture and river flows.
- **Centre for Ecology and Hydrology (CEH), Hydrological Summary report, July 2019** – The Centre for Ecology and Hydrology issues reports for the United Kingdom, which similar to the EA Water Situation Reports; provide analysis of various hydrological records for the month.

3.1.1 Antecedent Rainfall

From mid-month, more unsettled weather followed under a south-westerly airflow, bringing further disruption to power and transport infrastructure from convective activity: on the 19th, in Aberdeen, Cheshire and south Wales; on the 24th/25th, affecting up to 20,000 properties in northern Britain; and on the 28th (e.g. 91mm at Rochdale in 24 hours to 9pm on the 28th), causing surface water flooding of properties and transport networks in Scotland and north-west England (CEH, July 2019).

Most significantly of all, on the 30th, persistent convective activity across the Peak District and Yorkshire Dales resulted in remarkable rainfall totals: 95mm at Old Spital Farm (58mm in 45 minutes) and 102mm at Arkle Town (82mm in 90 minutes). This caused severe disruption through surface water flooding of local road networks and landslides across railway lines in the Yorkshire Dales. Substantially above average July rainfall totals were recorded in northern England, the Midlands and much of Scotland, most notably in an area stretching through the southern Pennines, Cheshire (which recorded more than twice the July average) and the Midlands (CEH, July 2019).

July rainfall totals in the Mersey, Irwell and Cheshire Rivers Group catchments were the 6th highest on record (records assessed from 1891) and were classed as exceptionally high for the time of year (Water situation report EA, July 2019).

3.1.2 Antecedent River Levels and Flows

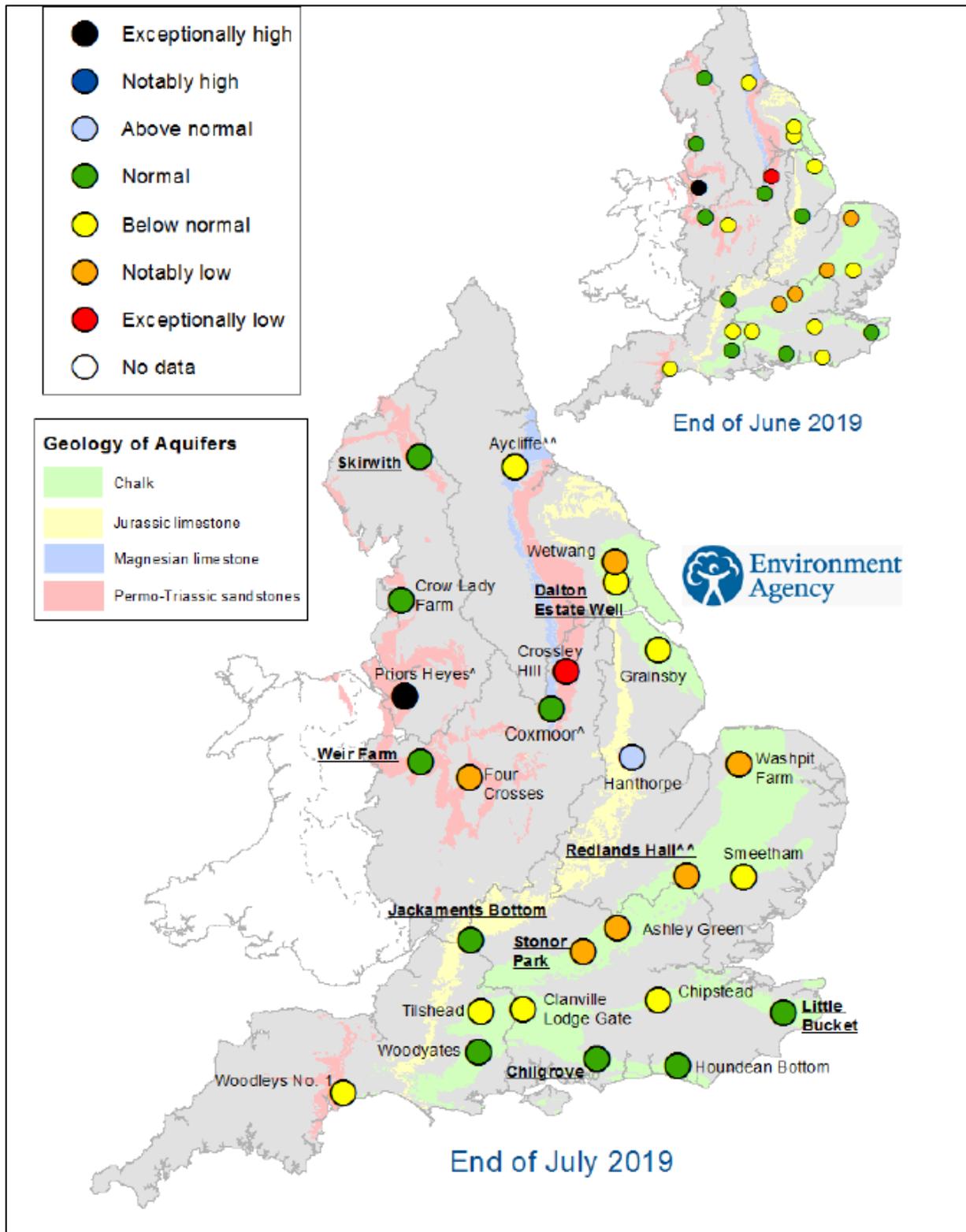
River flooding on the 28th in localised parts of northern England was reported. The Mersey recorded its two highest July daily mean flows on record (in a series from 1976) on the 28th and 31st. Rivers across the southern Pennines also responded markedly to exceptional rainfall on the 30th, destroying an iconic bridge near Grinton (North Yorkshire). July mean flows were generally above normal in northern Scotland, Yorkshire and the East Midlands, and were particularly notable in parts of north-west England (more than twice the average on the Mersey) (CEH, July 2019).

3.1.3 Antecedent Soil Moisture deficient

Soils became wetter during July in north-west England and became drier in parts of southern and Eastern England, reflecting the spatial distribution of rainfall. By the end of July, soil moisture deficits (SMDs) were lower than average (soils were wetter than average) for the time of year across much of north-west, north-East and central England. Water situation report EA, July 2019) Across the North West SMD of ≤ 10 mm were reported. For summer, this figure is usually 100 or 200 mm. The low figure for the end of July indicates how saturated the ground was prior to the this flood event.

3.1.4 Antecedent Groundwater

Figure 2 Groundwater levels for indicator sites at the end of June 2019 and July 2019



[^] The level at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction

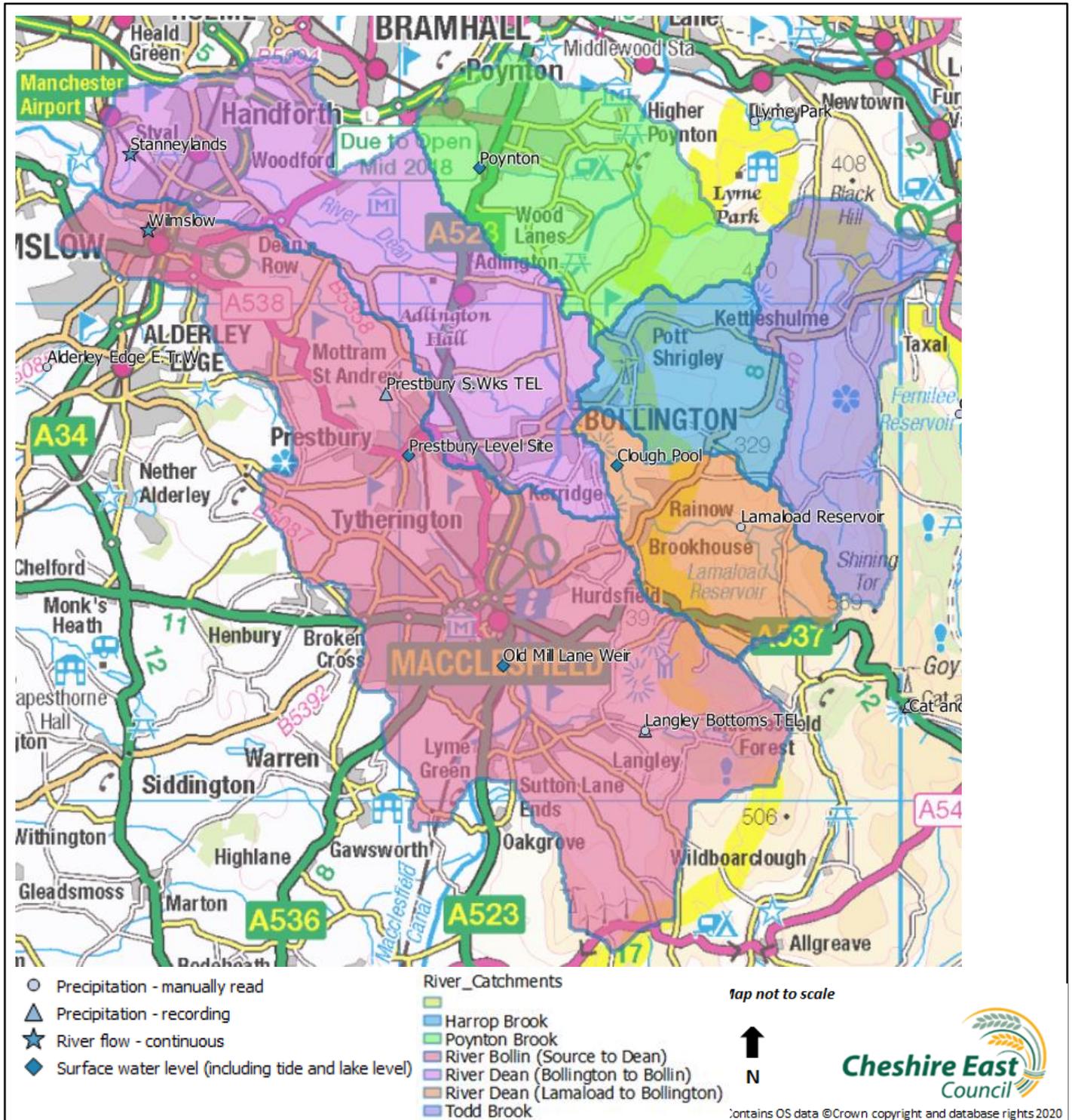
3.2 Recorded Event Data

Across the catchments a number of data sets are recorded, these include:

- Rainfall , both manually read and automated
- River level or surface water levels
- River flow

The location of the local catchment gauges are shown in the figure below.

Figure 3 Location of Environment Agency Gauges



3.2.1 Recorded Rainfall

Rainfall totals for the 27th – 31st July 2019 were recorded at the following locations:

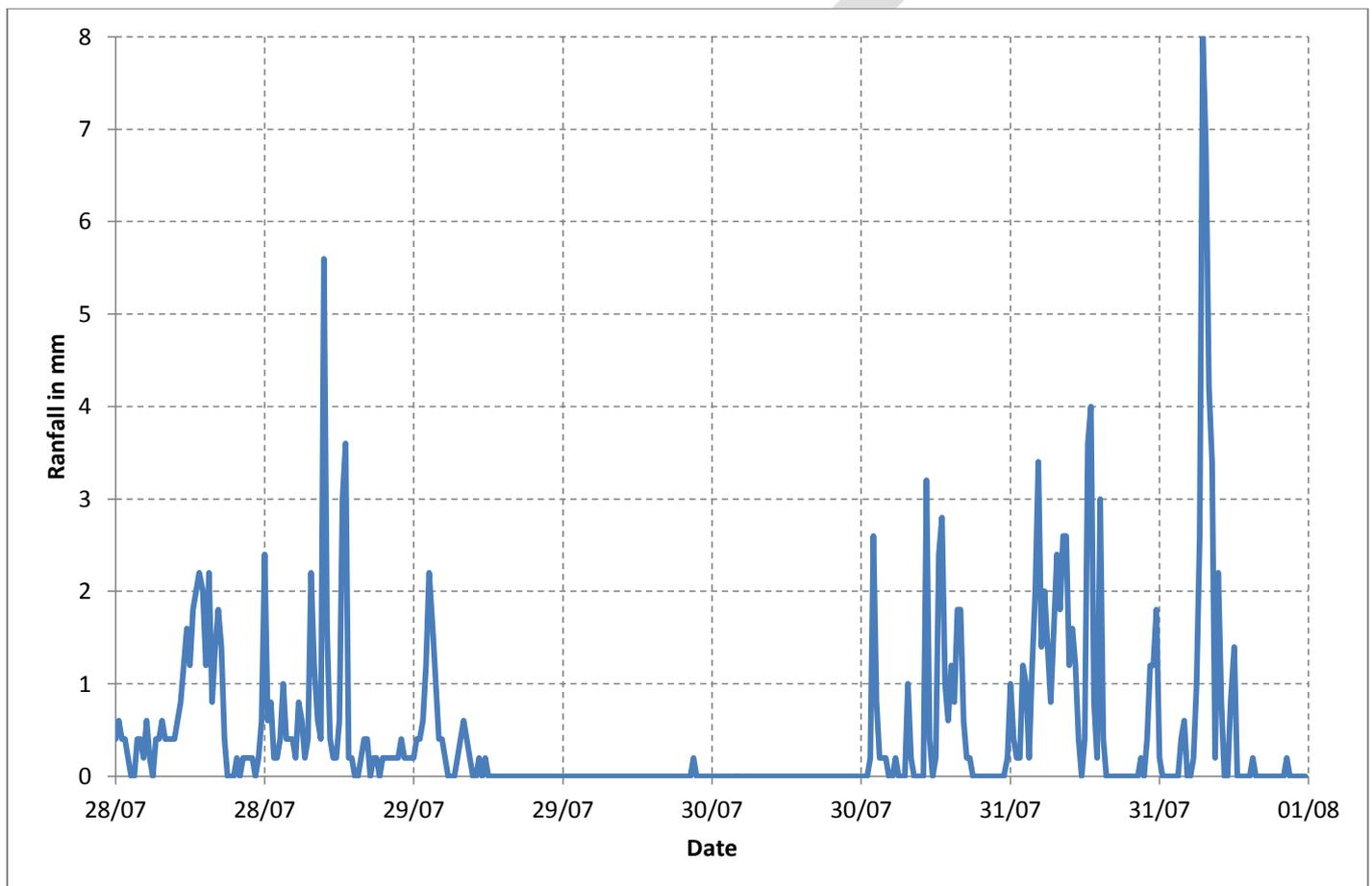
- 150mm at Hazel Grove
- 129mm at Prestbury WWTW*
- 180mm at Cat & Fiddle
- 128mm Langley Bottoms

Based on long term averages, the monthly average rainfall expected during July would be between 70-80mm.

*WWTW = Waste Water Treatment Works

The rainfall pattern is shown across the time period by the gauged record at the Cat and Fiddle, which shows the rainfall on the 27-28th July and 30-31st July, with a peak intensity of 30mm within an hour.

Figure 4 Rainfall Recorded (mm) at Cat and Fiddle



3.2.2 Calculation of reoccurrence interval

Rainfall events can be expressed as a probability or a return period, this is a statistical measure used to represent the magnitude of an event. For example the probability of a flood in any one year may be expressed as 1% Annual Exceedance Probability (AEP) or 1 in 100 year.

This does not mean that such a flood would occur every 100 years it is a statistical measure that suggest that in any given year, there is a 1% chance that it will happen, regardless of when the last similar event was. Or, put differently, it is 10 times less likely to occur than a flood with a 10% AEP or 1 in 10 years return period.

For this event the calculated return period across the catchments varies from approximately 0.5% AEP (1 in 200 year) for the Cat and Fiddle, 1.28% AEP (1 in 78 years) for Langley bottoms and 0.65% AEP (1 in 153 years) for Prestbury WWTW.

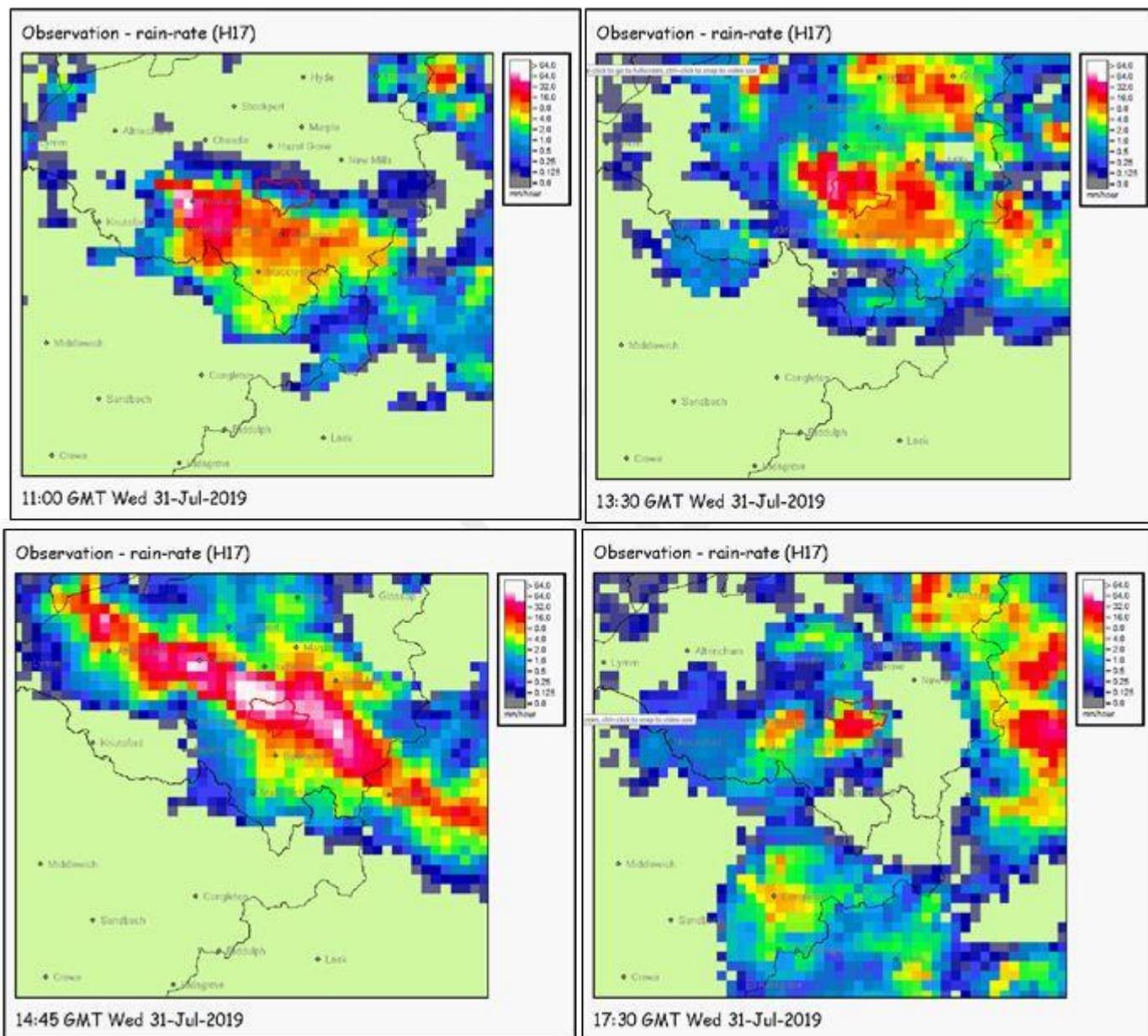
The variation in return period reflects where the most intense rain fell. The Cat and Fiddle gauge is just above the Todd Brook/Kettleshulme area.

3.2.3 Recorded Hyrad data

Rainfall Radar data is also reported as Hyrad data (Hyrad is a real-time record of radar and other hydro meteorological products)

The Hyrad images below show the storm on the 31st tracking across the catchments. The pink and white squares indicate areas where rainfall intensity is equal or greater than 32mm/hour.

Figure 5 Hyrad data at times between 11am and 17:30 on Wednesday 31st July 2019



Images courtesy of the Environment Agency - ©Institute of Hydrology.

3.3 Recorded River Levels

There are a number of gauges on Main Rivers which record the water level. This data is used by risk management authorities to monitor water levels in Main Rivers; this information may be used to trigger flood alerts or flood warnings, or remote gauges maybe used.

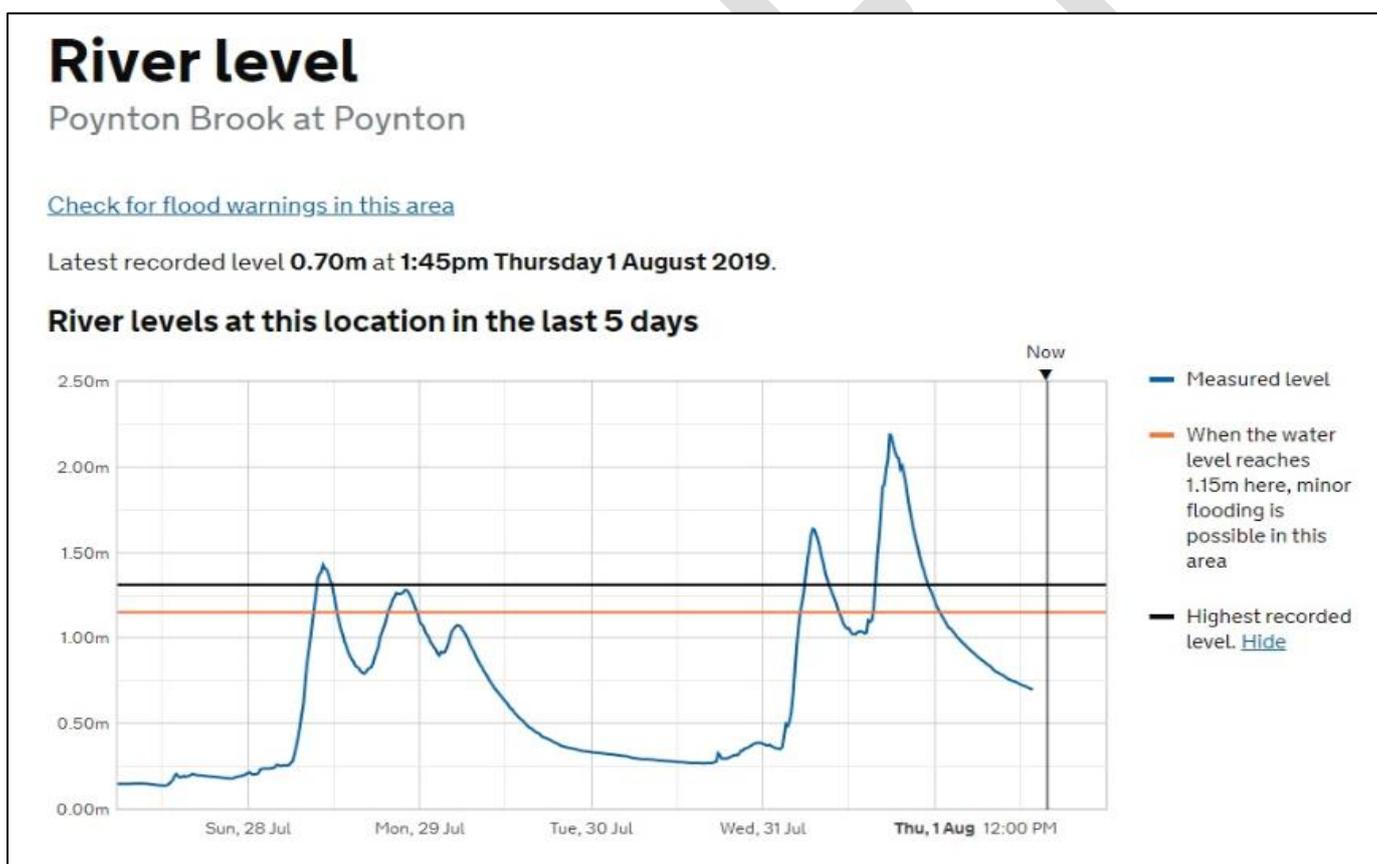
Local gauges are found at:

- Poynton Brook – Poynton brook near Midway
- River Dean – Clough Pool and Stanneylands
- River Bollin – Old Mill Lane, Prestbury and Wilmslow

There are no level gauges on the rivers on the Todd Brook or Harrop Brook catchments.

For the Poynton catchment a water level gauge is situated on Poynton Brook near midway at grid reference: 391600, 382718. Water levels at this gauge rose on Sunday 28th July following heavy rainfall, remaining elevated prior to further rain on Wednesday and Thursday. Records were broken on Thursday 31st July 2019 at 5:45pm when recorded river levels at Poynton Brook reached 2.195m, nearly a metre higher than the previous highest recorded on the 11th June 2016 (1.2m).

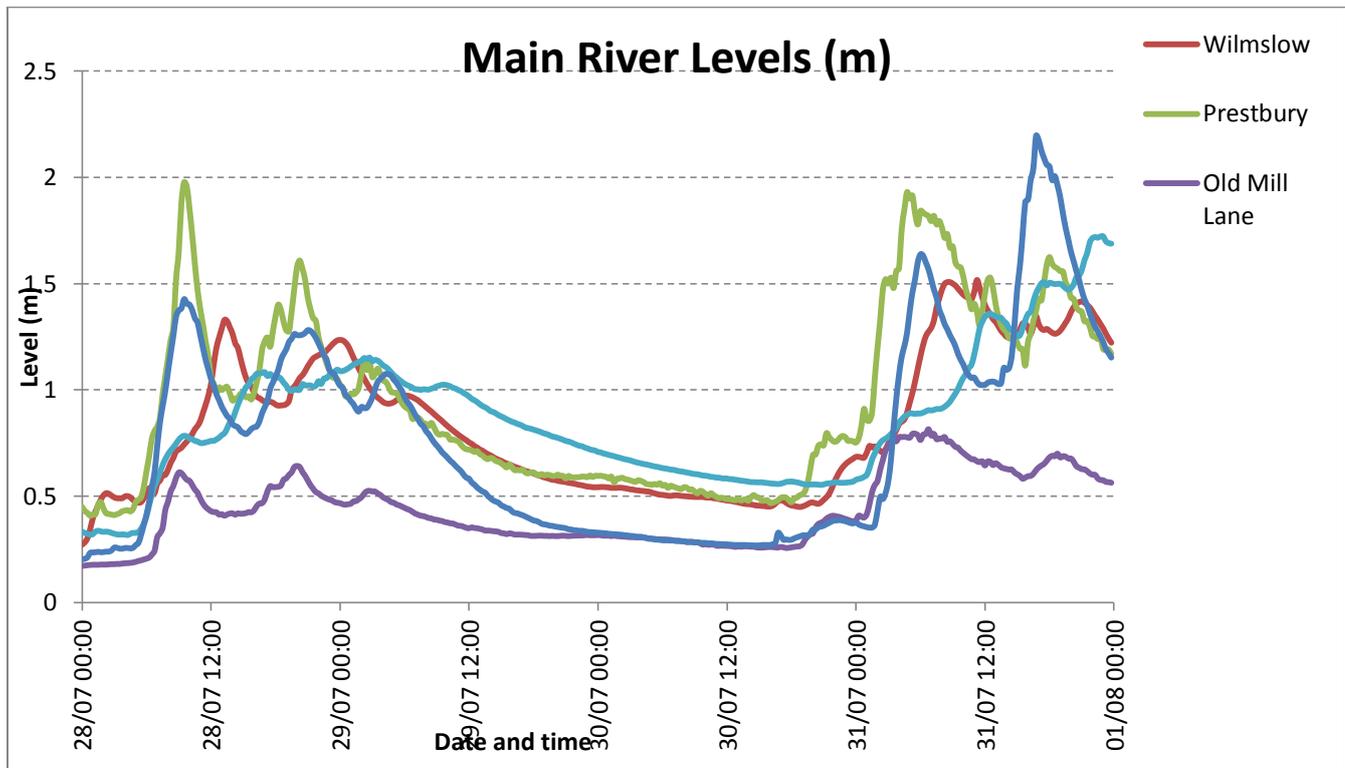
Figure 6 Measured River Level at Poynton Brook



Gauged water levels across the catchment show the rivers responses to this weather event.

The other river water level gauges all showed a similar pattern as the catchments responded to the rainfall event. The catchment responses will vary and dependant on the physical characteristics of the river catchment, barriers to flow, artificial drainage and any additional inflow/outflows to the system.

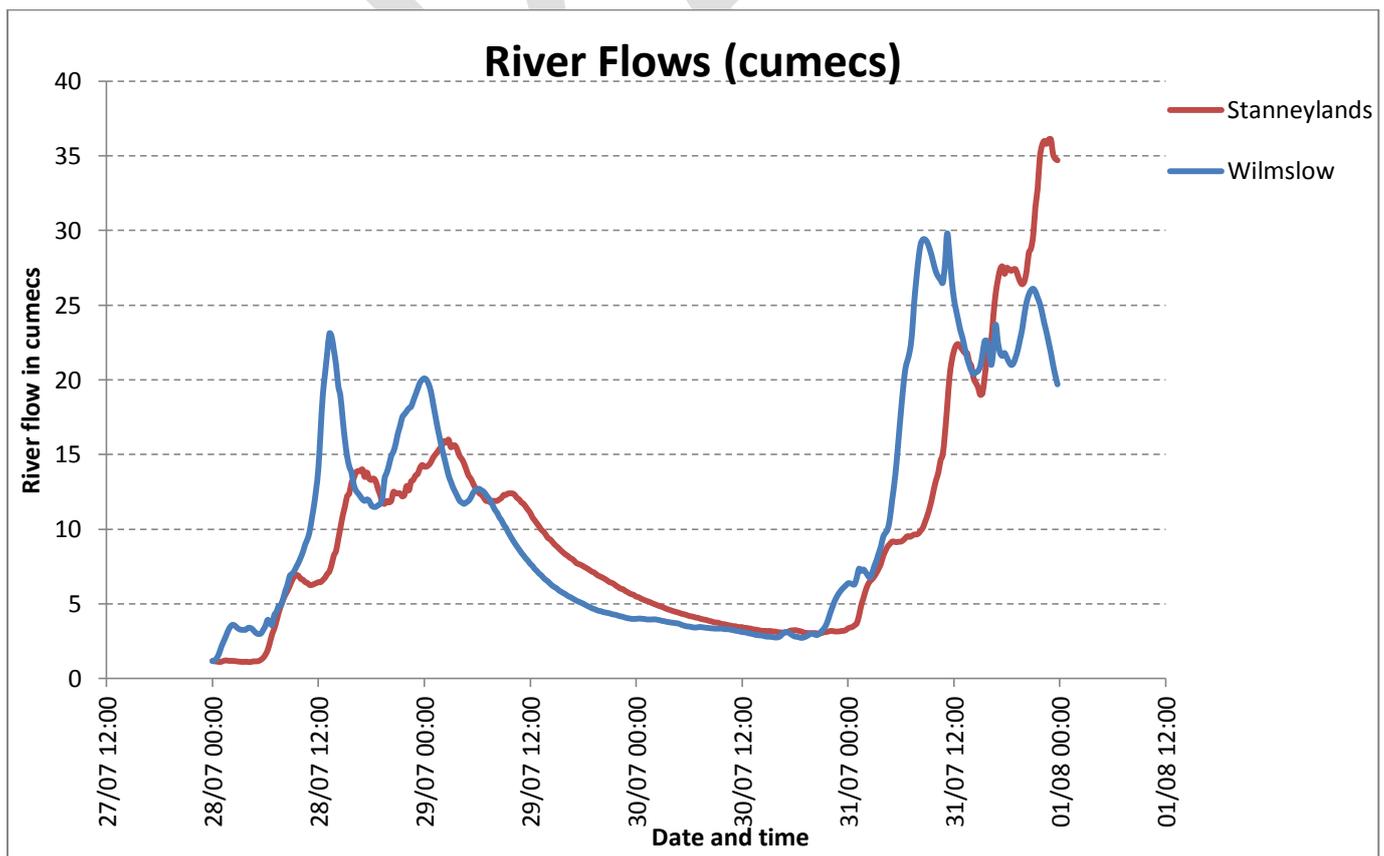
Figure 7 Main River levels (m)



3.4 Recorded River Flows

Across the catchments river flows are recorded on the River Dean at Stanneylands and River Bollin at Wilmslow. There are no flow gauges on the rivers on the Poynton Brook, Todd Brook or Harrop Brook catchments.

Figure 8 Main River Flows (cubic metres per second / cumecs)



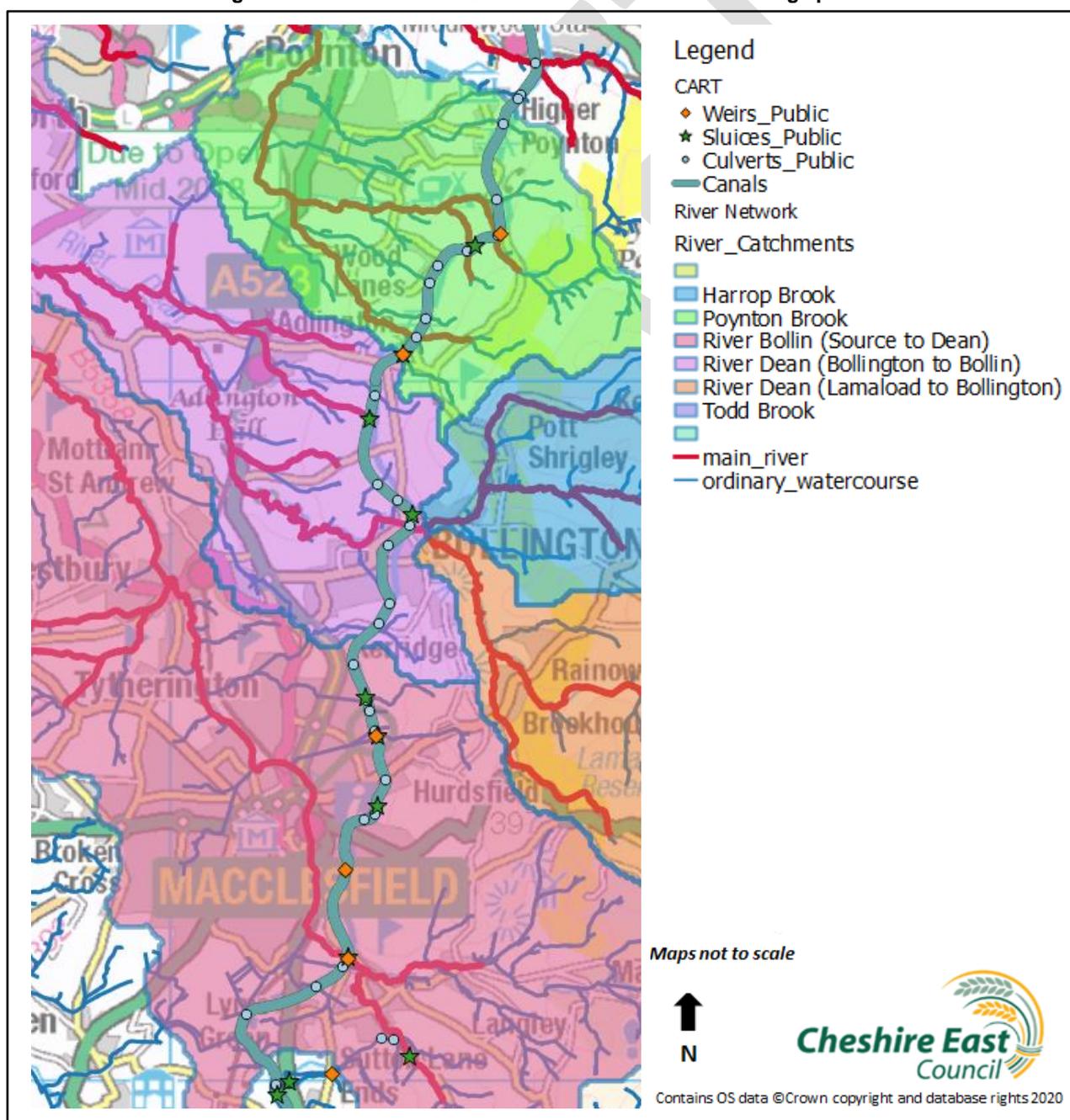
3.5 Canal Discharges

The canal network is managed by the Canal and River Trust. Canals are not designed or constructed to carry significant flood flows. The Macclesfield Canal runs from a junction with the Peak Forest Canal at Marple in the north, in a generally southerly direction, through the towns of Macclesfield and Congleton, to an end-on junction with the Hall Green Branch of the Trent and Mersey Canal. Four reservoirs feed water into the canal system. Four reservoirs feed water into the canal system.

Water levels are monitored at a number of locations. Trigger levels are set to prompt appropriate responses to fluctuations in water levels. During extreme events “Hi Hi” (Extreme high water trigger) or “Lo Lo” (Extreme low water trigger) levels result in the deployment of the duty staff to inspect and action as appropriate. Sluices are maintained along the canal that can be used as part of emergency responses. During the event 28th -31st July, no “Hi Hi” trigger levels were reached and no staff was deployed to site within Cheshire East, no sluices were opened.

When water levels in the canal are raised a number of static overflow weirs are located to allow excess water to flow from the system to maintain water levels. Weirs are located at: Redacre, Ryles Wood, Astrazeneca with the main flood weir located at Gurnett.

Figure 9 Macclesfield Canal Interactions with natural drainage paths



3.6 Environment Agency Flood Warning Areas

These catchments are served by four Environment Agency flood warning areas:

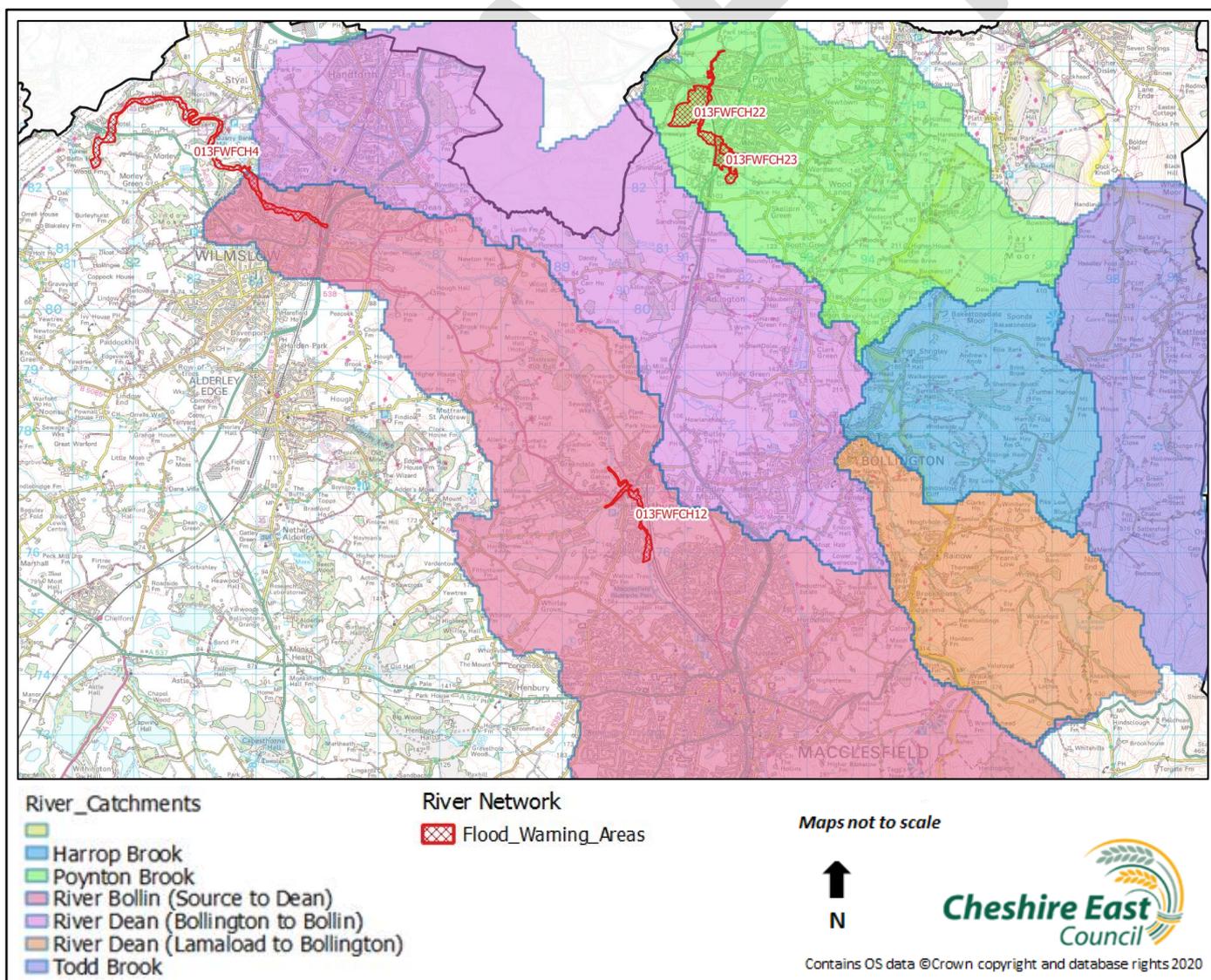
- River Bollin at Prestbury
- River Bollin at Wilmslow
- Poynton Brook at Wigwam Wood and parts of Armcon business park (013FWFCH22)
- Poynton Brook at Poynton and Midway (013FWFCH23)

Residents and/or businesses wishing to receive flood warnings can register online: <https://www.fws.environment-agency.gov.uk/app/olr/register> you do not need to live in the designated flood warning area to receive notification of flood warnings.

The river level at Poynton was above the Flood Warning level threshold for the first time since the installation of the river level gauge in 2008. Flood Warnings were issued prior to the thresholds being reached.

Flood warnings were issued for 013FWFCH22 at 10:20 on the Sunday 28th July and 06:21 on Wed 31st July. A Flood warning for 013FWFCH23 was issued at 18:05 on Wed 31st July.

Figure 10 Flood Warning areas associated with River Bollin and Poynton Brook

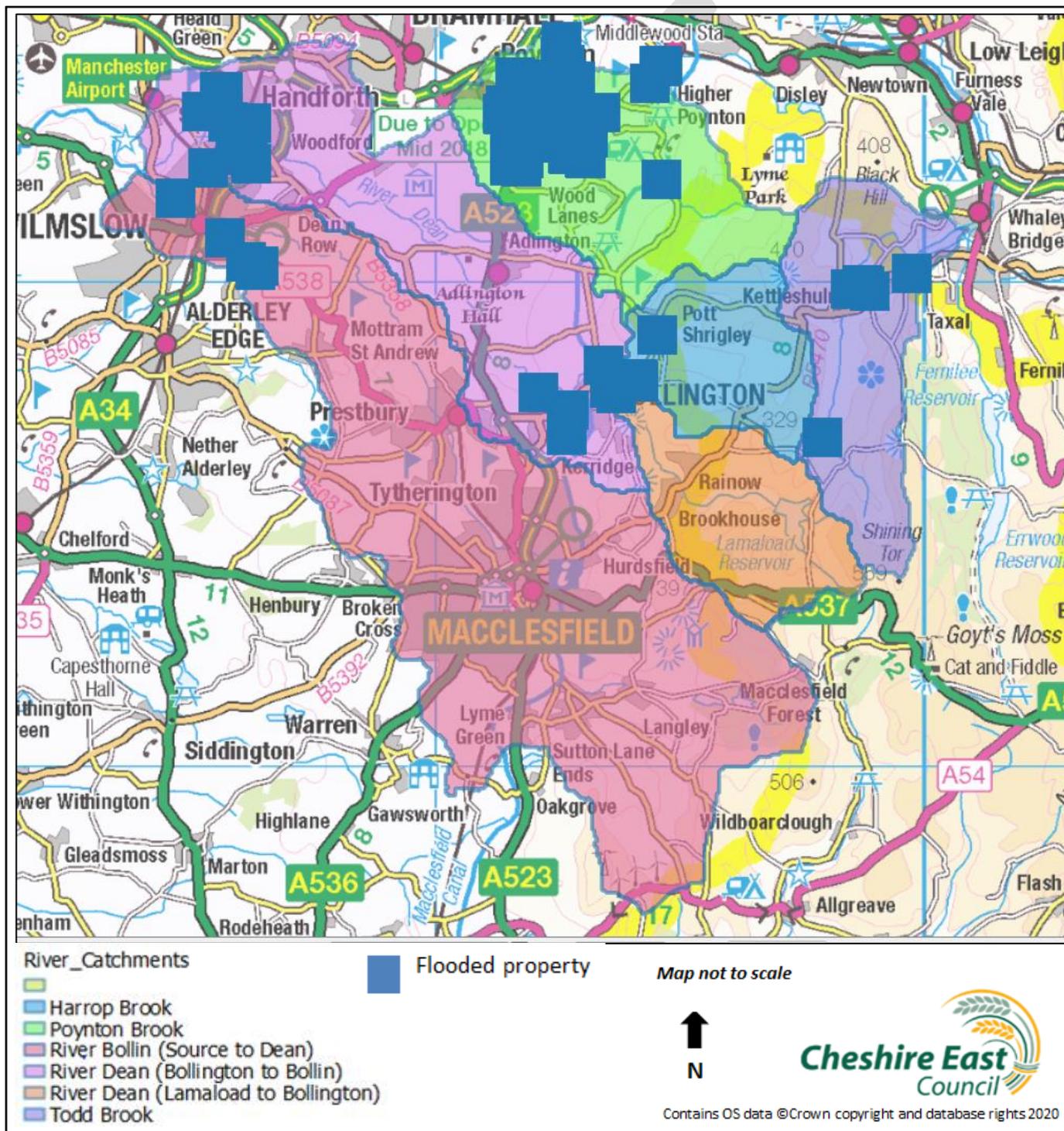


4 28th- 31st July 2019 Flooding – Catchment responses

The blue squares on the map below shows the locations which reported experiencing internal property flooding to the LLFA, United Utilities or the Environment Agency (either residential or commercial) during the period of 28th-31st July 2019.

Data shared with other parties may have been cross referenced with this dataset, however due to data protection regulations cannot be shared without the home owner’s prior permission.

Figure 11 Flooded Locations



OFFICIAL

4.1 Poynton Brook Catchment

The image below shows the area that drains onto Poynton Brook. The catchment can be split into a number of sub-catchments; Booth Green Brook and Poynton Brook (both classified as Main River); and Park Lane Stream and Coppice Stream (both classified as Ordinary watercourse).

Figure 12 Indicative catchment of Poynton Brook

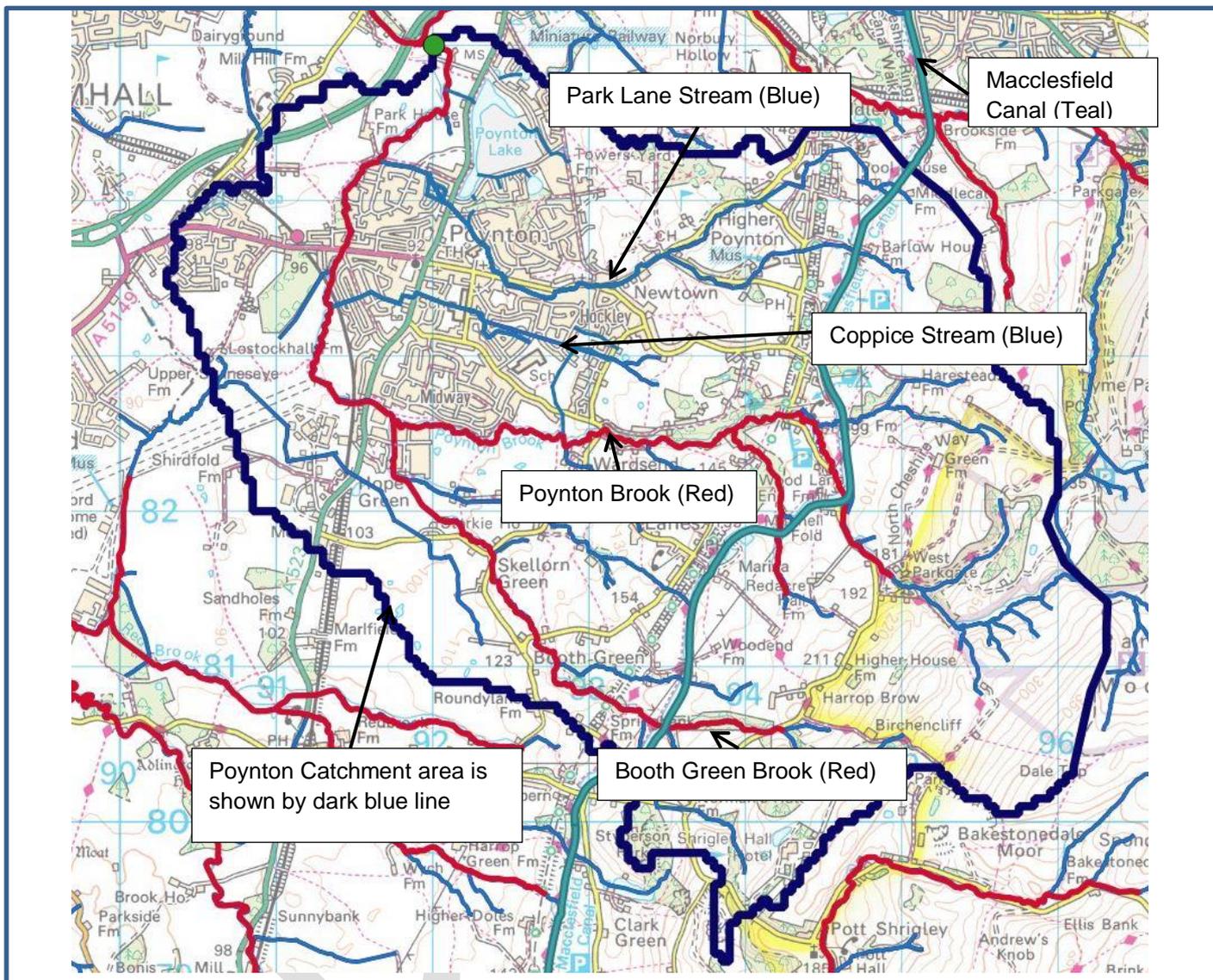


Table 3 Number of properties reported* flooding in Poynton

No. of properties reported*	July 2019
Internal Flooding Residential**	78
Internal Flooding Businesses	8

*formally reported to the Lead Local Flood Authority, Environment Agency and/or United Utilities

** Internal flooding residential refers to reports of (internal property flooding, including integrated garages. This does not include: uninhabitable cellars, detached garages and gardens

4.1.1 Summary description of surface water and sewer flooding in Poynton Brook catchment

Foul water drains flow downstream, typically by gravity, to the sewerage treatment works at Davyhulme in Manchester. Surface water sewers will outfall where possible into watercourses, both Main River and ordinary watercourses, where this is not possible they will drain into combined sewers (foul and surface water sewers) which will flow downstream to the treatment works.

In addition many of the highways gullies which drain surface water from the highway discharge water into these surface water or combined sewers.

During heavy rainfall events, surface water sewers maybe prevented from discharging when river levels are elevated. In extreme events this may cause the surface water sewer pipes to fill with water and/or surcharge the network.

Although all running throughout, five United Utilities foul water pumping stations were overwhelmed during the event on the 31st July 2019, three directly affected by the backing up of river water, which introduced flow which exceeded the capacity of the pump stations during the event.

4.1.2 Summary description of surface water and highway flooding in Poynton Brook catchment

Gullies are designed to remove water from the highway, on adopted roads within Cheshire East they are the responsibility of Cheshire East Highways to maintain. In residential areas like Poynton, most highways gullies will drain into United Utilities surface water or combined sewers, in areas in which no surface water sewers exist then highways drains may exist that outfall to watercourses, surface water sewers, combined sewers or soakaways. Highways drains are designed and constructed to drain water falling directly on the highway, for more smaller, low return period storms.

During heavy rainfall events, highway drainage and surface water sewers maybe prevented from discharging when river levels are elevated. In extreme events this may cause the systems to fill with water and/or surcharge the network.

4.1.3 Description of Main River flooding for Poynton Brook catchment (Booth Green and Poynton Brook)

Poynton Brook is classified as a Main River, with approximately 20km² of land within its catchment area which drains along Booth Green Brook and Poynton Brook (both Main River), forming part of the upper River Mersey catchment. All rainwater that falls within the green shaded area above will naturally drain towards and through Poynton.

Prolonged rainfall over the Poynton catchment led to 150mm of rain falling over a 5 day period. This caused river levels in the Main Rivers (and ordinary watercourses) to rise in response to this. In addition, surface water drainage systems (including highway drainage and surface water sewers) also reached capacity and flowed downstream (overland) towards Poynton Brook.

The flood map zone 3, indicates the extent of flooding associated with a 1% AEP (1 in 100yr event). In some places this flow is within the main channel or more typically flows go out of bank on the 1% AEP flow.

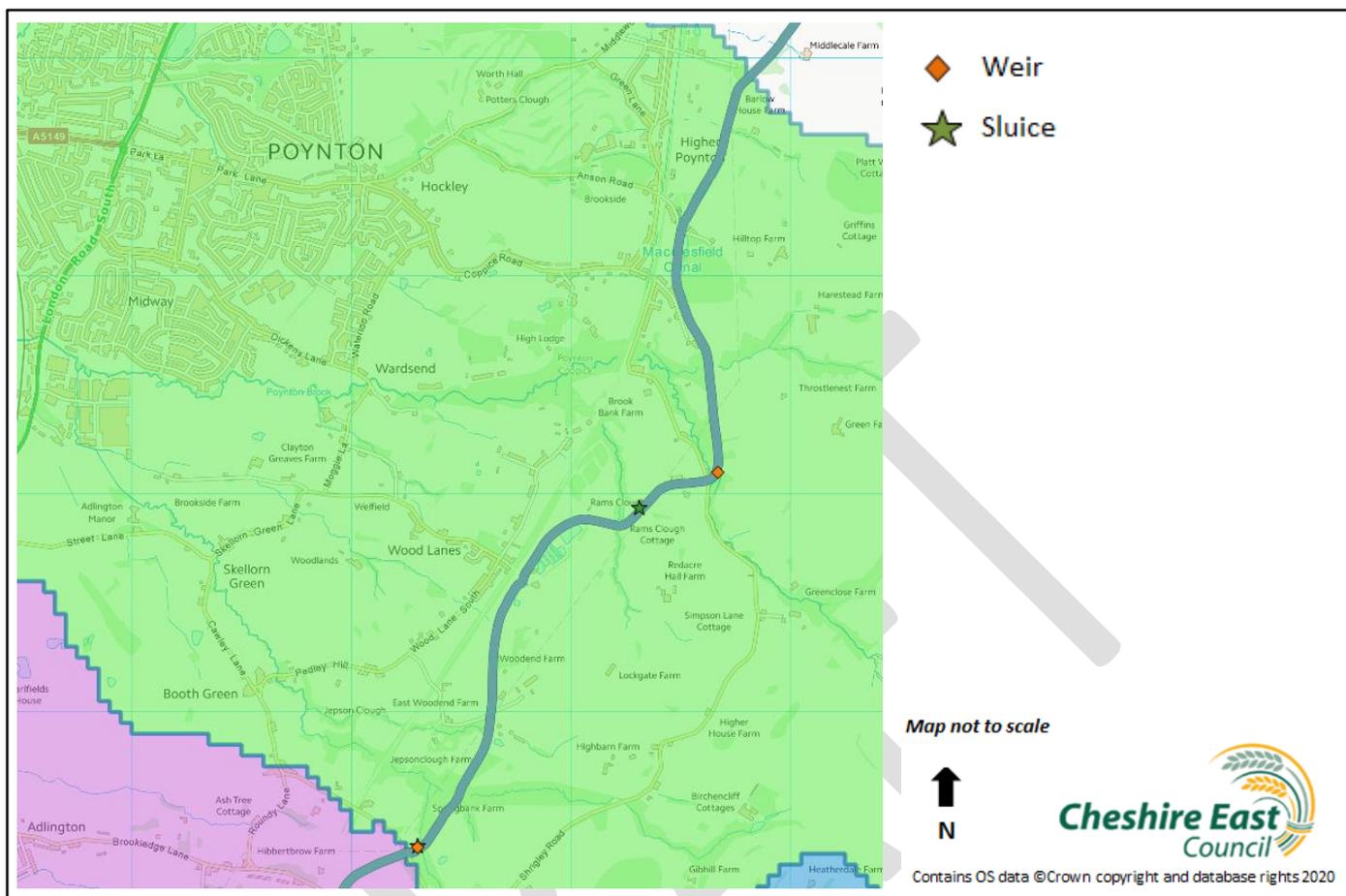
The river levels gauge on Poynton Brook shows the rivers response to the rainfall over the 5 day period, exceeding trigger levels on the 28th July resulting in the Environment Agency issuing flood alerts and flood warnings. On the 31st July the river level rose again triggering the Environment Agency to issue a Flood Warning for Poynton Brook at Wigwam Wood and parts of Armcon business park and Poynton Brook at Poynton and Midway.

Records were broken on Thursday 31st July 2019 at 5:45pm when recorded river levels at Poynton Brook reached 2.195m, nearly a metre higher than those recorded on the previous flood event of 11th June 2016. (1.2m).

The Macclesfield Canal interacts with the watercourses via weirs near the aqueduct near Mitchell Fold and Ryles Wood and sluices at Rams Clough and Ryles Wood. The Canal and River trust report that no "Hi Hi" trigger levels

were reached and no staff were deployed to site within the Poynton catchment or any of the Cheshire East area, no sluices were opened.

Figure 13 Canal Interactions with Poynton catchment



Symbols weir: orange diamond, sluice: green star

4.1.4 Description of flooding for Booth Green Brook (Main River, in Poynton Brook catchment)

The tributary to Poynton Brook is Booth Green Brook, which is also classified as a Main River. Evidence suggests that there are three locations in the Armcon Industrial Estate at which water overtopped the watercourse at low spots in the banks, which align with the modelled floodplain of this area:

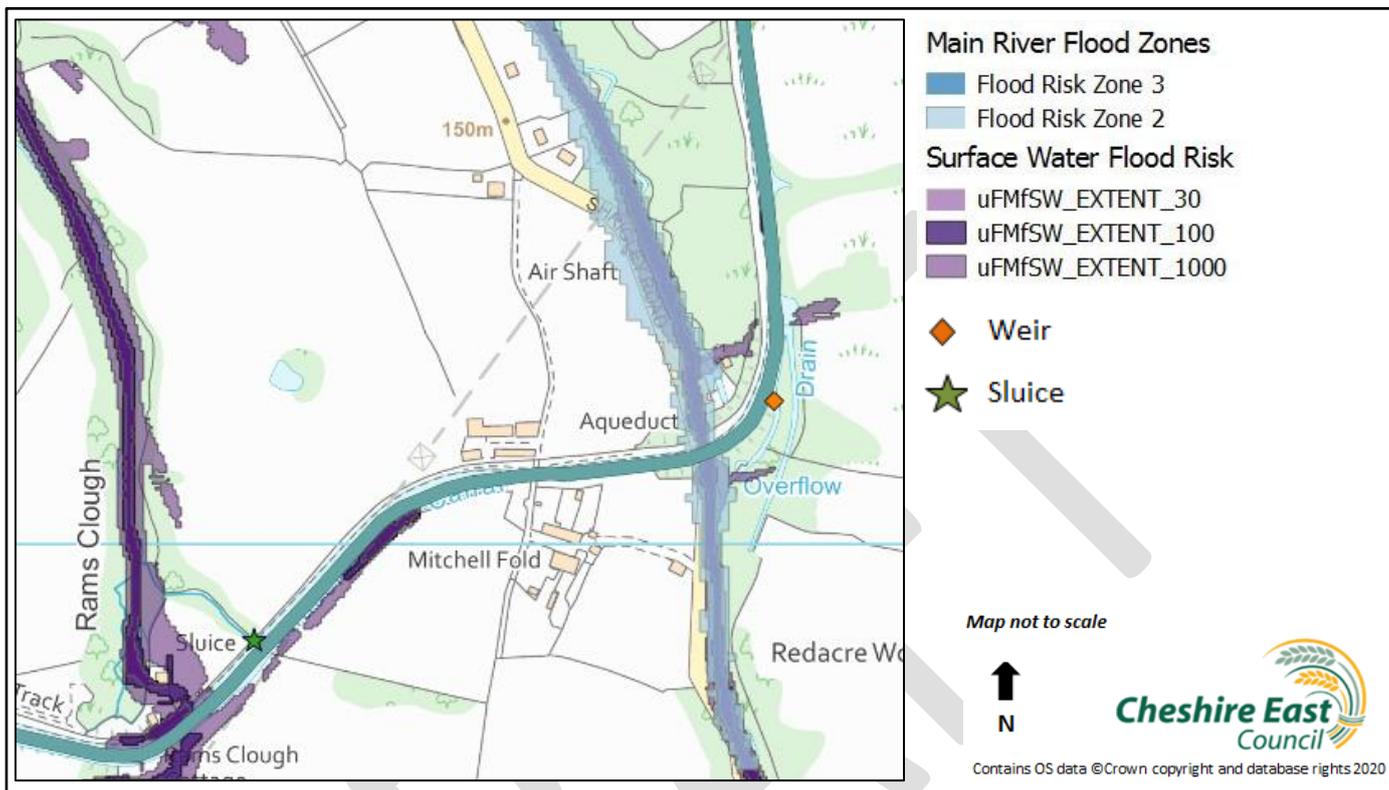
The right bank of Booth Green was overtopped upstream of the culvert at First Avenue, whilst reports were received that the culvert under First Avenue had overtopped on the right bank, just downstream of the bridge, photos show water lapping out of bank on right bank but not quite overtopping a decking area they have on the bank top. Flood wrack/debris further upstream indicated flow within channel, which was confirmed at the back of Second Avenue, which was also confirmed to be in-channel between Second Avenue and Hope Lane. Booth Green Brook was observed to be in bank at the confluence with Poynton Brook. Surface water flooding due to surcharged gullies was also evident on the industrial estate.

4.1.5 Description of flooding for Poynton Brook (Main River, in Poynton Brook catchment)

Reported flooding incidents on Poynton Brook are tackled from up to downstream. Residents reported river bank erosion on Poynton Brook near to the aqueduct both the Environment Agency and The Lead Local Flood Authority. The site was visited following the flooding by the Environment Agency who met with local residents.

At this location excess water can leave the Macclesfield canal via a weir (shown as orange diamond) draining into an overflow channel that flows south into Poynton Brook. Poynton Brook then flows north via a culvert under the Macclesfield canal. The sluice was not operated during this event.

Figure 14 Flood risk at Poynton Brook near Aqueduct

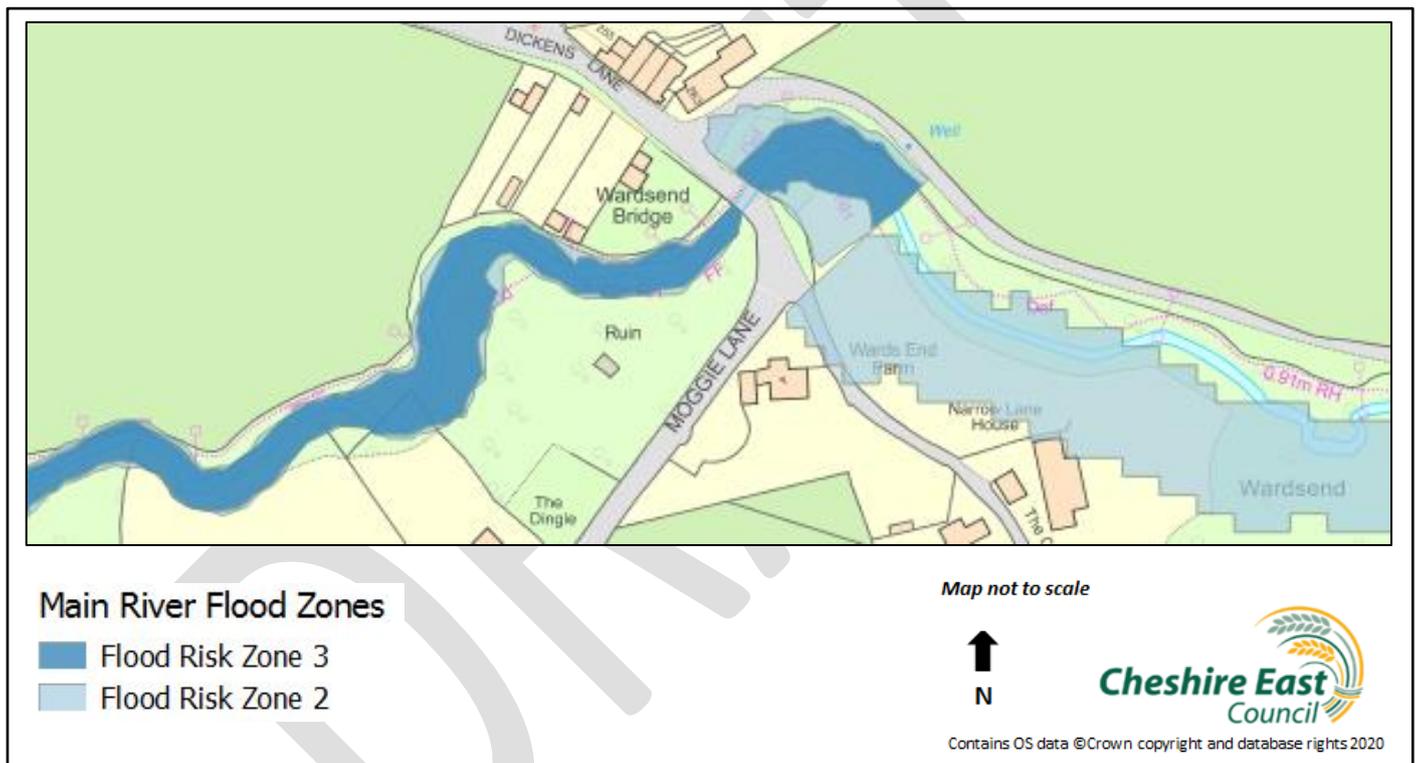


Property flooding from Main River and surface water overland flow occurred adjacent to Wards End bridge. Water levels were reported to be high upstream of the bridge, and then rose quickly. The high water levels overtopped the bridge, and caused the downstream parapet to fail, along with considerable erosion of adjacent land. The limited size of the aperture of the bridge opening and its high headwall suggests it acted to retain water and reduce flows downstream, and may have been specifically designed to reduce flooding further downstream. It was reported that the rapid water level rise was due to a blockage in the bridge opening. At some point the blockage cleared through the opening. Both gas and mains water pipes flow across this structure which has been considered in its redesign by Cheshire East Highways, the Environment Agency was consulted to as part of these works.

Photograph 1 Wards End Bridge retaining wall upstream (left photo) and downstream (right photo) after the flood.

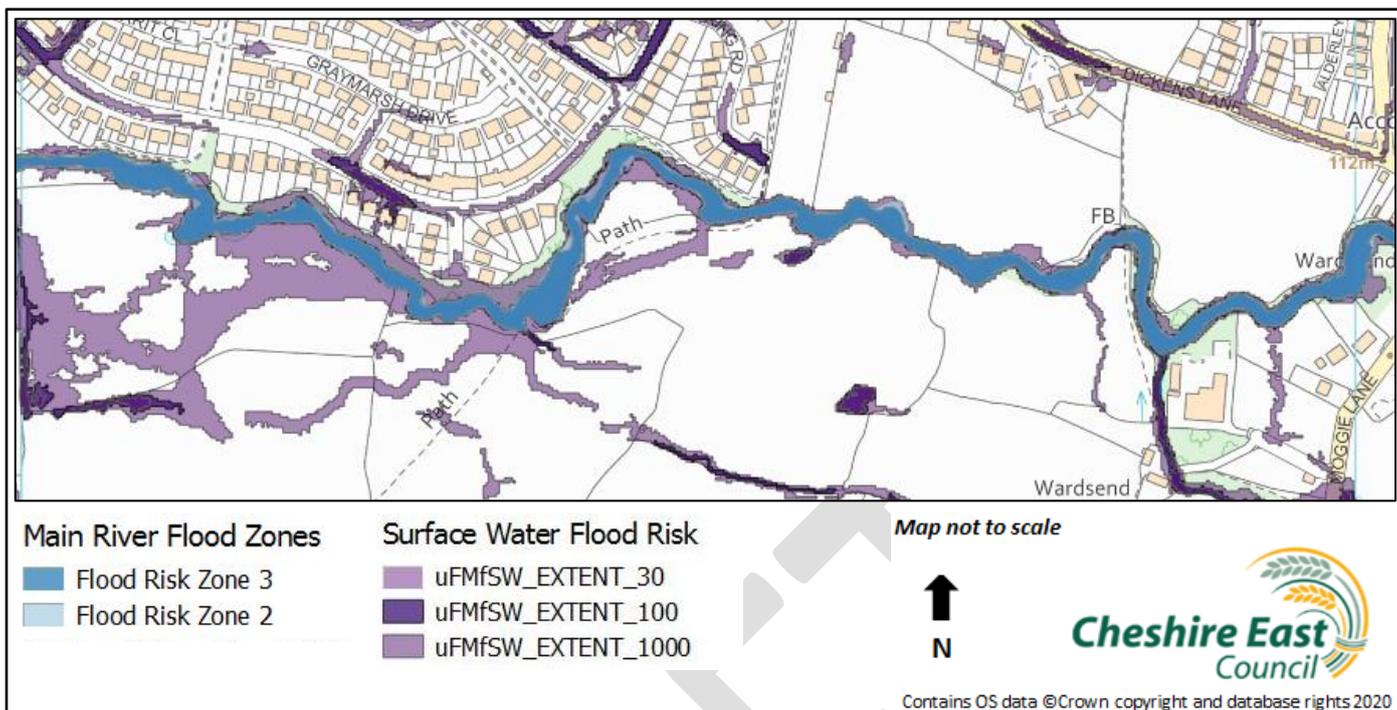


Figure 15 Fluvial Flood Risk near Wards End Bridge, Poynton Brook



Poynton Brook then flows west, naturally filling up its natural floodplain. Much of the corridor adjacent to Poynton Brook remains undeveloped; there were no reports of property flooding until the urban area. Flood wrack was observed on the right bank at several locations, indicating water out of bank on the right bank (to the north) of Poynton Brook.

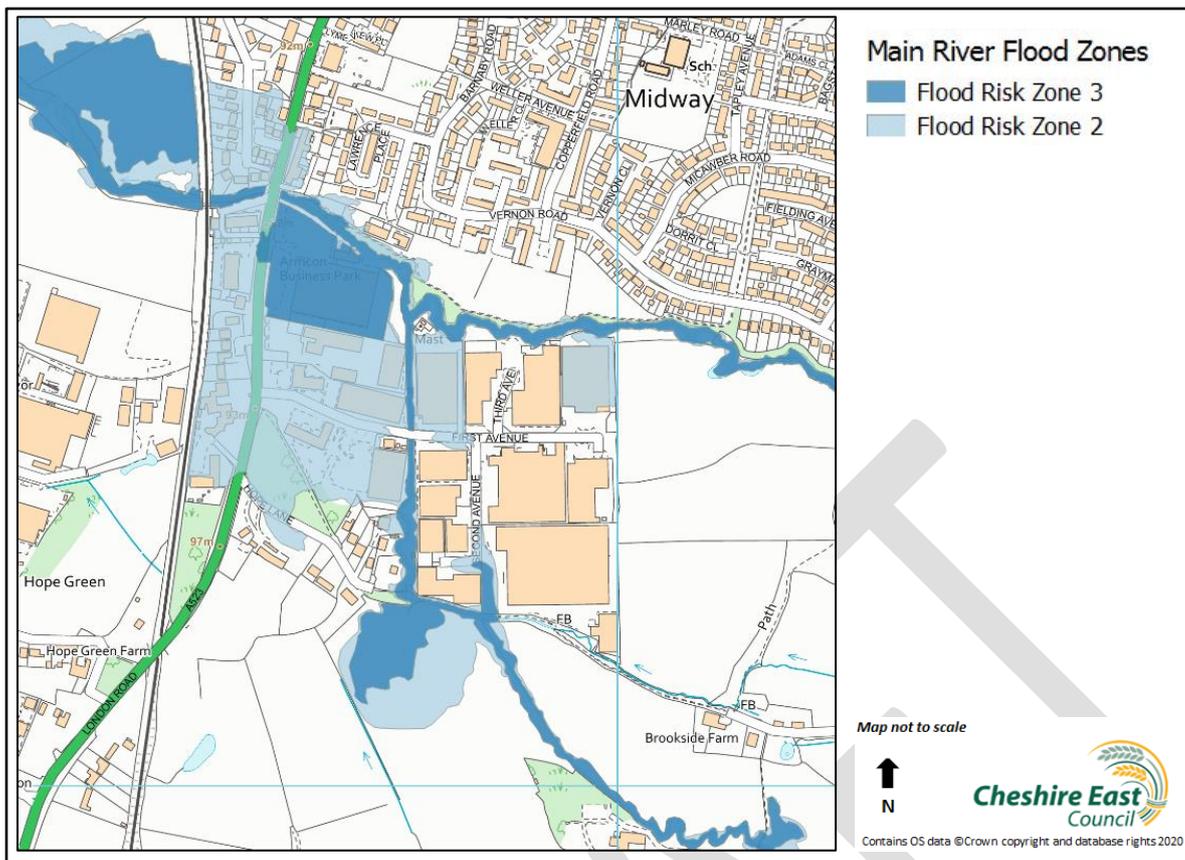
Figure 16 Flood risk* along Poynton Brook between Ward End bridge and industrial estate



On the left bank (south side) of Poynton Brook next to Armcon industrial estate upstream of the Booth Green confluence, flood wrack marks were observed to be contained in-bank (but only just) for the majority of the section, apart from a low spot where out of bank flows across the back of a industrial unit were observed for around 20 metres and an exit route for flows (back to Poynton Brook) was observed.

Downstream of the confluence with Booth Green Brook, Poynton Brook was contained in channel on the left bank (south side) along the rest of the industrial estate perimeter due to an embankment that is approximately 5 feet higher than floor levels in industrial estate. The river was contained the river side of the embankment until a low spot adjacent to the corner of industrial unit, where the bank is considerably lower and wrack was observed indicating that flows entered the Armcon Industrial Estate at this point from Poynton Brook. This low spot runs for around 40 metres. Downstream of here, flood wrack indicated that the remaining flows were just in-bank on the left bank, probably in part due to a large portion of the flows flowing out through the industrial estate.

Figure 17 Poynton Brook Floodzones 2 & 3 (Industrial Estate)

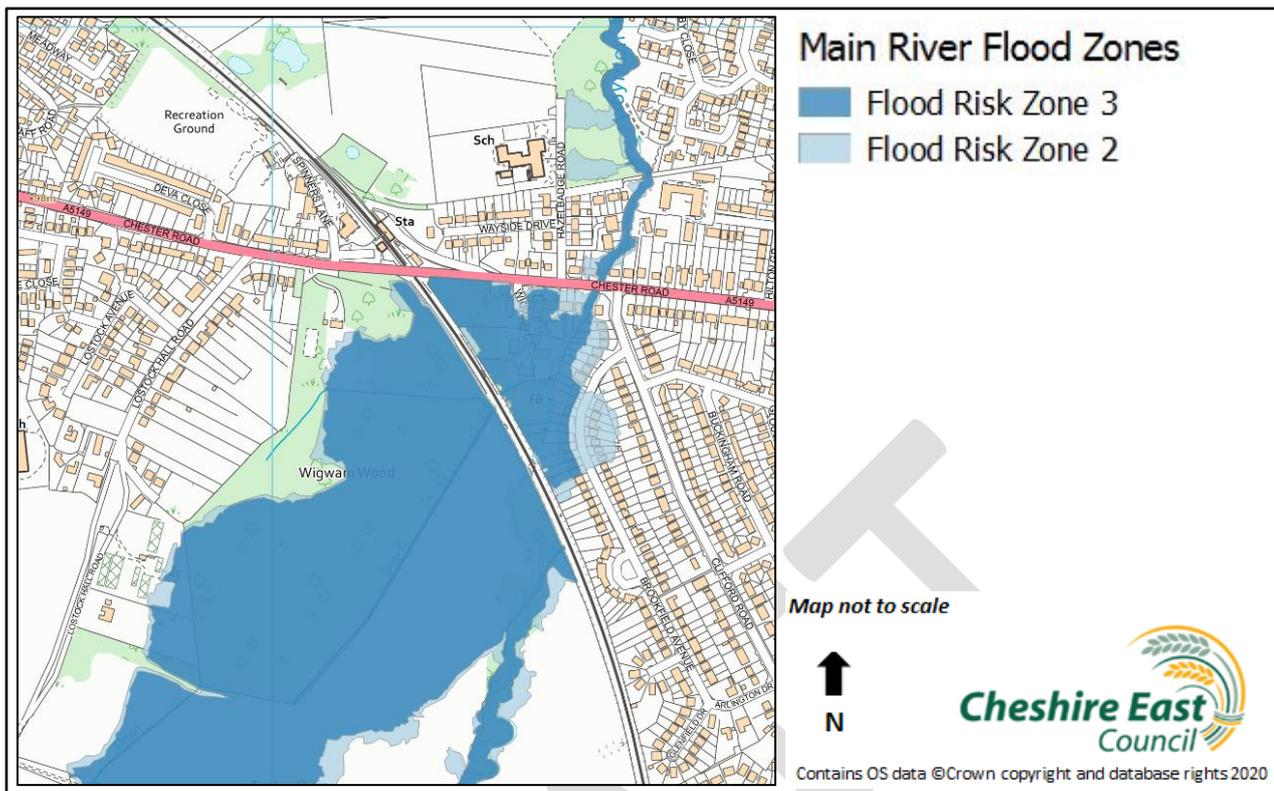


Once the flood water had left the watercourse, it followed the natural topography of the floodplain/land as it made its way along the lowest point back to the watercourse. This, coupled with surface water flooding (resident reported gullies and manholes surcharging) resulted in flooding to properties and premises in the Armcon industrial Estate, on London Road, Lostock Road and Woolley Avenue. Water flowed along the highways, into properties and through gardens as it made its way back into Poynton Brook. Water then receded quickly.

At a local care home staff confirmed that water got into garages not the property, but flooding was exacerbated by vehicle movements through the floodwaters (bow waves).

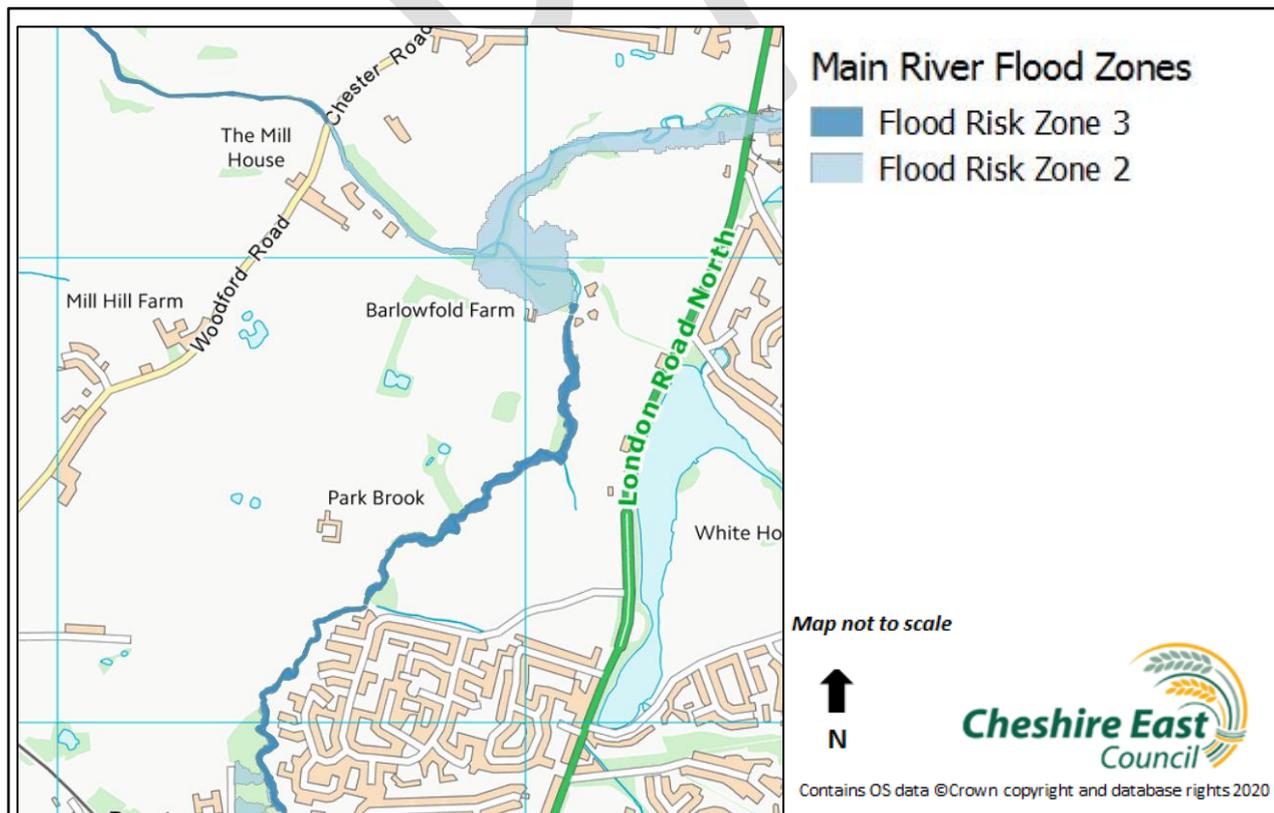
Poynton Brook then flows north towards Wigwam Wood, with the Coppice Stream joining the Main River behind Brookfield Avenue after flowing under the railway line. Additional watercourses drain into the Main River at Wigwam Wood and this area is classified as a natural floodplain for Poynton Brook. Residents reporting internal and external property flooding in this location and raised river levels and along this stretch as far up at Hazelbadge footbridge; the flood risk zones at this location are shown below.

Figure 18 Poynton Brook Floodzones 2 & 3 (Wigwam Wood)



As Poynton Brook continues north, Park Lane Stream joins the Main River downstream of Philips Bridge. Poynton Brook then flows to join Norbury Brook. Main River levels were elevated along this reach, with water spilling out of bank onto the natural river floodplain.

Figure 19 Poynton Brook Flood zones 2 & 3 (Confluence with Norbury Brook)



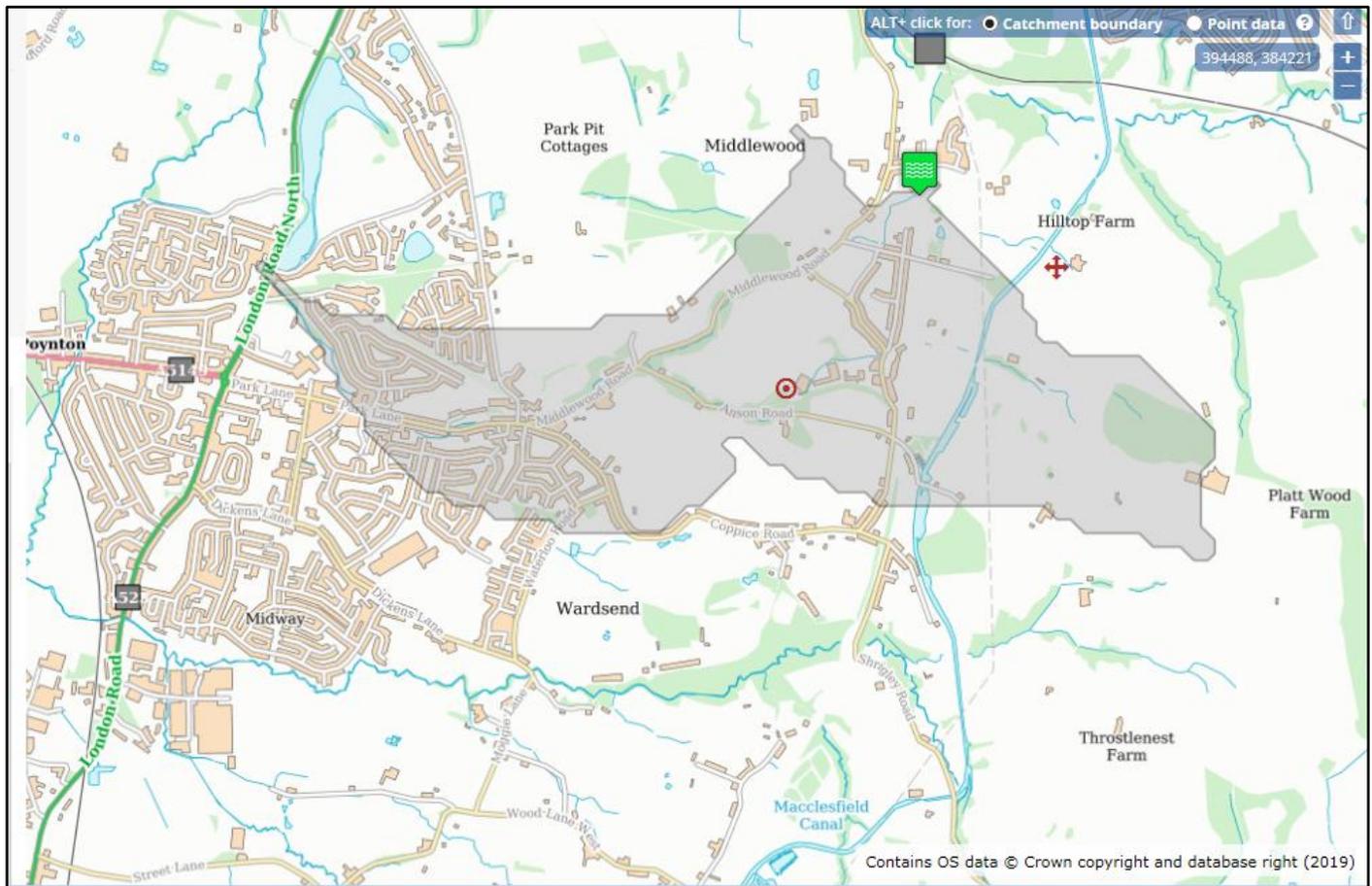
4.1.6 Description of flooding for Park Lane Stream (ordinary watercourse) (including Higher Poynton)

Flooding occurred on 31st July, with a further weather event occurring on Friday 9th August 2019.

Flooding on the 31st July in Poynton related to Main River, surface water and local drainage systems; on the 9th August flooding was a result of surface water and local drainage systems.

The ordinary watercourse capacity throughout Poynton has an annual exceedance probability of between 5% - 3.3%. This means that the system will be surcharged and flood following a storm with a magnitude greater than 5% AEP or a 1 in 20 year return period. This means that based on current data the probability of the system flooding for any one year is 5%

Figure 20 Indicative natural catchment of Park Lane Stream



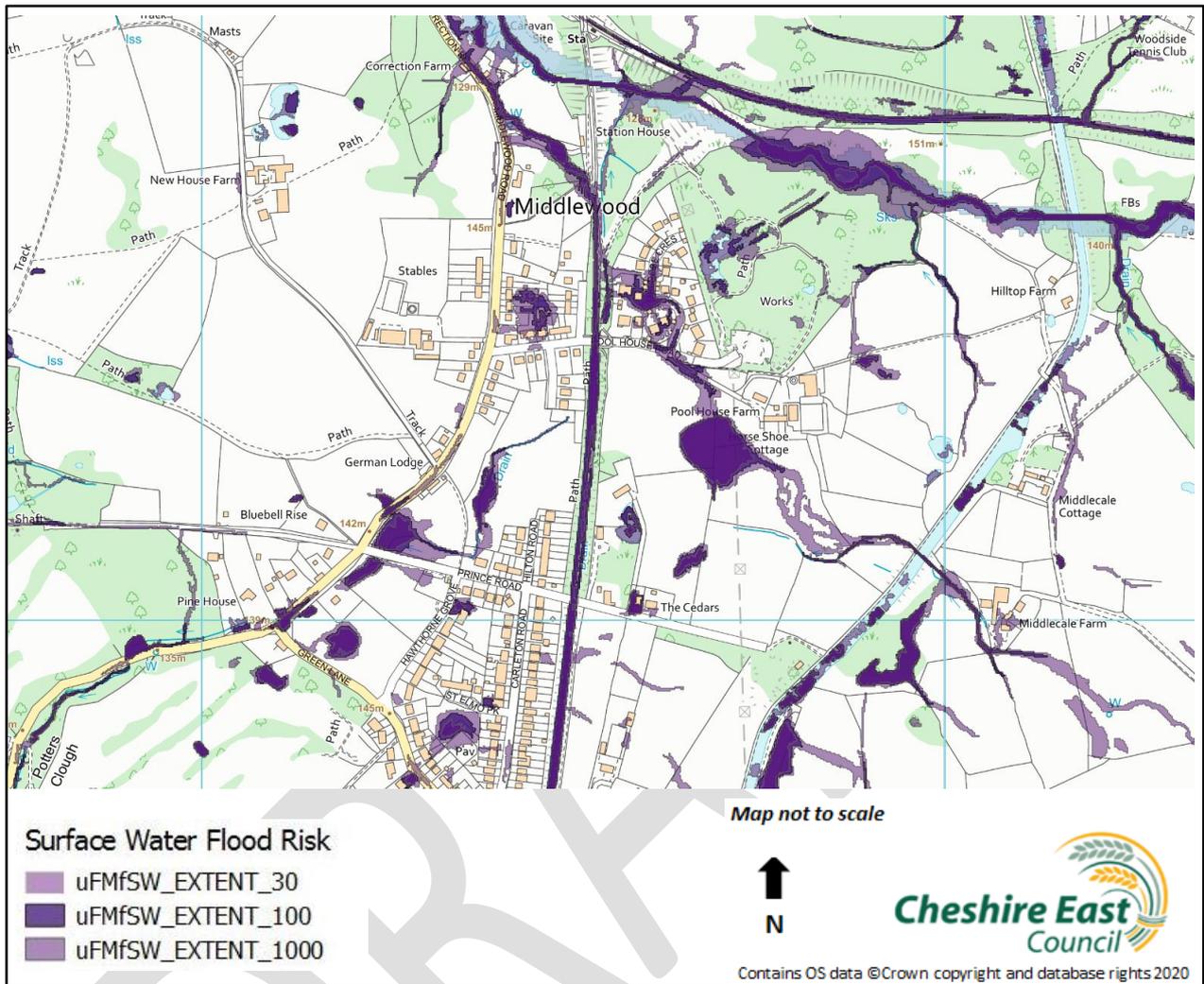
In Higher Poynton the catchment of Park Lane stream extends East beyond the Macclesfield canal as shown in the figure above. The river flows west following the natural topography of the land making its way across the surface, land drains and through the soil and rocks underground.

Water ponds at Pool House farm, in a natural depression. There is a land drain across Pool House farm that drains west under the Middlewood Way (the old Railway) to join the open watercourse in fields towards the end of Hilton Road, this then flows south towards Prince Road and then west towards Middlewood Road. When the capacity of the drainage channel and the natural depression at Pool House farm is exceeded; excess water flows overland to the north following the ground levels. By flowing north, eventually down to the Middlewood Way the flood waters move into the neighbouring catchment of Norbury Brook.

As the watercourse flows downstream, a depression in the field to the north of Prince Road fills with water. Frequent flooding here is due to the post-industrial landscape and small culvert sizes in the drainage channels, and there may

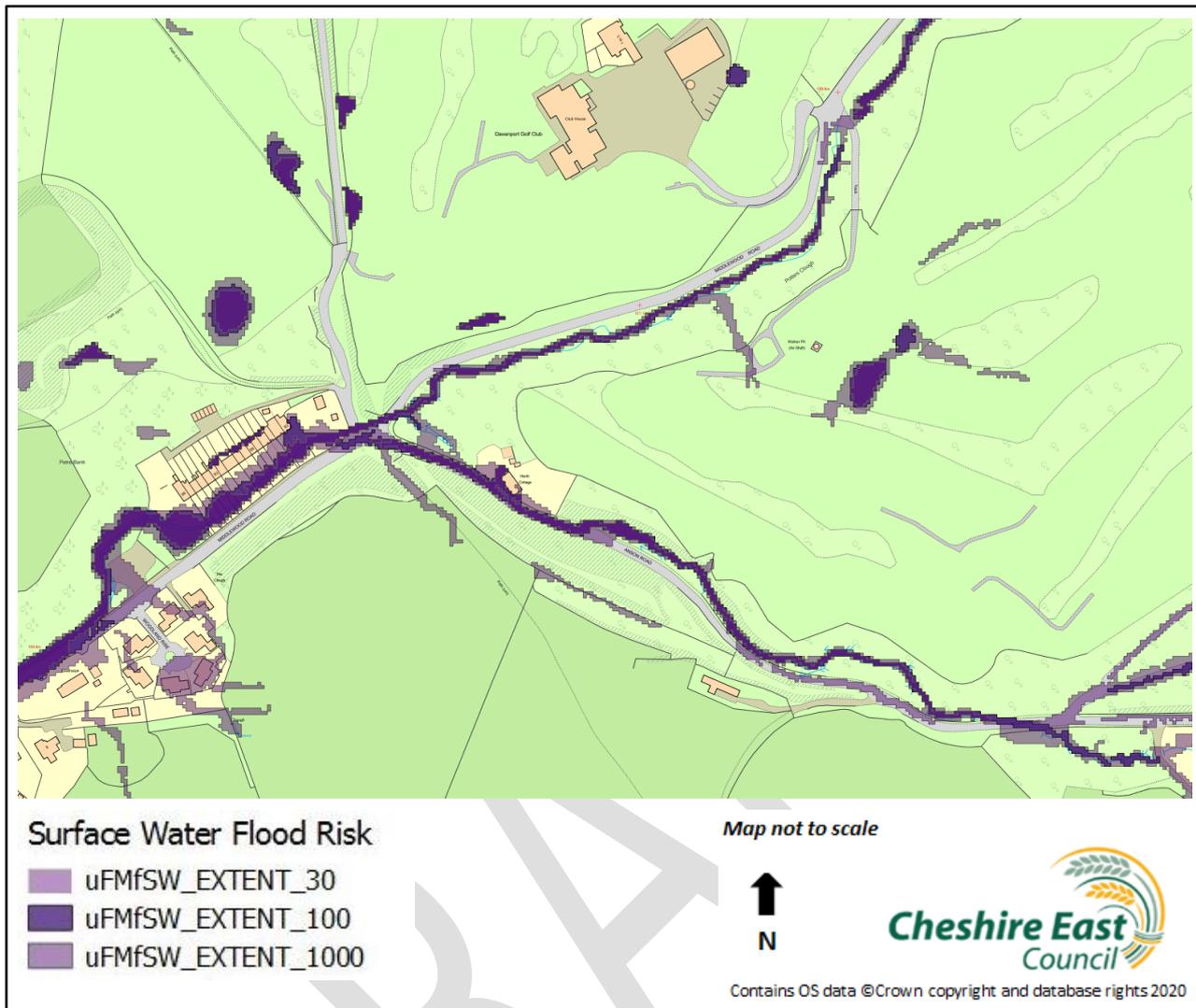
also be subsidence due to mining. The pond was formerly more extensive, named Richardson’s Pool (1849 maps), later known as “German Pool”. This fills as the channel outfall capacity is exceeded.

Figure 21 Flood Risk Map Middlewood Way area



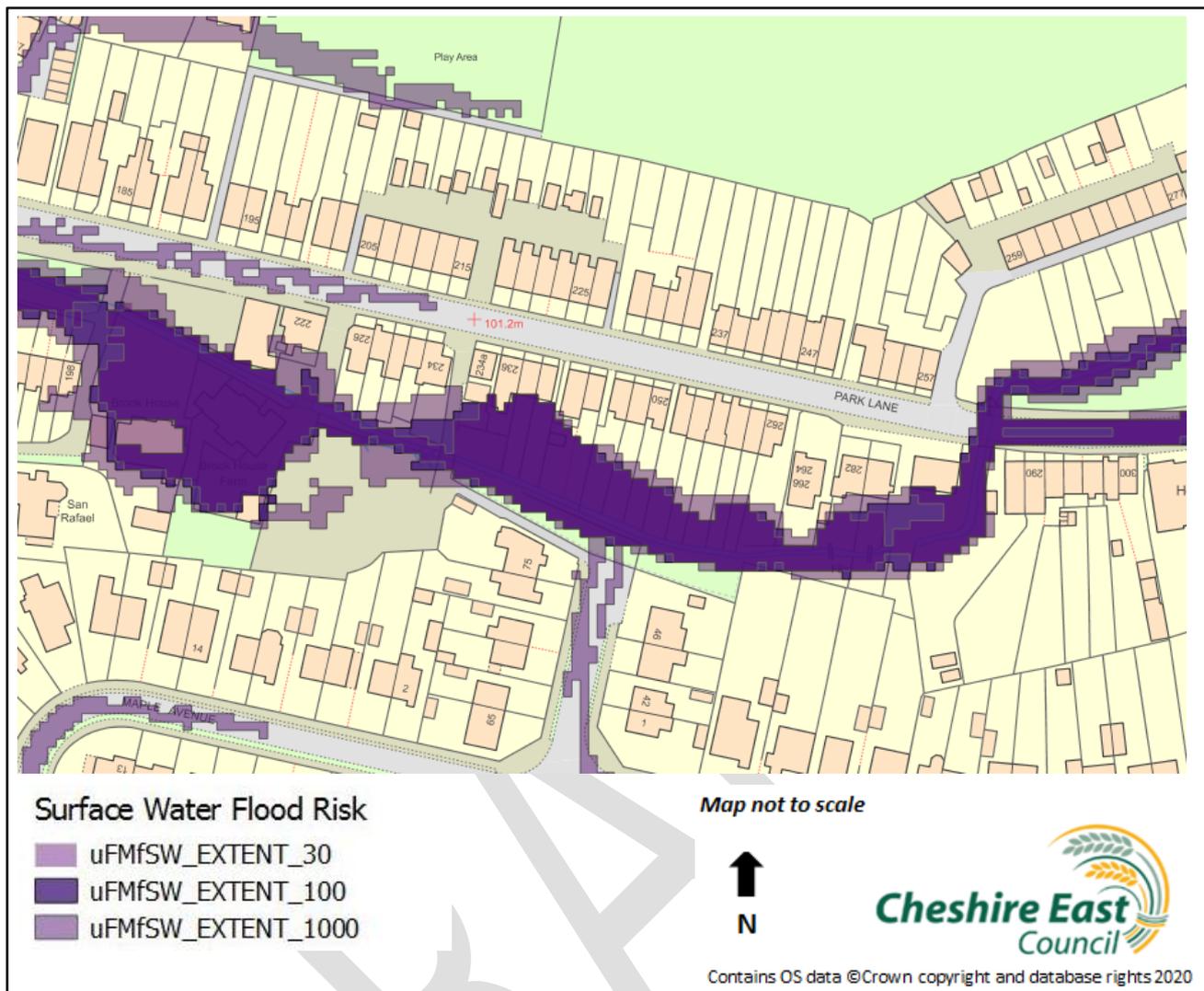
Downstream of this location the surface water continued to flow off saturated fields downhill onto Middlewood Road, which became a channel for flood waters, overwhelming surface water drainage systems. Reports and footage of saturated surfaces (fields) generating large volumes of runoff were received in this area, as the capacity of the land to store water was exceeded. In some instances where properties are located downslope, flooding occurred.

Figure 22 Flood Risk Map Middlewood Road / Anson Road area



Park lane Stream flows in a westerly direction, flowing to the north of Middlewood Road, crossing under Towers Road and flowing parallel to Park Lane. Flood waters appeared to use the highway as an overflow channel, reducing flows along Park Lane stream. As the stream turns and flows south under Park Lane the two systems merged and downstream of this point, the combined flows resulted in out of bank flooding along Park Lane stream affecting properties and business. Sewers were also overwhelmed in these areas driven by the high water levels in the stream and property owners directing flood water into the combined sewer. In this area the stream flows through a number of residential gardens.

Figure 23 Flood Risk Map Park Lane area

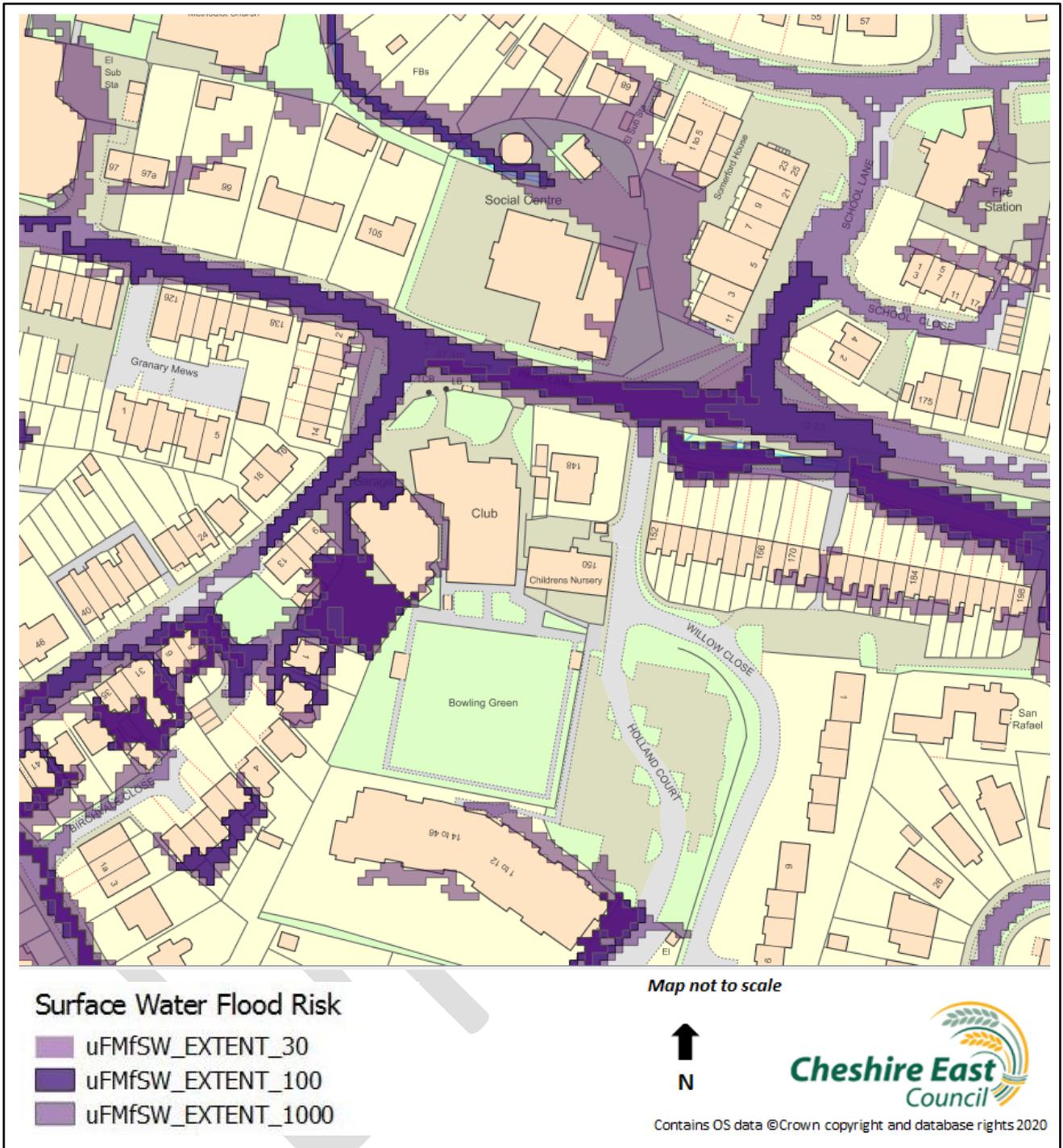


Park Lane stream continues to flow west towards Willow Close, this section surcharged and water flowed out of bank, following the ground levels to find the lowest point, down highways, footways and driveways towards properties and gardens. As the stream flows north in culvert around the social centre out of bank flooding was also reported.

Following the 2016 floods work was undertaken by the Council and local landowners to clear the channel and culvert under Willow close / Park Lane to increase the capacity in this location. The trash screen at this location is inspected and maintained by Cheshire East highways on a monthly basis and in response to storm events.

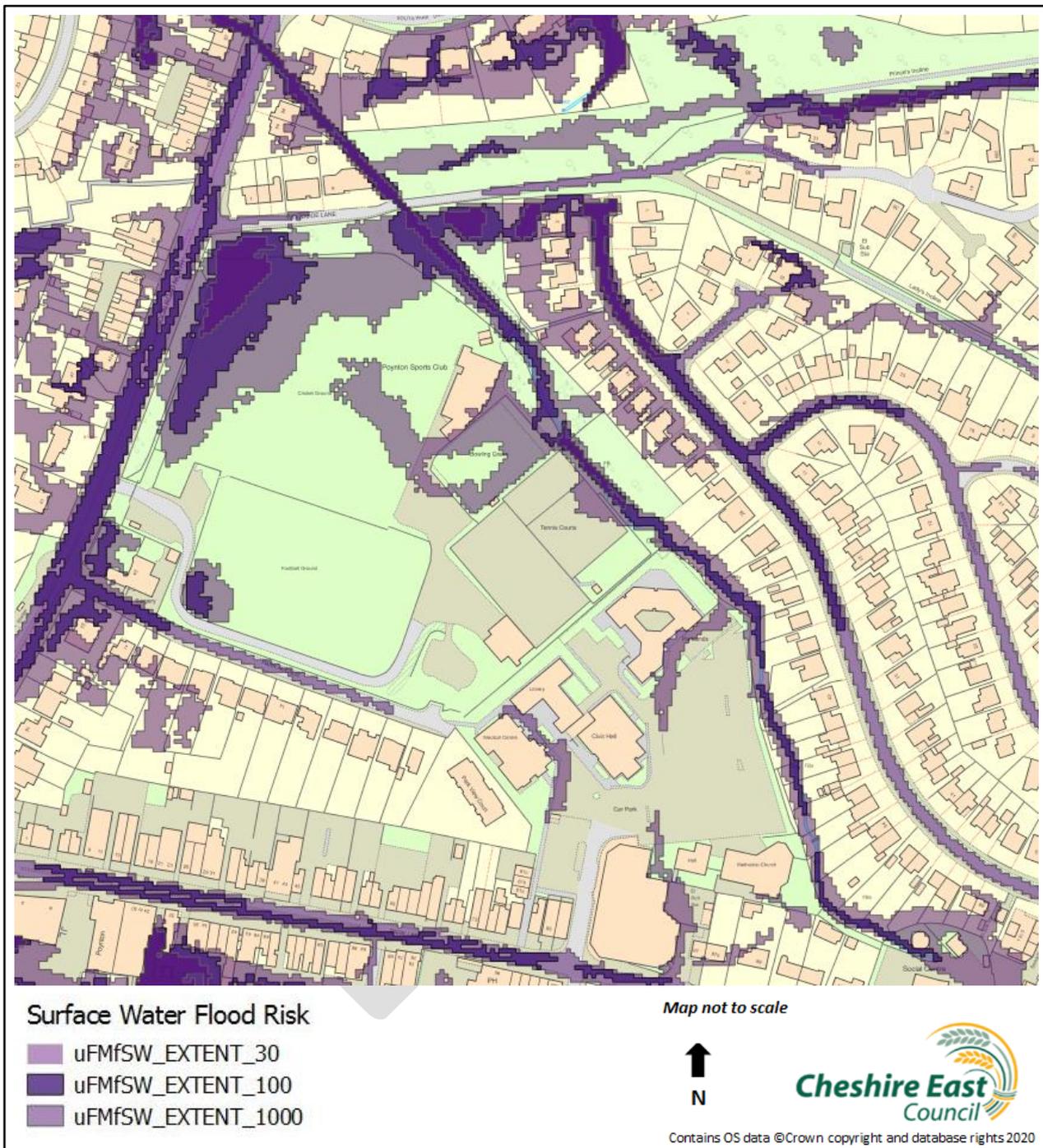
A combination of river water from Park Lane Stream and surface water flows south down Clumber Road. Foul flooding was also reported by local residents in this area, likely to be the result of inundation from river water directed to the sewer further upstream in the catchment. Evidence suggests that the flow paths indicated by the risk mapping and the ponding locations were closely matched during flood events.

Figure 24 Flood Risk Map Park Lane / Clumber Road area



The stream flows north through the gardens of a number of properties, then alongside Poynton Sports club, where it splits into two (bifurcates). A walkover of this area was undertaken after the flooding and wrack marks suggested that the risk maps provided a good approximation of the pattern of flooding experienced at this location.

Figure 25 Flood Risk Map Poynton Sports Club area



The main channel continues north to Woodside Lane and under London Road North towards Mayfair Close, with a secondary channel, which is largely culverted flowing a short distance north through a number of gardens to discharge into Poynton Pool. This channel has been observed a number of times since the 2016 event, and was blocked temporarily without consent from Cheshire East Council in 2017. Since this date the system has been passing a flow, allowing excess water from the channel to flow to Poynton Pool. Access onto this riparian system is

limited. Cheshire East Council is proposing to locate an additional access chamber to allow flows to be monitored on Woodside Lane. If feasible this channel will be utilised to divert some surface water flows from the main channel, this work will be undertaken in partnership by Cheshire East Council and United Utilities.

Figure 26 Bifurcation of Park Lane stream towards Poynton Pool



As the river emerges from underneath London Road the river flows downstream through residential gardens through a metal trash screen and into a bifurcated culvert system underneath Mayfair Close and Tulworth Close. These structures remain the maintenance responsibility for the riparian owner at this location.

The main flow of water is directed north under Mayfair Close, then west under residential gardens to a section of open channel at Glastonbury Drive. The second, an overflow channel flows west through gardens to Tulworth Road where it flows north to rejoin the main flow. The maintenance of these systems remains the responsibility of the property/land owners, predominantly the local residents, where these culverts flow under a section of adopted/public highway this would be the responsibility of Cheshire East Council. Without prejudice, Cheshire East Council undertook a through clean of this culvert system removing several tonnes of silt and debris in Spring 2020. No defects were found on this system at this time.

Figure 27 Ordinary watercourses near Glastonbury Drive

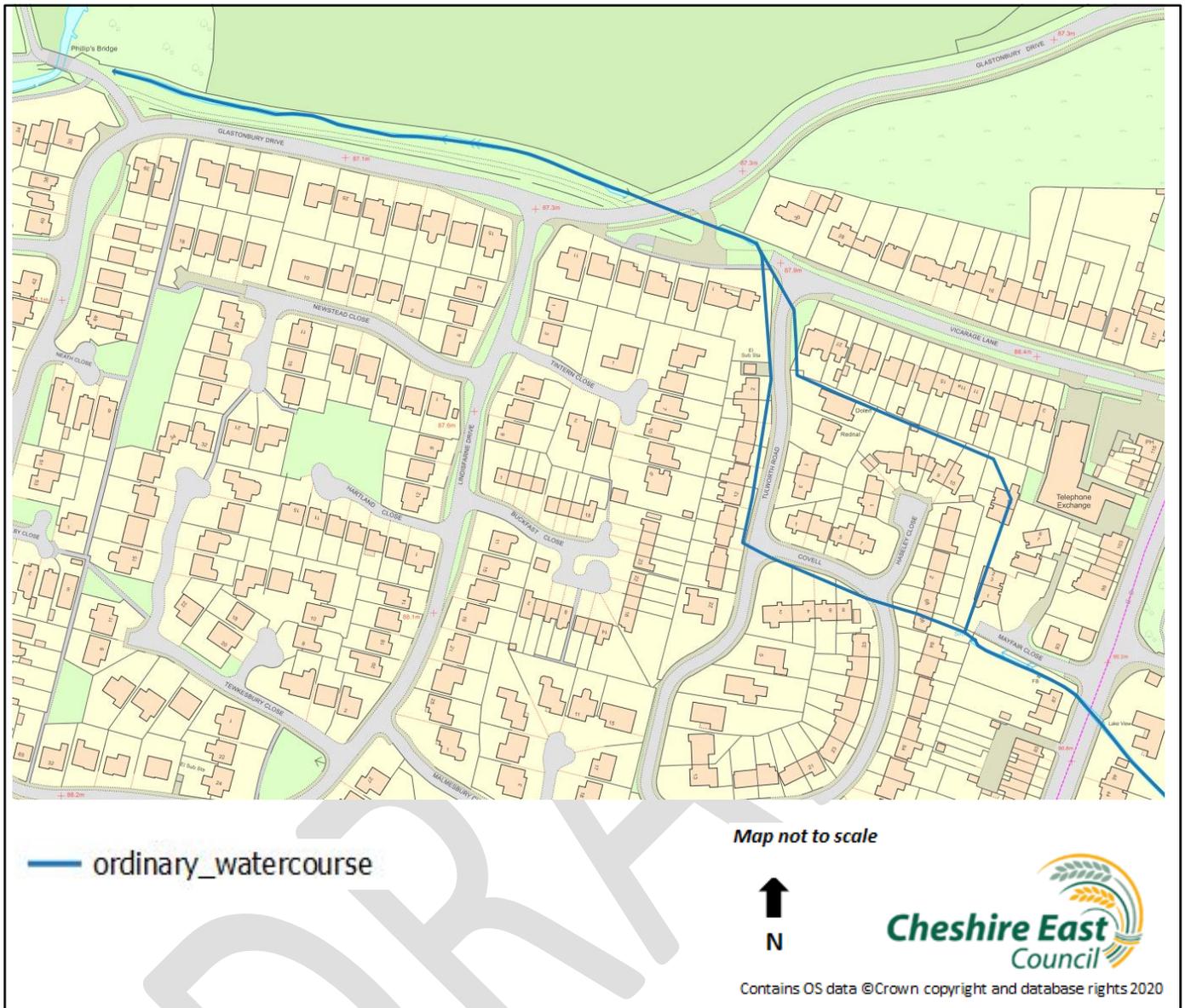
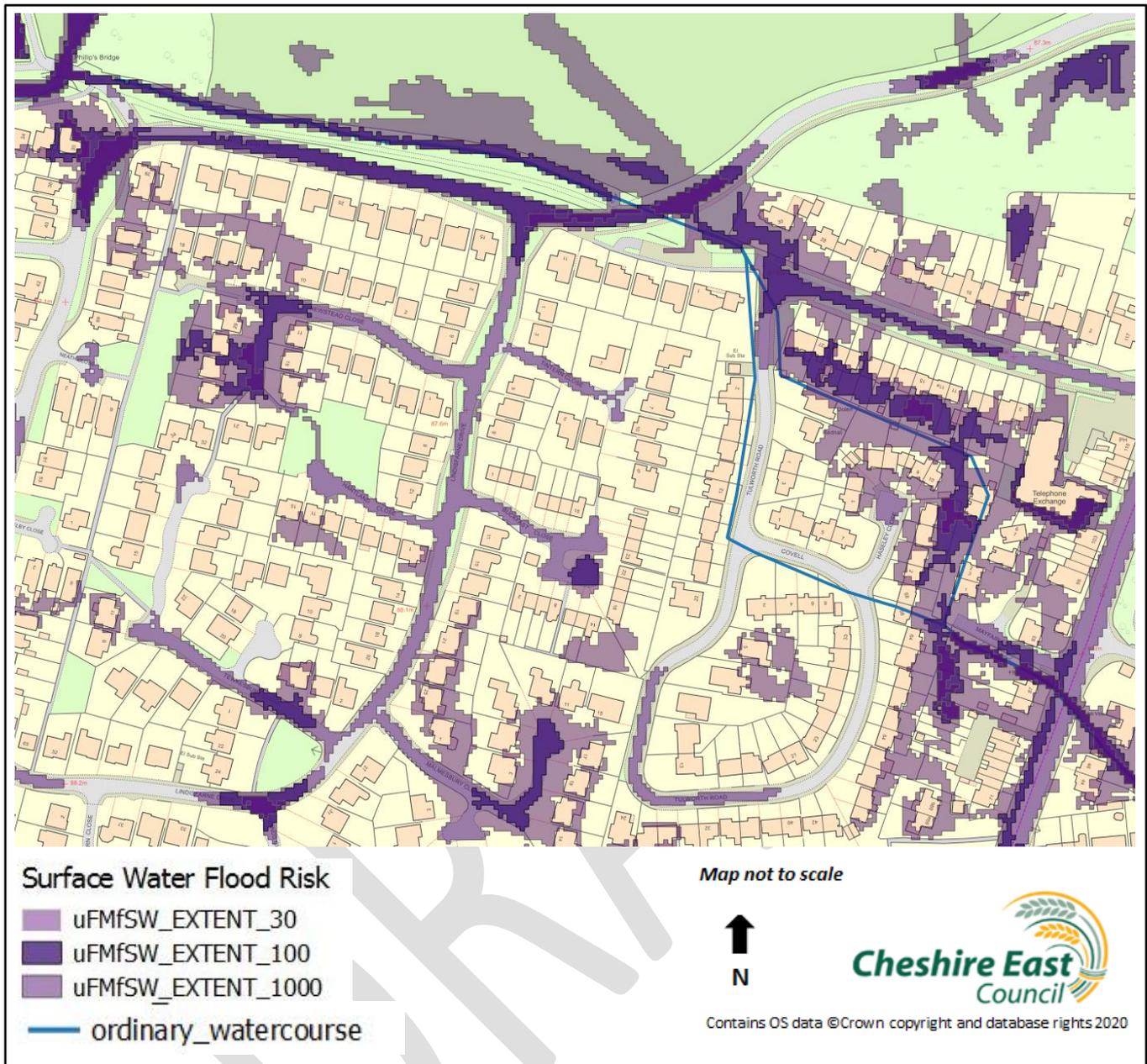


Figure 28 Flood risk near Glastonbury Drive



The natural course of the river then flows west joining Poynton Brook at Phillips Bridge. The natural overland flow routes across the adjacent fields show the paths floodwater is expected to accumulate and flow.

During flood events residents have reported that a small channel cut into the banks of the channel alongside Glastonbury Drive helped to divert water back into the channel and onto adjacent land to the north.

Figure 29 Flood routes to Poynton Brook north of Glastonbury Drive

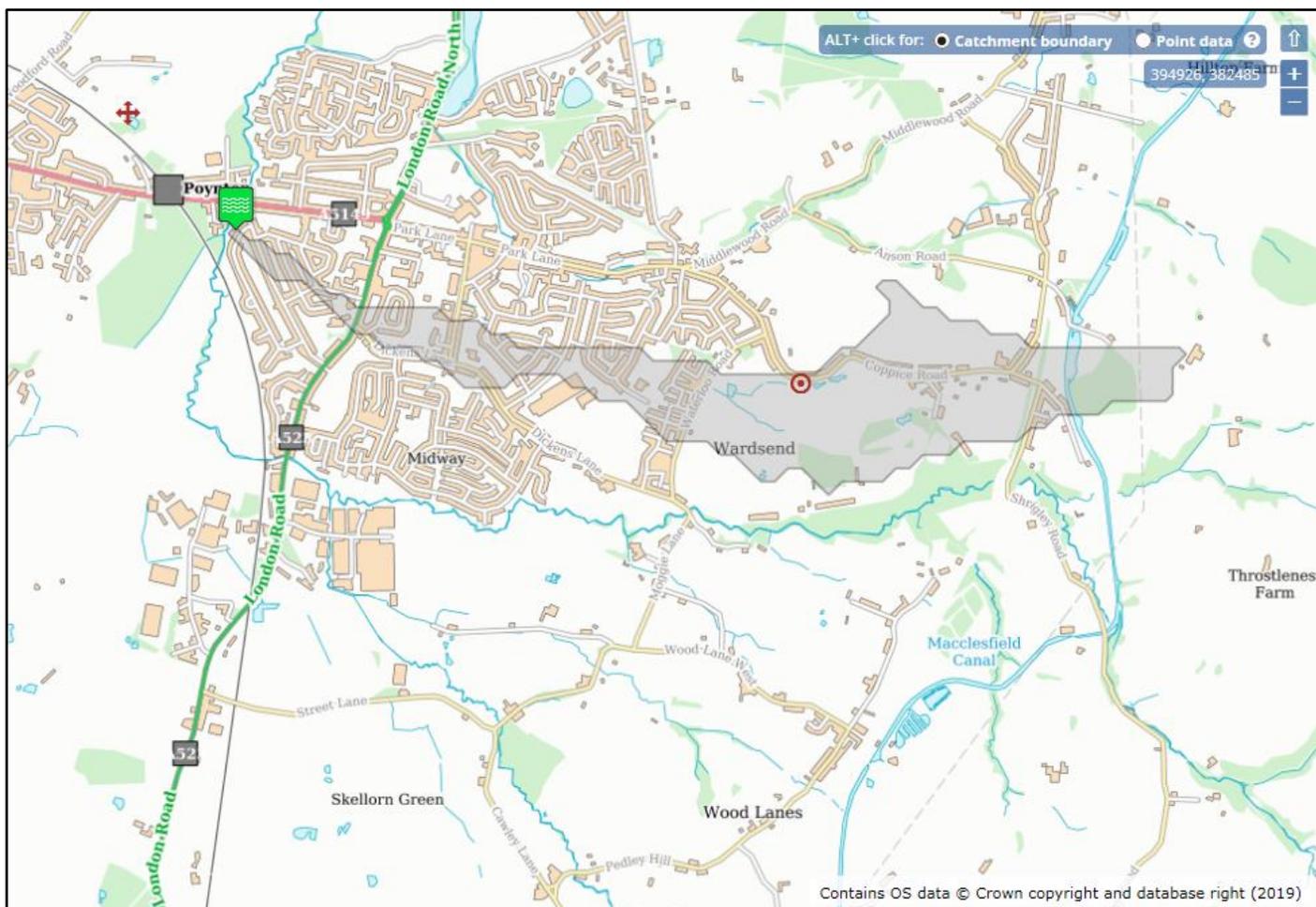


4.1.7 Description of flooding for Coppice Stream (ordinary watercourse)

Flooding occurred on 31st July, and a further (smaller) weather event occurred on Friday 9th August 2019.

The ordinary watercourse capacity throughout Poynton has an annual exceedance probability of between 5% - 3.3%. This means that the system will be surcharged and flood following a storm with a magnitude greater than 5% AEP or a 1 in 20 year return period. This means that based on current data the probability of the system flooding for any one year is 5%.

Figure 30 Indicative natural catchment of Coppice Stream



The headwaters of the ordinary watercourse, Coppice Stream are in Poynton Coppice and the adjacent agricultural land. The watercourse flows East via a number of small ponds towards Waterloo Road where it then splits and flows in culvert under neighbouring residential estates for a considerable distance. The lower part of Coppice Stream is diverted from Easton Close (via Kettlethulme Way and the Worth Primary School) in culvert to Poynton Brook. Surface water and watercourse flooding occur in these locations. Anecdotal evidence suggests that historically land use management practices upstream were more beneficial at slowing the flow and that more water may have been stored upstream of Waterloo Road.

The second culverted section joins with United Utilities sewers to flow towards Pine Walk and Cherry Tree Avenue. During extreme rainfall events flooding is reported in these areas as the systems below overwhelmed, and as overland flow from the school playing fields flows Eastwards.

Although this natural watercourse is now in culvert/sewers the land levels may still reflect the natural drainage paths as highlighted on the flood risk maps. In heavy rainfall, it is expected that water will still flow to these topographical low spots.

The culverted watercourse continues to flow East, following Ivy Road, Holly Road towards Clumber Close where there are two sections of daylighted or open watercourse. When capacity in the culvert is exceeded, water may surcharge from this system. Flooding occurred in this vicinity from a combination of surface water and ordinary watercourse flooding. Flood water is looking to rejoin the watercourse and flows via the easiest path to rejoin the watercourse at Vernon Primary School.

Coppice Stream then continues to flow East to London Road South, along Queensway, crossing both Clifford Road and Brookfield Avenue before joining the Main River to the East of the railway line.

Flooding occurred at downstream locations where local drainage systems were unable to discharge due to elevated Main River levels. Further upstream flooding occurred, because the runoff generated by the significant rainfall, exceeded the design capacity (size) of the pipes.

Figure 31 Coppice Stream, Waterloo Road, Worth Primary School area

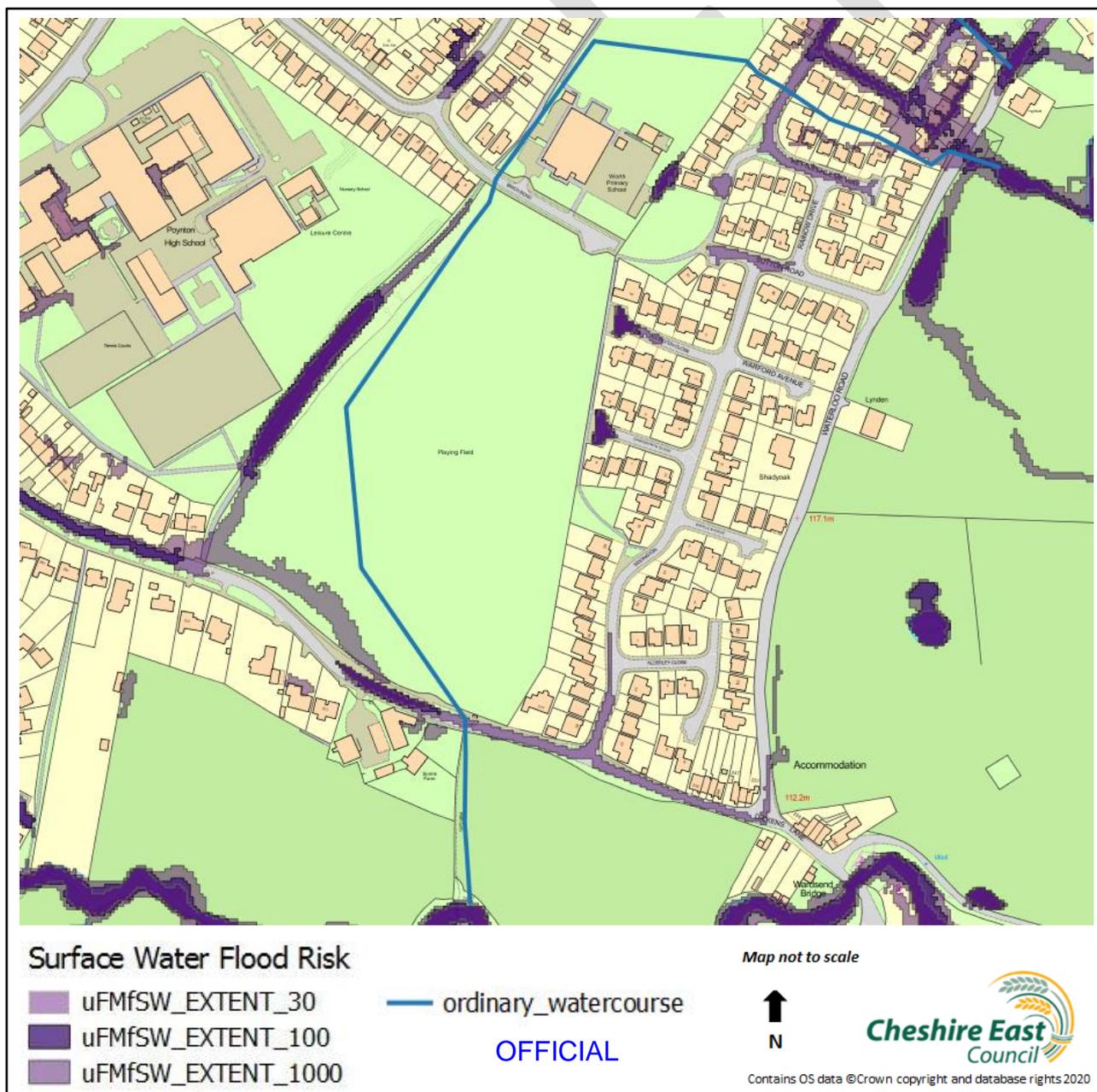


Figure 32 Coppice Stream, Ivy Road, Holly Road, Clumber Close area

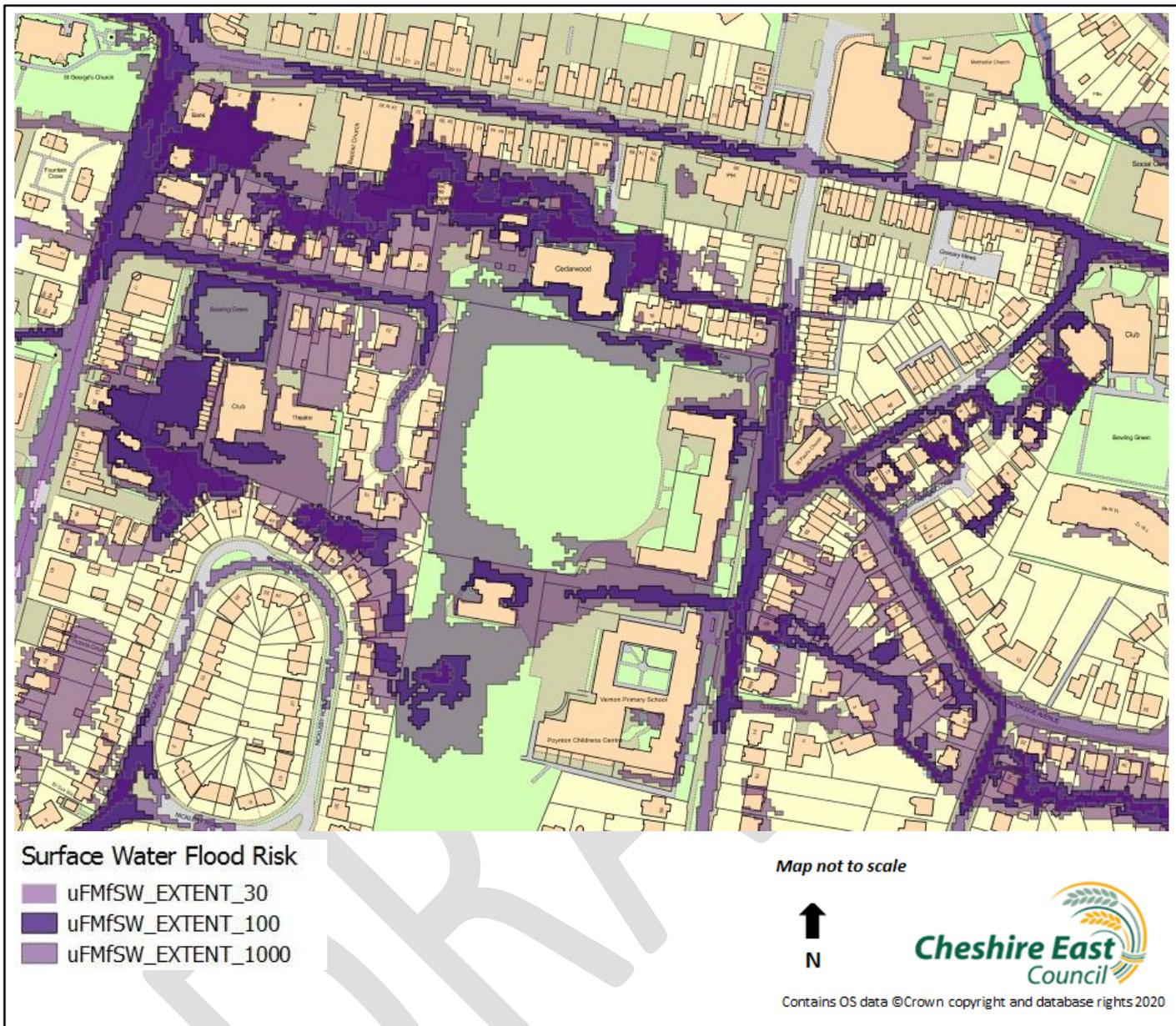
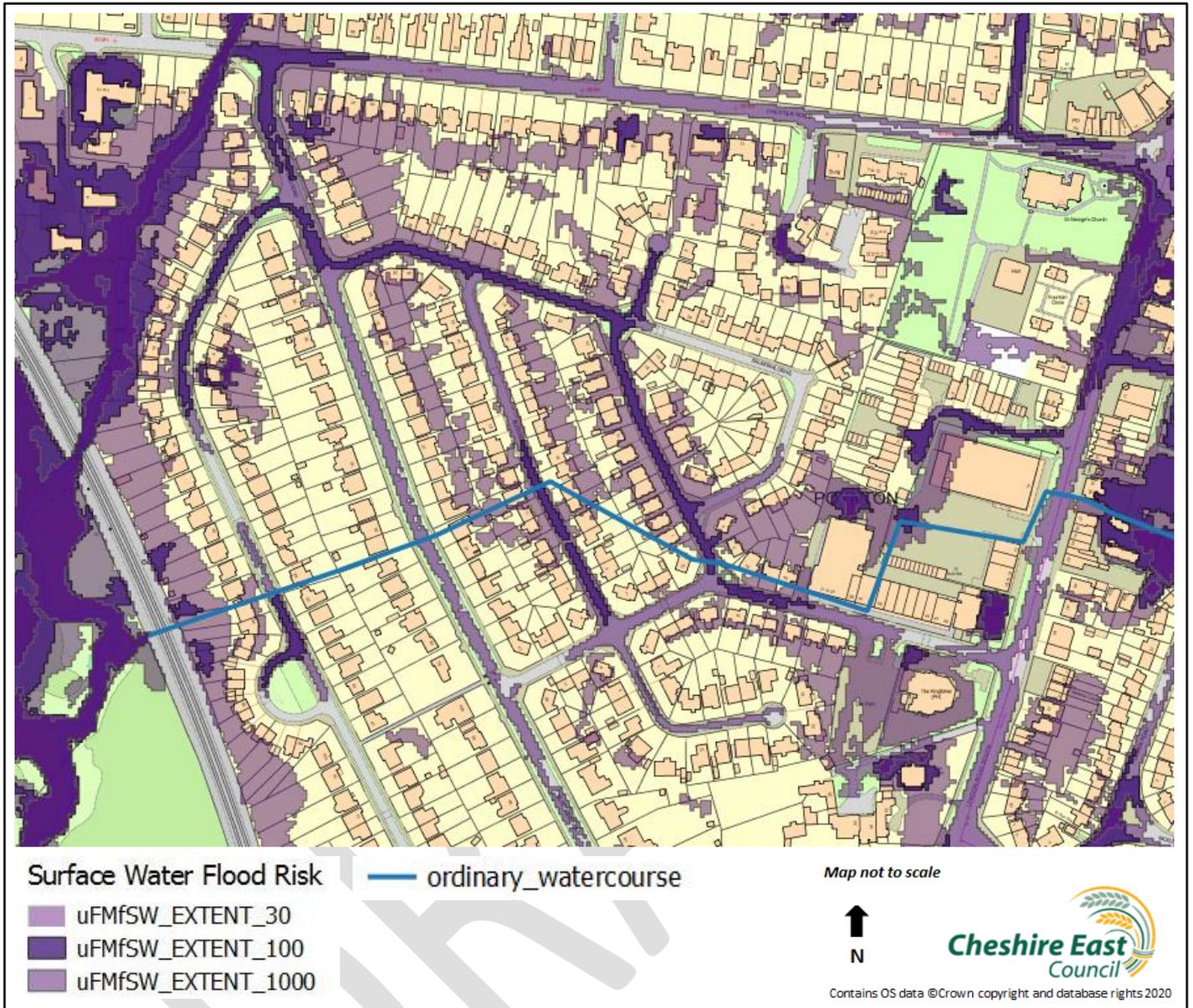


Figure 33 Coppice Stream indicative path shown as blue line



4.1.8 Description of flooding for unnamed ordinary watercourses around Poynton Pool

Flooding occurred on 31st July, a further smaller weather event occurred on Friday 9th August 2019.

A number of unnamed ordinary watercourses drain into Poynton Pool, the bifurcation stream from Park Lane stream and others along South Park Drive, Anglesey Drive and from the pond on Towers Road. In these areas flooding was reported from various mechanisms including surface water, sewer and ordinary watercourse. Teams from Cheshire East Highways and United Utilities are working with residents to resolve these issues.

Poynton Pool discharges via a culvert into Poynton Brook, Main River. Poynton Pool is maintained by Cheshire East Council in line with its duties under the Reservoirs Act, 1975.

The reservoir was surveyed in October 2019 and improvements are currently being made to the outfall which flows through adjacent farmland discharging into Poynton Brook to allow for the system to be drawn down in extreme events. The natural catchment of Poynton Pool is limited and the feature has not been designed as a flood defence feature.

Figure 34 General arrangements at Poynton Pool Reservoir

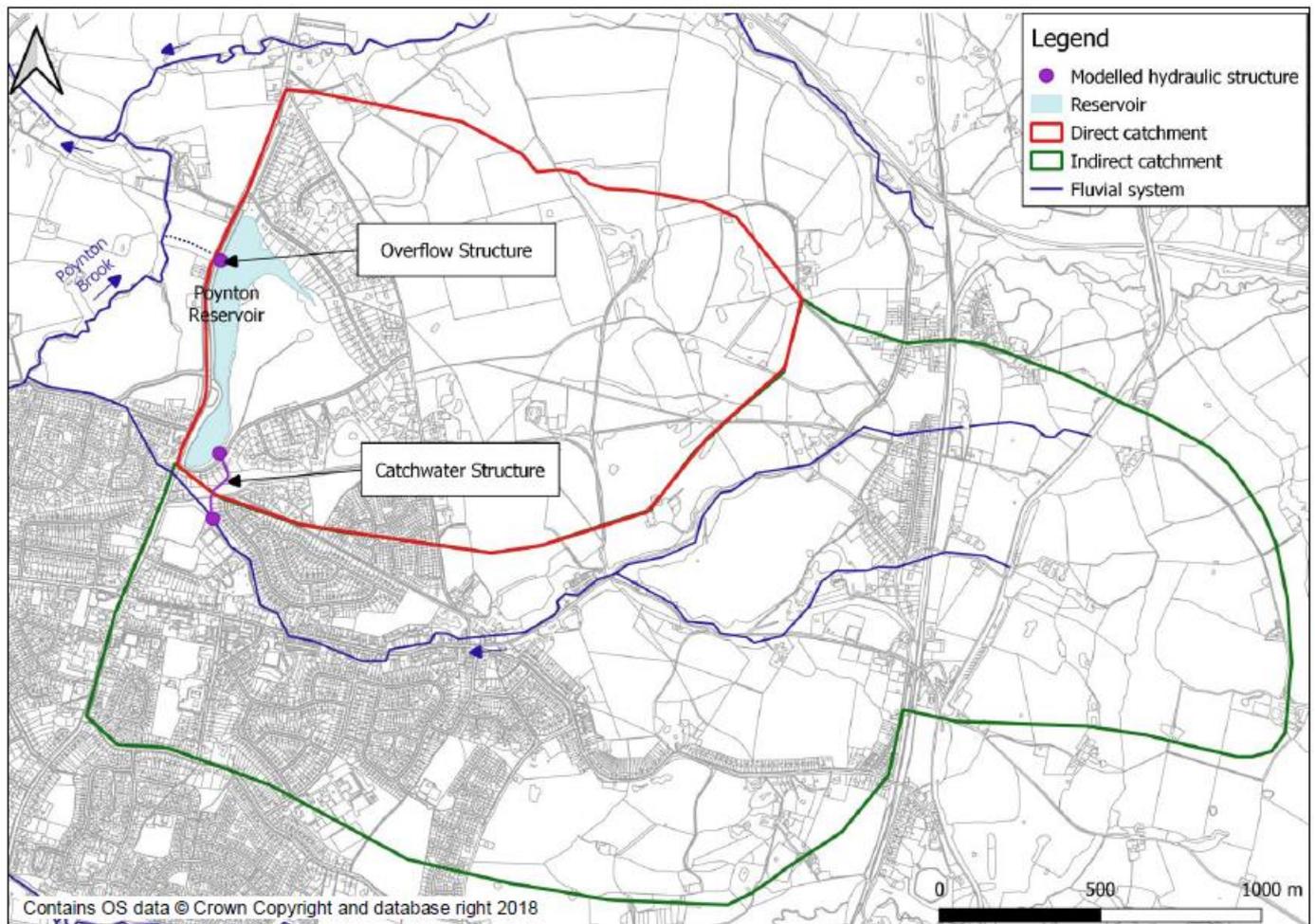
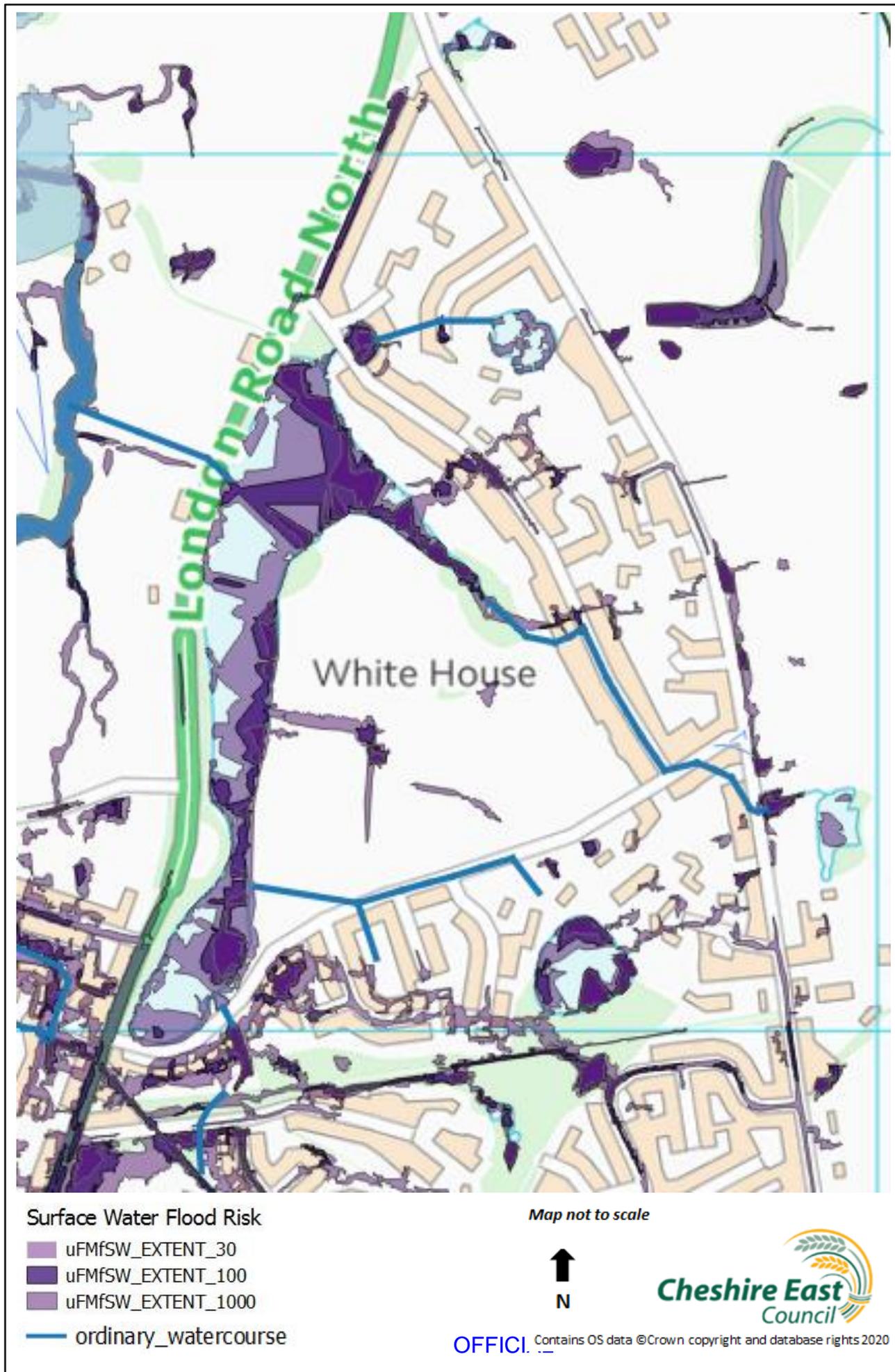


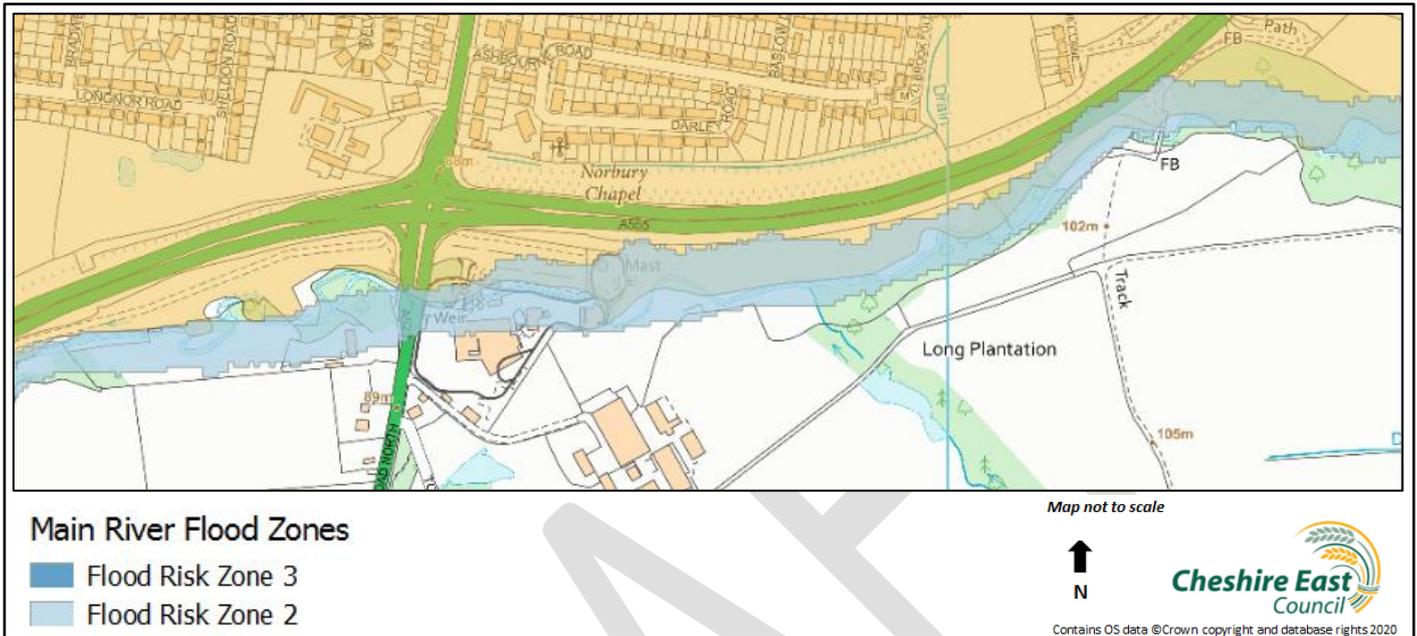
Figure 35 Flood Risk maps and ordinary watercourses around Poynton Pool



4.1.9 Description of flooding for Norbury Brook (Main River) within Cheshire East

Flooding was experienced adjacent to Norbury Brook, which is a Main River, where water left the main channel and floodplain flows spilled through a local garden centre. The flooding associated with the Norbury location is being investigated further by Cheshire East Council, Stockport Borough Council and the Environment Agency.

Figure 36 Norbury Brook Floodzones 2 & 3 (Land shaded orange falls within Stockport Borough Council)



Further downstream no obstructions to flow was reported at the A555 bridge where Poynton Brook joins Norbury Brook, although the river level was high and spilling out of bank.

Photograph 2 A555 Bridge over Norbury Brook, image taken: 18:16 on 31/07/2019



4.1.10 Poynton Brook - RMA Responses

Table 4 Response Timeline Poynton Brook Catchment

Date & Time	RMA	Response
28/07/2019 10:19	Environment Agency	Flood Warning issued for Poynton Brook at Wigwam Wood and parts of Armcon Business Park
28/07/2019 10:23	Environment Agency	Flood Alert raised for Middle River Mersey
28/07/2019 (various)	United Utilities	Attended 17 customer enquiries
29/07/2019	Environment Agency	Community Information Officers sent to Poynton to verify flooding following issue of Flood Warning on 28 July. No internal property flooding found.
29/07/2019 08:20	Cheshire East Highways	Attended site – emergency call out to Dickens Lane
29/07/2019 (various)	United Utilities	Attended 5 customer enquiries
30/07/2019 (various)	Cheshire East Highways	Attended 1 customer enquiry
31/07/2019 06:21	Environment Agency	Flood Warning issued for Poynton Brook at Wigwam Wood and parts of Armcon Business Park
31/07/2019	Environment Agency	EA Site Controller attended site
31/07/2019	Cheshire East Highways	Sandbags available from Poynton Town Council Civic Centre
31/07/2019 08:57	Environment Agency	Flood Alert raised for Middle River Mersey
31/07/2019	LLFA attended site	Investigating localised garden flooding
A major flooding incident has been declared		
31/07/2019 (various)	Cheshire East Highways	Number of calls / locations
31/07/2019	Cheshire East Council	Emergency refuge centre opened in Poynton
31/07/2019 (various)	Cheshire Fire and Rescue	Cheshire Fire and Rescue Service attended a total of 42 flooding related incidents in and around Poynton, Bollington and Wilmslow. Within Poynton crews had been to more than 20 incidents, including rescuing at least 11 people from flood water in the area
31/07/2019 (various)	United Utilities	Attended 27 customer enquiries
31/07/2019 13:00	LLFA attended site	Investigated flooding following the length of Park Lane stream from Middlewood Road to Poynton Brook.
31/07/2019	Cheshire East Highways	Staff deployed to remove log from culvert at Tulworth Road
31/07/2019 18:05	Environment Agency	Flood Warning raised Poynton Brook at Poynton and Midway
01/08/2019	Cheshire East Highways	Sandbags available from Poynton Town Council Civic Centre
01/08/2019	Environment Agency	Community Information Officers sent to verify flooding
01/08/2019 (various)	United Utilities	Attended 31 customer enquiries
05/08/2019	Environment Agency	Community Information Officers sent to verify flooding
07/08/2019	Environment Agency	Officers attended to survey properties flooded
08/08/2019	Environment Agency	Officers attended to survey properties flooded
15/08/2019 1-7pm	Multi-Agency	Multi-Agency Drop in session, Civic Centre in Poynton attended by approximately 300 residents

4.1.11 Poynton Brook Catchment - Site Specific Recommendations

Based on the analysis for July 2019 flooding events, the following actions are recommended to the locals RMAs.

Table 5 Recommended actions for the Poynton Brook Catchment

RMA	Recommended Action
Cheshire East Council and Stockport Borough Council	Investigate local flooding associated with Poynton garden centre from Norbury Brook location
Cheshire East Council	Work with Town Council and Flood Action Group to update Community Resilience plan for Poynton (held by Poynton Town Council and first established in 2015)
Cheshire East Highways	Investigate drainage on Dickens Lane, highway drainage, in conjunction with property East
	Investigate London Road (North and South) Completed March 2020
	Investigate Anglesey Drive drainage. Completed March 2020
	Investigate Clifford Road highway drains – discharge into Main River at Hazelbadge Bridge
	Investigate Brookfield Avenue – discharge to Main River
	Investigate Pickwick Road
	Investigate Dicken Lane/Yew Tree Lane
	Investigate Clumber road
	Reconstruct Wards End retaining wall. Due to be completed July 2020.
	Investigate drainage on Middlewood Road
Proposed new access chamber on Woodside Lane. Meetings held on site Spring 2020 to seek feasibility with regards to local oil pipeline.	
CEC as LLFA in conjunction with partners as applicable*	Investigate feasibility for a surface water separation (from sewer to watercourse) scheme upstream of Pine Walk/Elm Close/Cherry Tree Avenue at Worth Primary School

	Investigate feasibility of a surface water separation (from sewer to watercourse) scheme around Dickens Lane area
	Investigate feasibility of a “slow the flow” Natural Flood Management project for Coppice Stream – upstream of Waterloo Road, with partners and land owners
	Investigate feasibility of a “slow the flow” project for Park Lane Stream – upstream of Middlewood Road, with partners and land owners
	Assist with the investigation of the privately owned /riparian owned drainage system in the catchment upstream of Jacksons Brickworks.
Environment Agency	<p>As part of the post-flood recovery, EA teams went through main watercourse from Wards End Bridge to the Armcon Industrial Estate, and at key points and in the more built-up areas, removed flood wrack blockages to enhance conveyance. A similar process was undertaken further downstream at Wigwam Wood. The EA are also investigating the Main River capacity and bank heights at Armcon Industrial Estate.</p> <p>The EA have commissioned Cheshire Wildlife Trust to work with partners to implement NFM interventions upstream of Poynton.</p>

*(United Utilities/Environment Agency/Land owners)

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4.2 Todd Brook Catchment

The image below show the extent of the Todd Brook river catchment.

Figure 37 Todd Brook Catchment

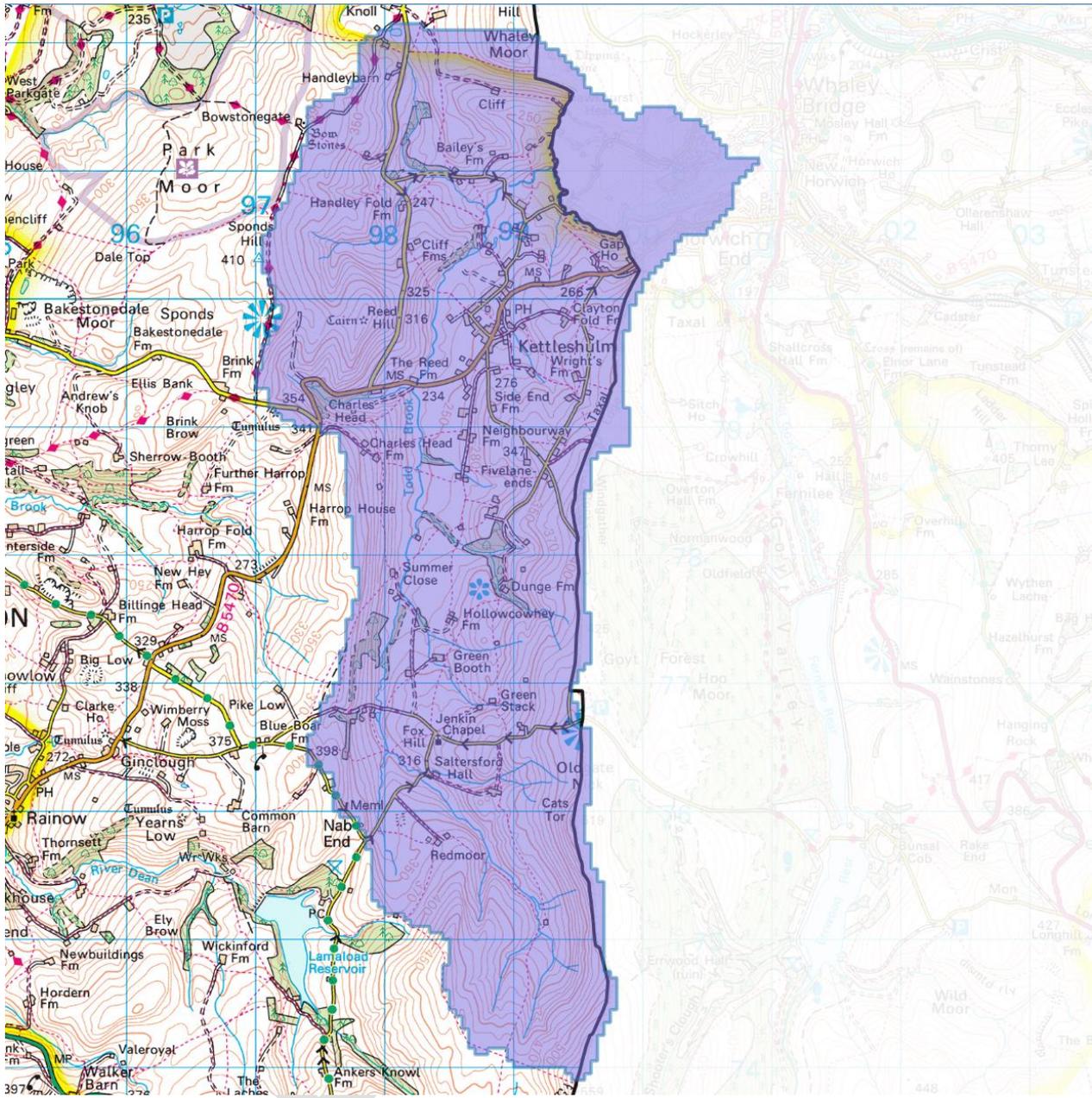


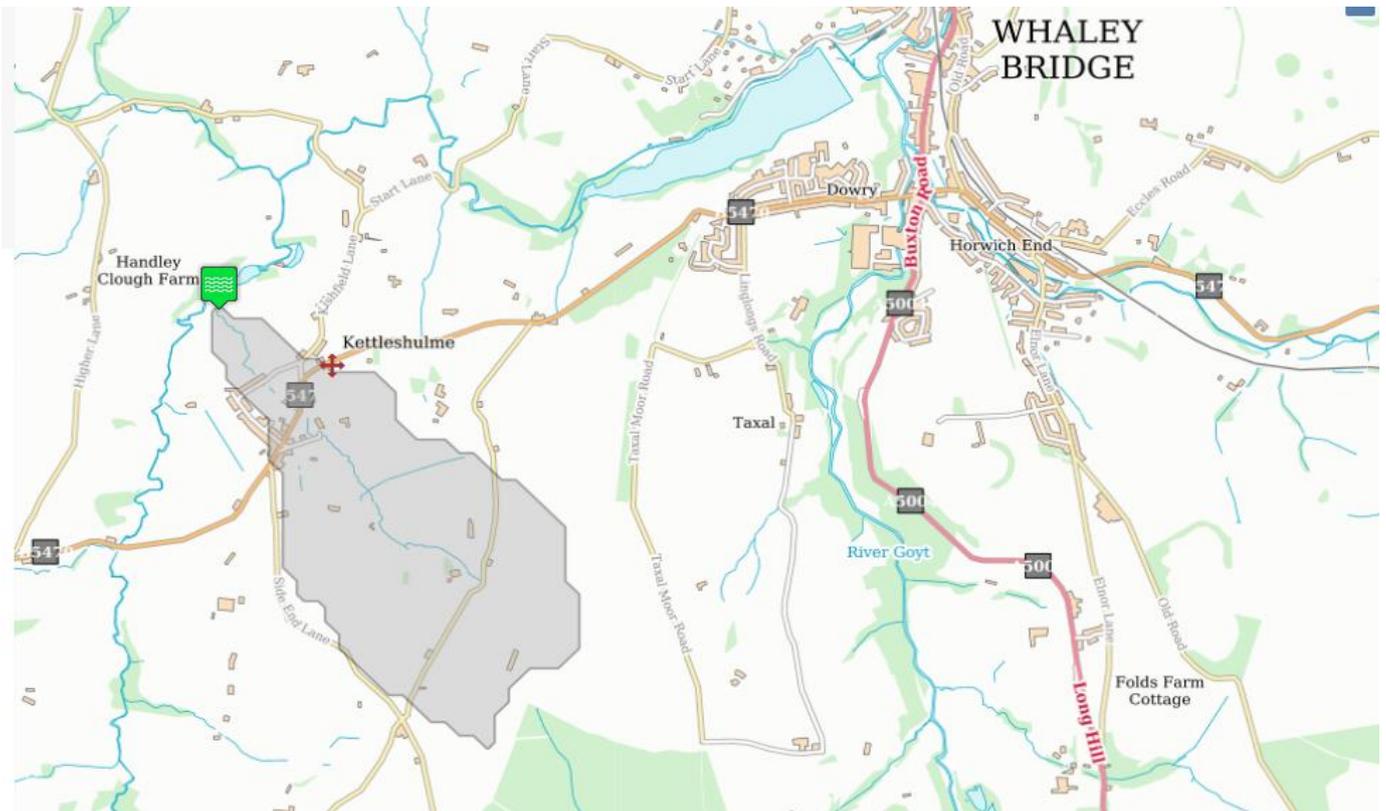
Table 6 Number of properties reported* flooding in Kettleshulme:

No. of properties reported*	July 2019
Residential flooding**	11
Commercial Flooding	3

*formally reported to the Lead Local Flood Authority, Environment Agency and/or United Utilities

** refers to reports of (internal property flooding, including integrated garages. This does not include: uninhabitable cellars, detached garages and gardens

Figure 38 Indicative catchment of tributary of Todd Brook



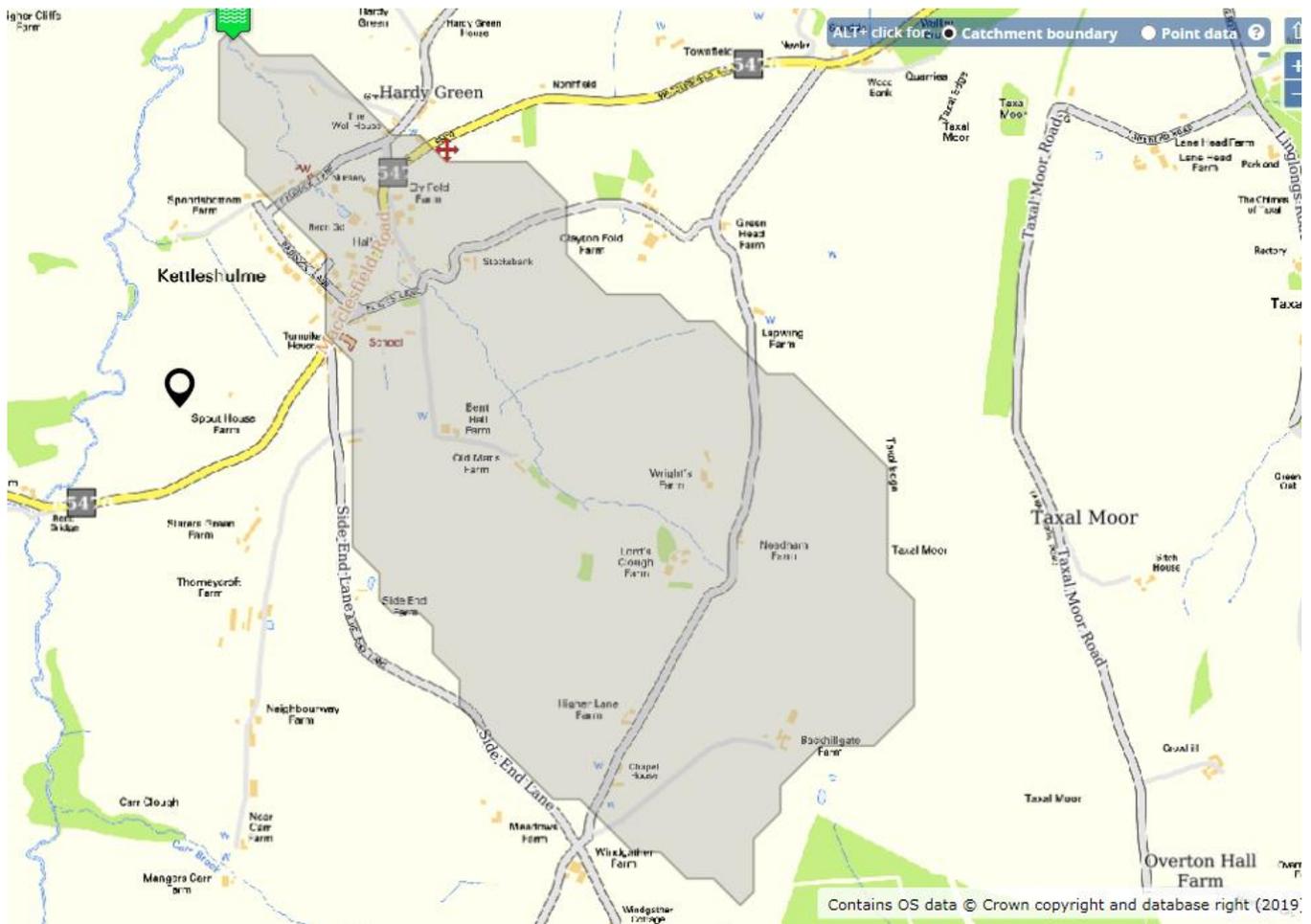
4.2.1 Description of flooding in Kettleshulme (ordinary watercourse and surface water):

Following days of rainfall, local watercourses swelled as water poured down from the local saturated hillsides into the un-named tributaries that feed Todd Brook. The catchment map indicates the area which gathers rainfall and drains downstream towards Kettleshulme into Todd Brook and ultimately towards Whaley Bridge. The Cat and fiddle Rain gauge, which recorded the most rainfall, is just upstream of Kettleshulme and the Todd Brook catchment.

Following a large cloud burst on the afternoon of Wednesday 31st July, the small watercourse quickly rose, residents reporting a surge as watercourse levels rose by 2-3feet. This level was sustained for a period of approximately an hour, before levels rapidly started to drop. The water flowed over land and down roads to reach drains and watercourses, which flowed down through the local pub and garden centre carrying huge volumes of debris and silt, eventually flowing down adjacent to a row of terraced houses, the water entered residential properties at this location, and the pressure of the water caused severe structural damage resulting in the need for the cottages to be evacuated, uninhabitable until repair works have been completed.

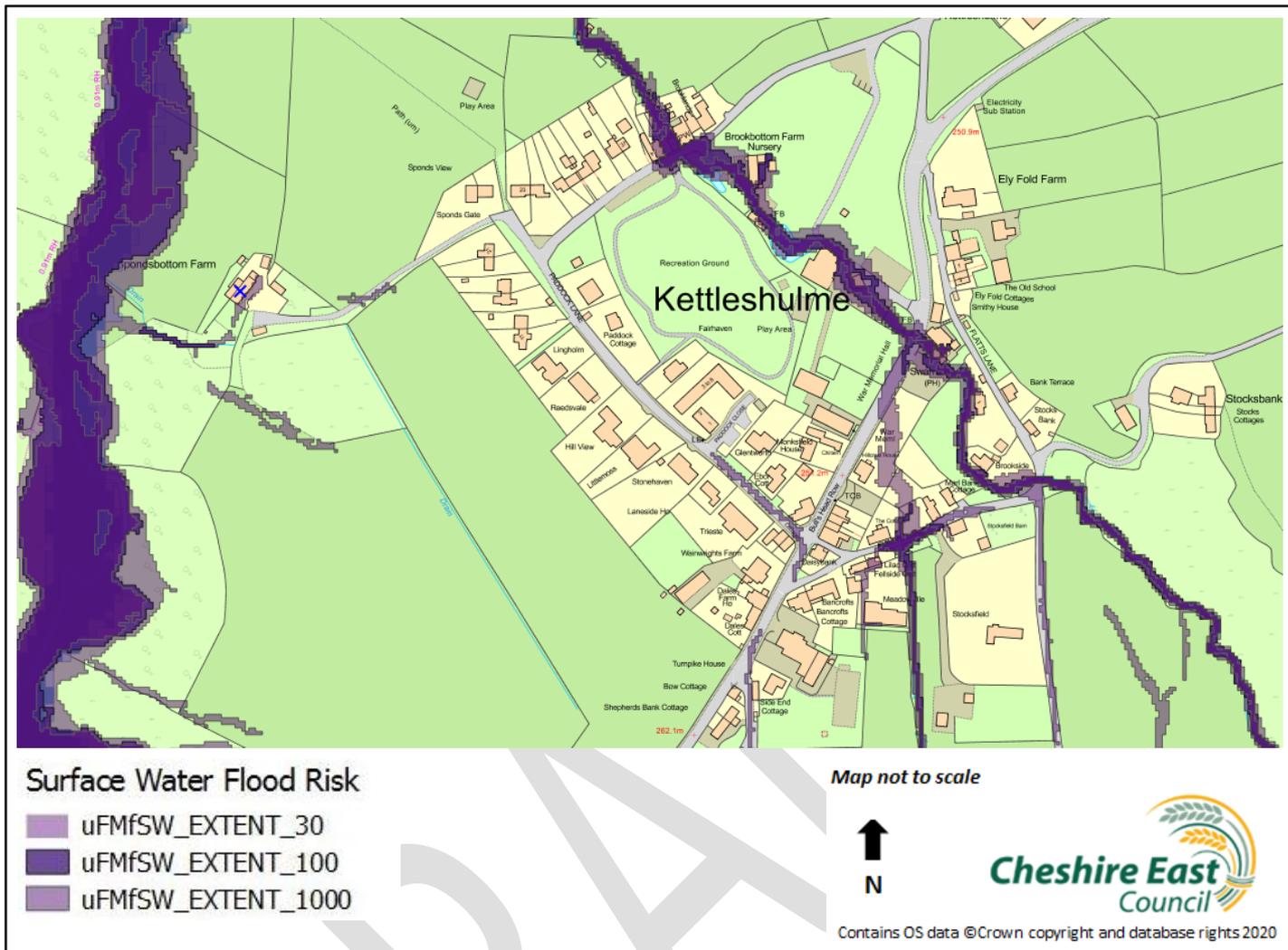
This was not the only area within Kettleshulme; a property reported flooding from local drainage, which also was overwhelmed following the cloud burst.

Figure 39 Indicative catchment of Todd Brook tributary through Kettleshulme



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Figure 40 Flood risk for Kettleshulme



4.2.2 Todd Brook Catchment - RMA Responses

Flooding was not initially reported to the risk management authorities. Discussions have been undertaken with the Parish Council and residents who are now working with Cheshire Flood Resilience team at Cheshire East Council to ensure that a community resilience plan is in place now that the risk of flooding has been identified in this area.

Table 7 Response Timeline for Todd Brook Catchment

Date & Time	RMA	Response
31/07/2019	Cheshire Fire and Rescue	Not notified
31/07/2019	Cheshire East Highways	Not notified
04/09/2019 3-7pm	Multi-Agency	Multi-Agency Drop in session, Civic Centre in Bollington attended by approximately 80 residents
04/10/2019	Environment Agency	Site visit with NFM practioners to look at upstream Natural Flood Management (NFM) intervention options.
10/08/2019	Environment Agency	Community Information Officers sent to verify flooding on site.
25/10/19	Environment Agency and Cheshire East	Community Resilience meeting at Kettleshulme Parish Council
07/05/20	Environment Agency and Cheshire East	Virtual community resilience meeting with Kettleshulme Parish Council

4.2.3 Kettleshulme, Todd Brook Catchment - Site Specific Recommendations

Based on the analysis for July 2019 flooding events, the following actions are recommended to the locals RMAs.

Table 8 Recommended actions for Todd Brook Catchment

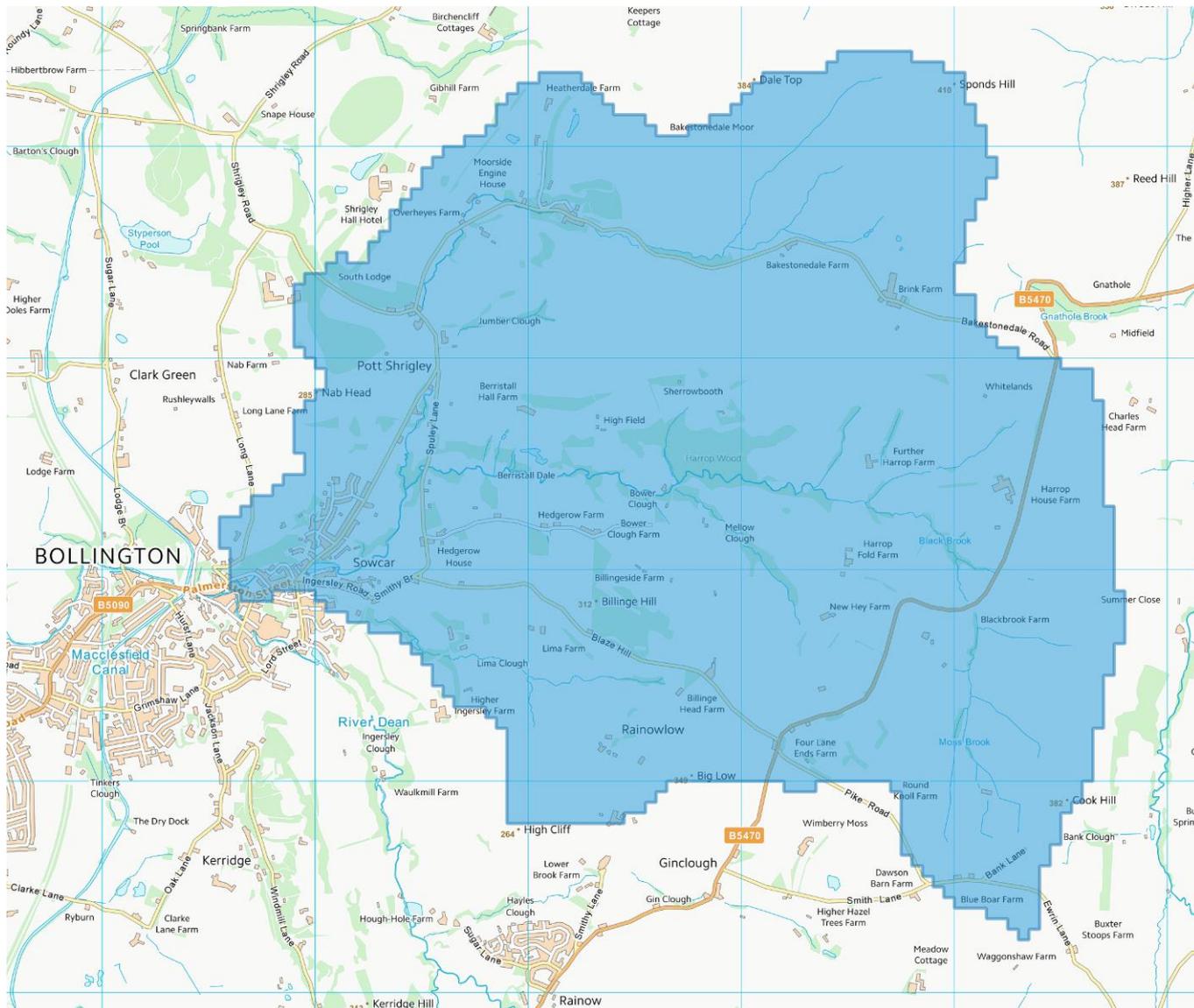
RMA	Recommended Action
Property Owners	Consider property level protection measures for those properties lower than adjacent land levels, and within a flood risk area where flow paths are identified on the flood risk maps. Advice can be provided by the LLFA and The Flood Hub: https://thefloodhub.co.uk/
Cheshire East as LLFA	Discuss and enforce where necessary the maintenance of local landowners drainage systems
Riparian Owners	Maintenance of local field drainage systems
CEC as LLFA in conjunction with partners as applicable*	EA instigated Natural Flood Management site visit. Work with local residents to ascertain land ownership. The EA have commissioned Cheshire Wildlife Trust to implement Natural Flood Management (NFM) interventions upstream of Kettleshulme.

*(United Utilities/Environment Agency/Land owners)

4.3 Harrop Brook Catchment

The figure below shows the extent of the Harrop Brook catchment. Harrop Brook joins the River Dean at Bollington and forms the River Bollin.

Figure 41 Harrop Brook Catchment



Flooding Mechanism: Surface water, Ordinary watercourse

Table 9 Number of properties reported* flooding in Harrop Brook Catchment

No. of properties reported	July 2019
Residential Flooding**	24
Commercial Flooding	4

*formally reported to the Lead Local Flood Authority, Environment Agency and/or United Utilities.

** refers to reports of (internal property flooding, including integrated garages. This does not include: uninhabitable cellars, detached garages and gardens

4.3.1 Description of flooding at Bollington (Ingersley Road) (Ordinary Watercourse flooding)

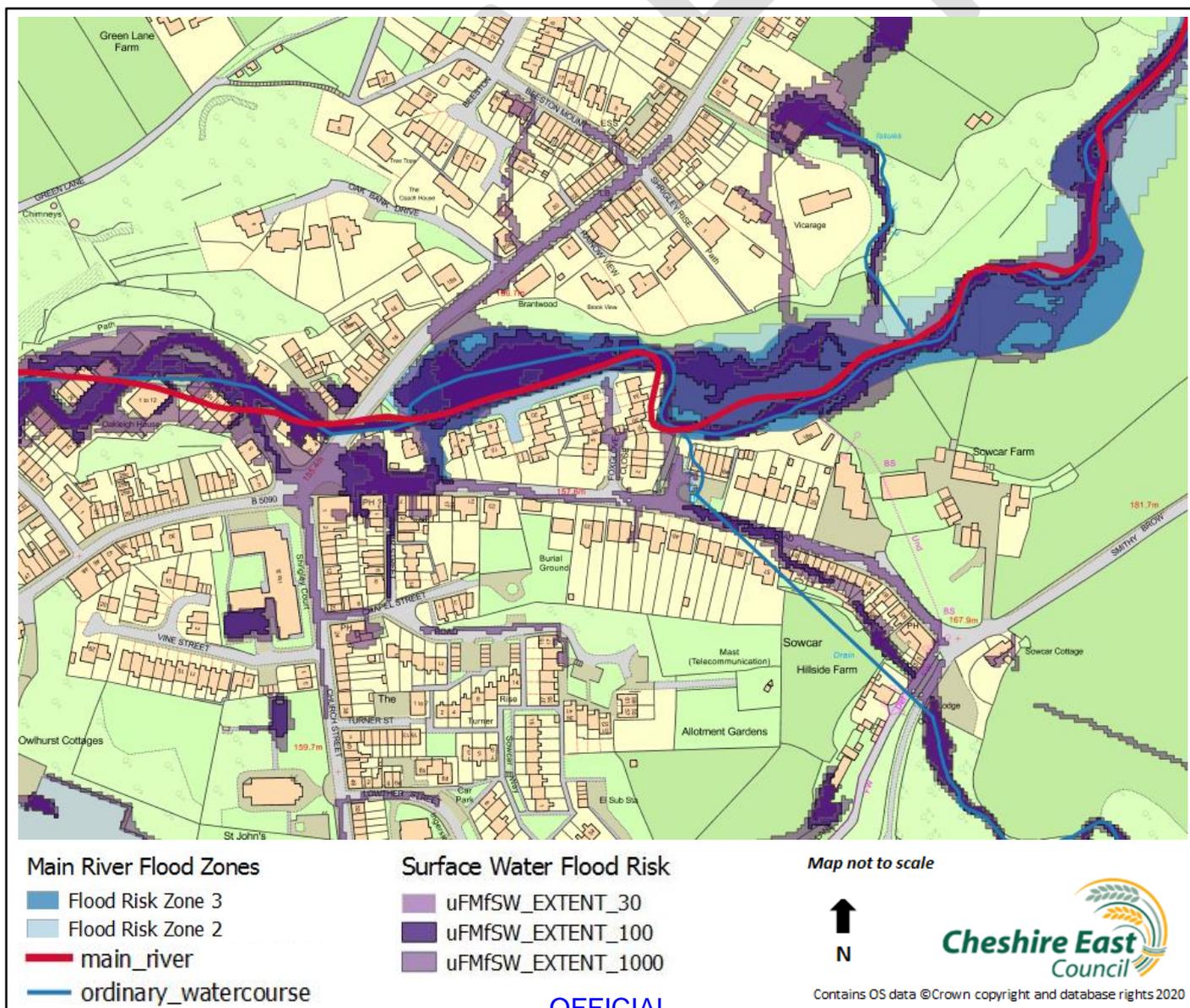
On Sunday 28th July a resident reported a crack appearing in Ingersley Road, they stated that the tarmac was lifting up along the crack and also the pavement appeared to have been lifted and sunk in places. It was stated that water was running out of these cracks down the road. This was reported to Cheshire East Highways, the Police and United Utilities. The site was inspected on Monday 29th July by the highways team. It was suggested to the residents that the culvert underneath the road surface may be blocked.

Following the torrential rainfall a section of Ingersley road was flooded by the early hours of Wednesday 31st July. The watercourse that runs under Ingersley Road Culvert, appears to have become obstructed during the flood event which resulted in a build-up of a large volume of water. Consequently the pressure built up to such an extent that the force of the water demolished the culvert and the surrounding road infrastructure.

Residents reported pumping flood water from outside the pub into the river, for 12 hours, using a number of pumps and from inside the pub to a local road gully. The road was closed with signs and cones on site.

Following the event significant levels of work are being undertaken to ensure that the water can flow freely along Ingersley Road Culvert These works have now been completed. The restoration of this section of Ingersley Road entailed a significant level of work.

Figure 42 Risk map for Ingersley Road, Bollington



4.3.2 Description of flooding at Pott Shrigley

Property and carriageway were inundated with water when the river levels rose and flowed out of bank. Site visits have confirmed these to be in locations where culverts were surcharged. This appears to correspond to the sheer volume of water, and flood debris rather than any specific capacity related issues.

4.3.3 Harrop Brook Catchment – RMA responses

Table 10 Response Timeline Harrop Brook – July 2019

Date & Time	RMA	Response
29 th July 2019	Cheshire East Highways	Attended the site
31 st July 2019	Cheshire East Highways	Attended site, road was reported clear at 01:05am 01/08/2019
12 th , 13 th , 14 th August 2019	Environment Agency	Community information officers sent to Bollington to verify flooding Community information officers sent to Bollington to verify flooding
4 September 2019	Multi Agency	Multi agency flood drop in held at Bollington Civic Centre
7 th November 2019	Environment Agency	EA site visit to Pott Shrigley
27 th February 2020	Environment Agency	EA further site visit with Cheshire East

4.3.4 Harrop Brook Catchment - Site Specific Recommendations

Based on the analysis for July 2019 flooding events, the following actions are recommended to the locals RMAs.

Table 11 Recommended actions for Harrop Brook

RMA	Recommended Action
Cheshire East Highways	A condition survey is to be conducted on the ordinary watercourse from Mill Lane to outfall into Harrop Brook.
	Review the extent of erosion to the embankment and the effect it could have on the structure of the road (brook at Mitchelfold)
	Kerb raising work, on request and with permission of property owner completed.
	Work ongoing to alleviate immediate impact of the culvert collapse and to determine the nature and extent of the repair work required.
Environment Agency	The Environment Agency served notice on the owner of the culvert to improve the culvert intake and works to improve this are underway and ongoing. The EA have commissioned Mersey Rivers Trust to implement Natural Flood Management (NFM) interventions upstream of Pott Shrigley.
Riparian Owners	Ensure that you have access to any watercourses that flow through your land, by installing suitable access chambers or seeking an agreement with neighbours to use theirs for access to inspect and maintain the watercourse.

*(United Utilities/Environment Agency/Land owners)

4.4 River Dean Catchment

Figure below shows the extent of the River Dean catchment. The orange shading shows the upper catchment (Llamaload to Bollington) and the purple shading the lower catchment (Bollington to the River Bollin).

Figure 43 River Dean Catchment

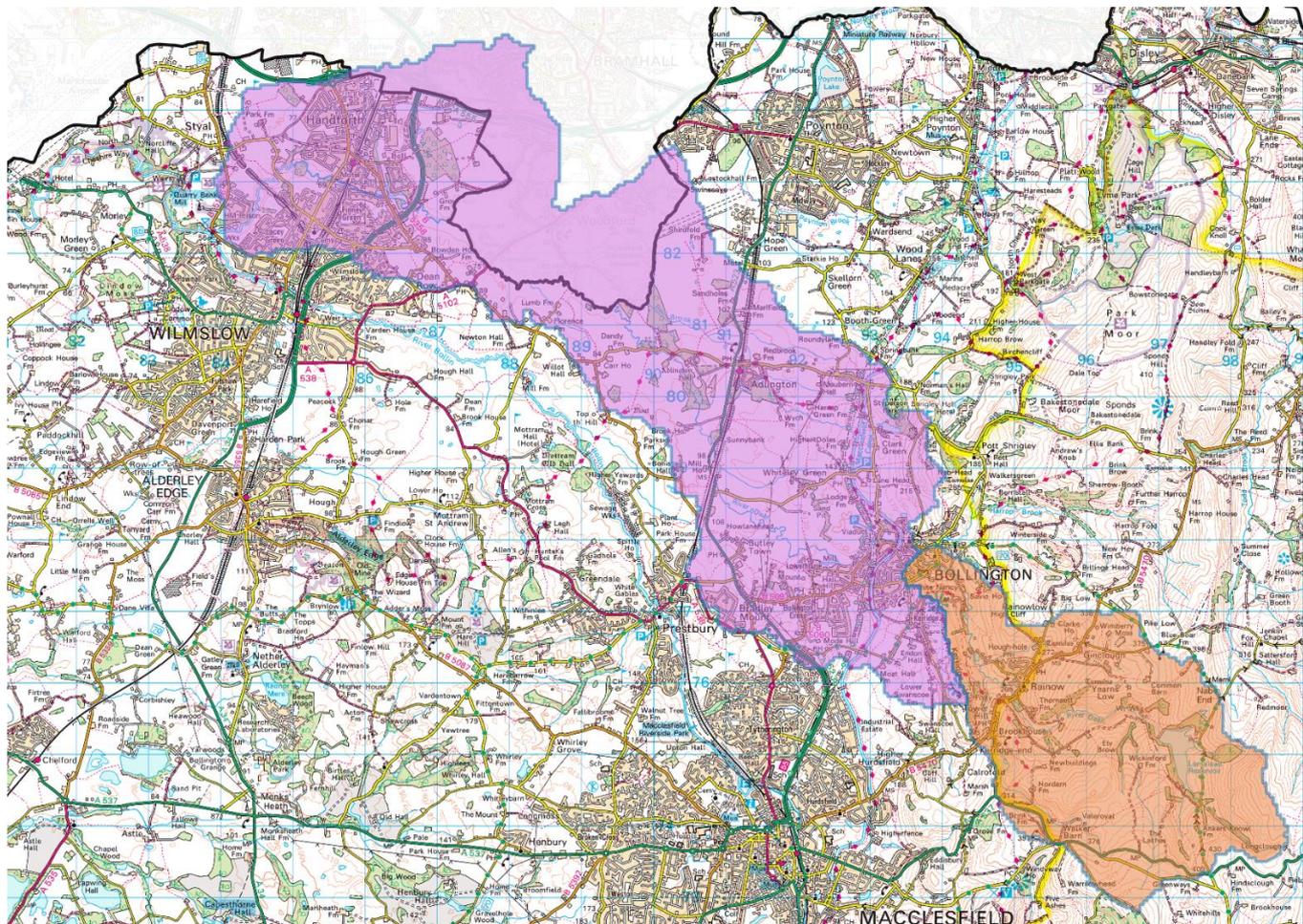


Table 12 Number of properties reported* flooding in River Dean Catchment:

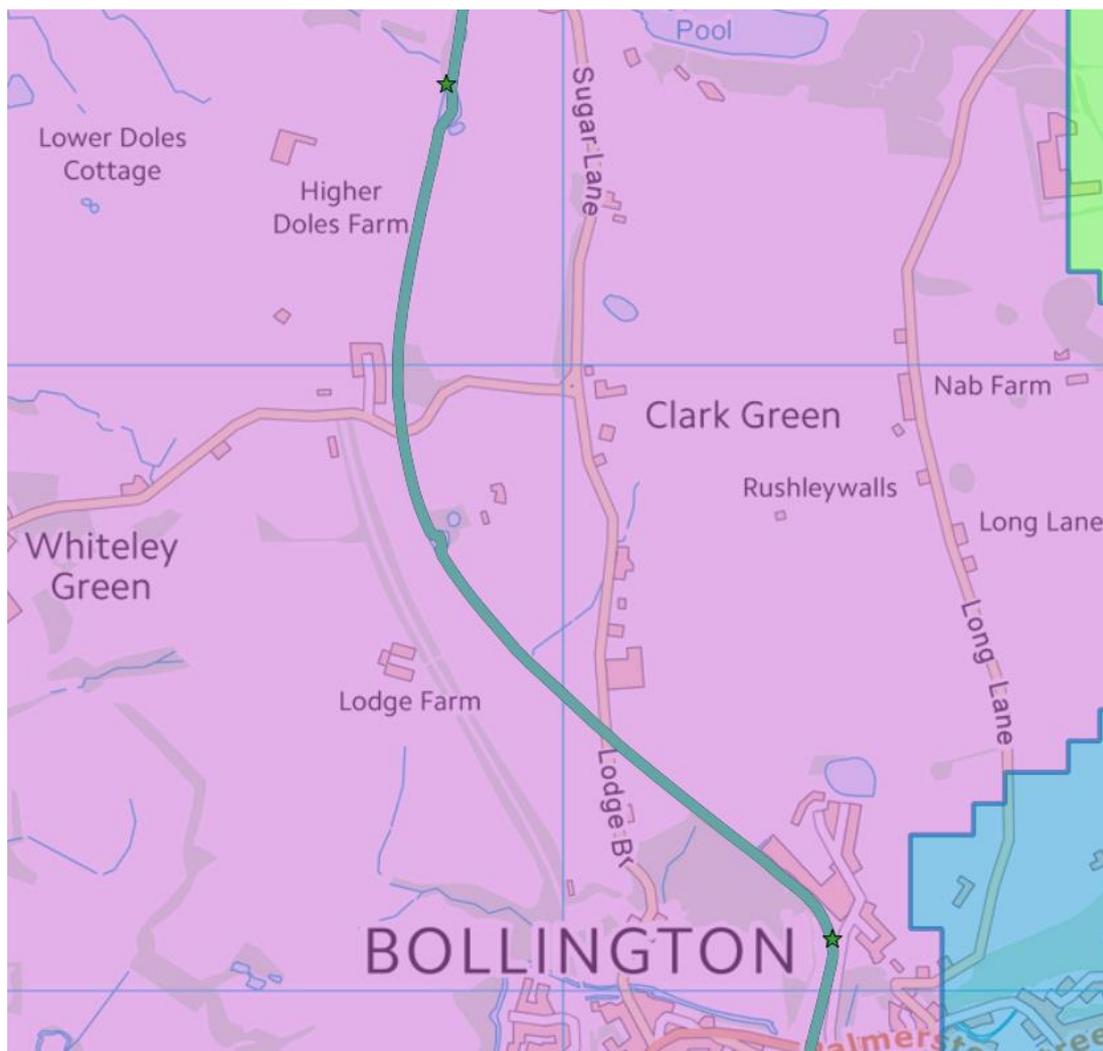
No. of properties reported*	July 2019
Residential flooding**	7
Commercial Flooding	1

*formally reported to the Lead Local Flood Authority, Environment Agency and/or United Utilities

** refers to reports of (internal property flooding, including integrated garages. This does not include: uninhabitable cellars, detached garages and gardens

** Internal flooding residential refers to reports of (internal property flooding, including integrated garages. This does not include: uninhabitable cellars, detached garages and gardens

Figure 44 Canal Interactions with Dean catchment



Symbols: Sluices shown as green stars near Clark Green and Clarence Road, no overflow weirs in the catchment.

4.4.1 Description of flooding at River Dean (Main River)

Residents in properties at Lowerhouse and Waterhouse Mill, saw elevated levels in the River Dean, but the water did not flow out of bank at this location.

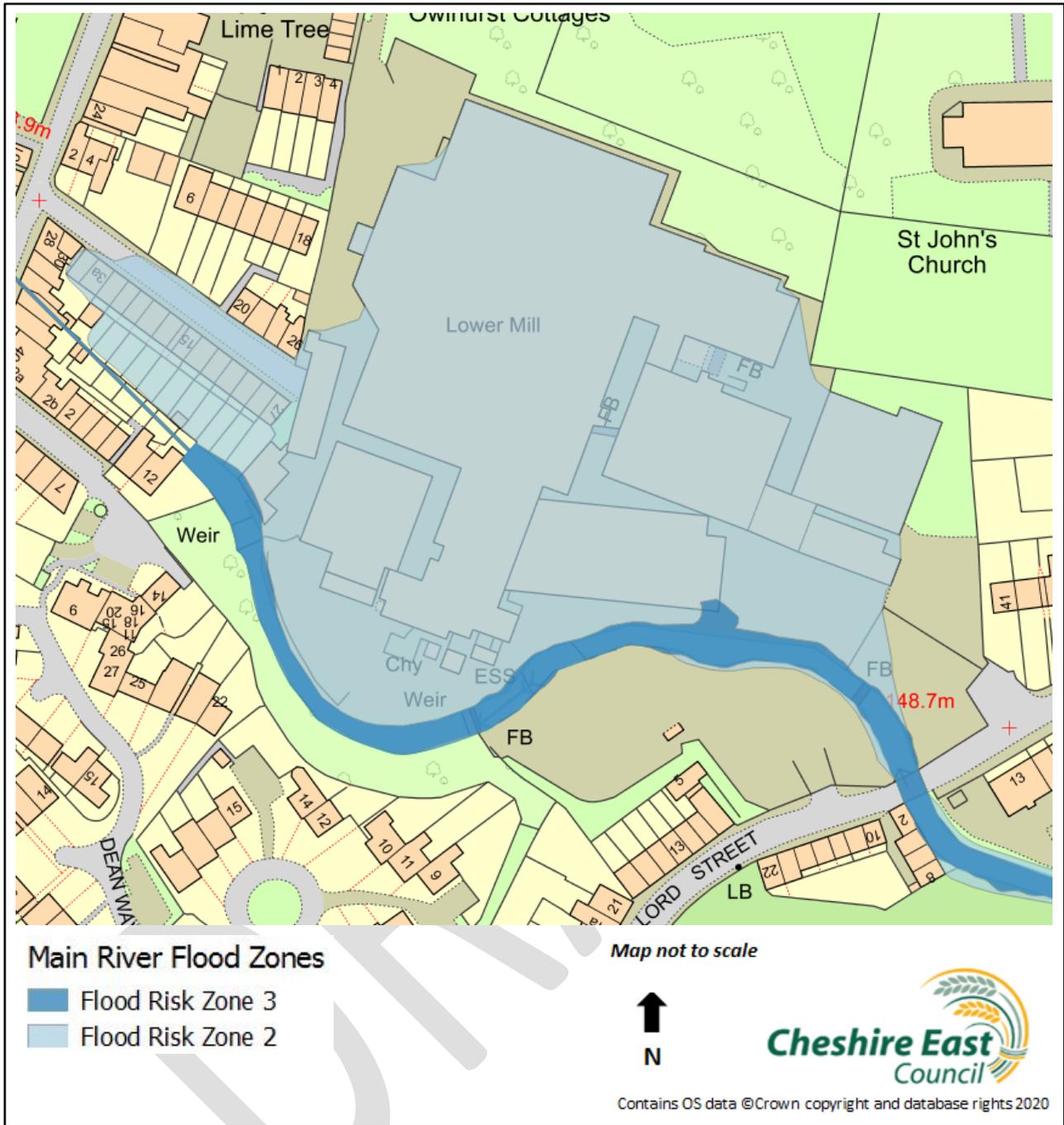
The Recreation Ground was flooded by water from the River Dean combined with surface water, the water flowing and returning to the Dean downstream of the weir.

4.4.2 Description of Main River flooding near Lower Mill/Oldham Street, Bollington.

Lower Mill sits adjacent to the River Dean in the floodplain. During this event it was reported that flooding mechanism was caused by the Main River, River Dean. Water levels rose and breached the banks of the river flooding a nearby factory. The flood water then built up against the back wall of the factory (bordering Oldham Street) and finally caused a door to blow, allowing flood water to escape, flowing with some velocity. In a previous event (1998) a similar mechanism was reported.

Further downstream at Water street, a footbridge across the river reduced conveyance, causing a localised increase in water levels upstream.

Figure 45 Lower Mill, River Dean, Bollington



Further downstream at Water Street and John Street a footbridge across the river reduced conveyance, causing a localised increase in water levels upstream. As well as causing river levels to overtop the banks upstream, this exacerbated the local surface water drainage issues reported below, by elevating river levels and preventing local drainage routes to the river.

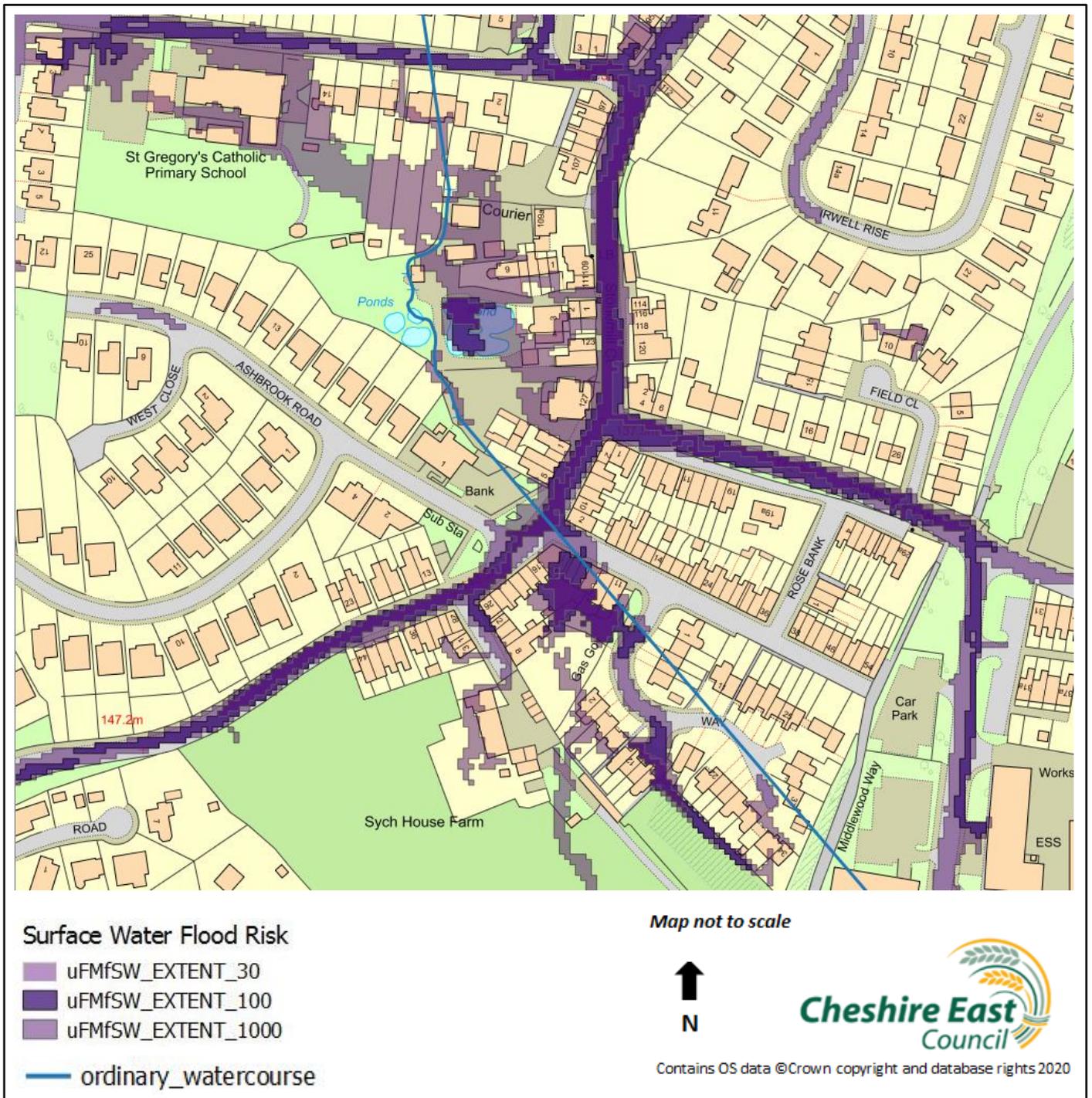
4.4.3 Description of flooding at Princess Street (surface water/ordinary watercourse)

Flooding to local cellars and gardens experienced in this area. Two fire engines attended site to assist 5 local homeowners, highways and the Council were notified of flooding. Investigations following the event identified a blockage was found a section of ordinary watercourse.

The riparian owner was instructed to remove the blockage by the LLFA (blockage removed 24/09/2019) and ensure that the flow through this section is maintained.

Surface water systems maintained by United Utilities also outfall into this culverted section of the watercourse, United Utilities to investigate.

Figure 46 Flood risk at Princess Street, Bollington



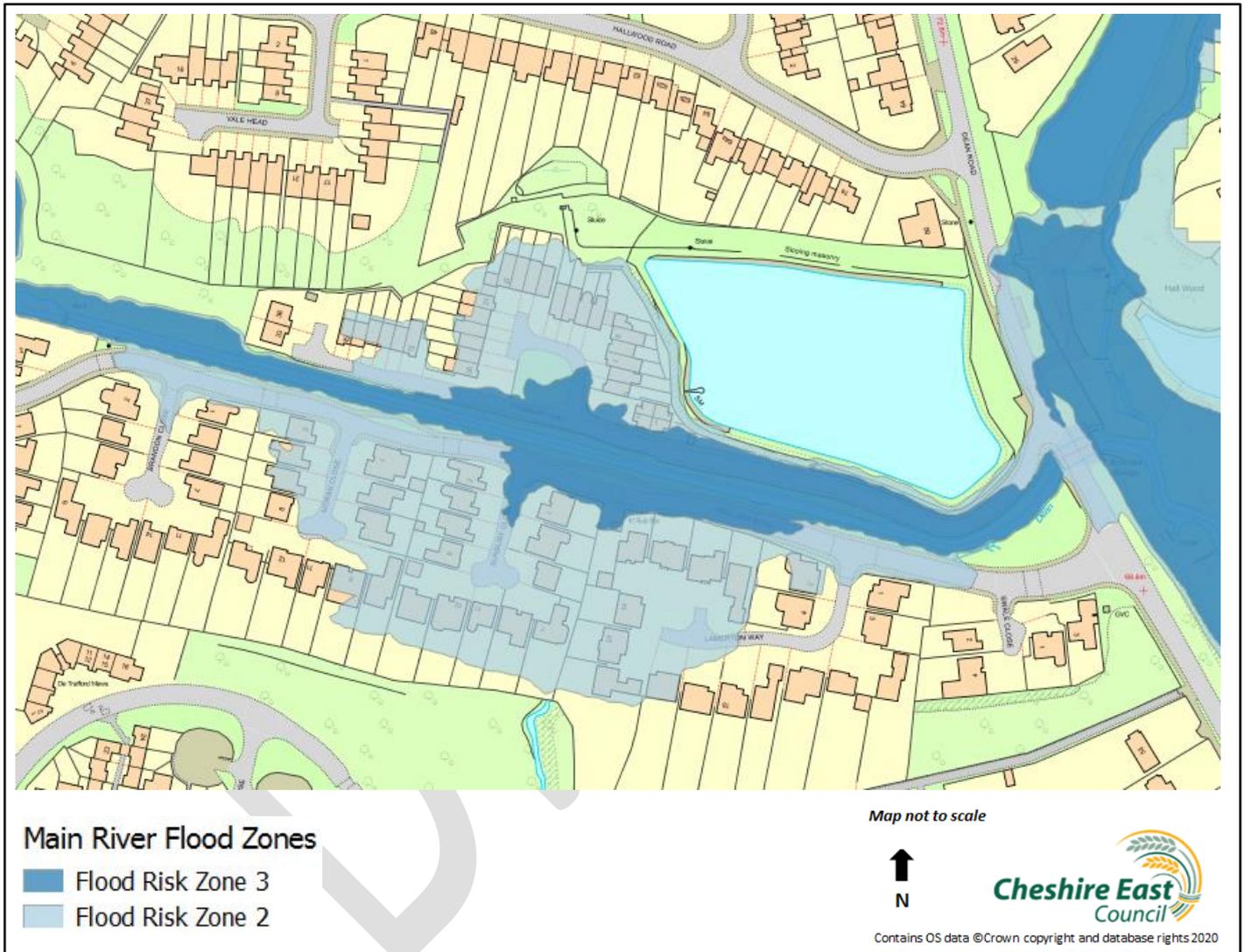
4.4.4 Description of flooding in Wilmslow:

Environment Agency Community Information Officers attended on 5th August 2019, and found no evidence of internal flooding in Wilmslow town centre.

4.4.5 Description of flooding in Handforth:

Finsbury Way which runs in parallel to River Dean was flooded by the Main River, flood water was reported into local driveways and up to doorstep level. The stream on the other side of the road between Finsbury Way and Welland Road is maintained by a pump and the water levels rise following heavy rainfall. This area is within floodzone 2 & 3 as indicated by the Environment Agency's risk map.

Figure 47 Finsbury Way, River Dean



4.4.6 River Dean Catchment - RMA Responses

Table 13 Response Timeline River Dean Catchment

Date & Time	RMA	Response
31/07/2019	Cheshire Fire and Rescue	Attended site
31/07/2019	Environment Agency	Environment Agency site controller attended site at Handforth
31/07/2019	United Utilities	Attended site
31/07/2019	Cheshire East Highways	Attended site
05/08/2019	Environment Agency	Community Information Officers sent to Wilmslow, to verify flooding on site. No internal property flooding found
05/08/2019	Environment Agency	Community Information Officers sent to Handforth, to verify flooding on site.
12/08/2019	Environment Agency	Community Information Officers sent to Bollington, to verify flooding on site.
13/08/2019	Environment Agency	Community Information Officers sent to Bollington, to verify flooding on site.
14/08/2019	Environment Agency	Community Information Officers sent to Bollington, to verify flooding on site.
04/09/2019	Multi Agency	Community flood drop in held at Bollington Civic Centre attended by approximately 80 residents
12/09/19	Multi Agency	Community flood drop in held at Wilmslow Library attend by 11 residents

4.4.7 River Dean Catchment - Site Specific Recommendations

Based on the analysis for July 2019 flooding events, the following actions are recommended to the locals RMAs.

Table 14 Recommended actions for River Dean Catchment

RMA	Recommended Action
CEC as LLFA in conjunction with partners as applicable*	Investigated flooding on Princess Street, in conjunction with United Utilities. A blockage was found in a section of ordinary watercourse. The riparian owner was instructed to remove the blockage by the LLFA (blockage removed 24/09/2019) and ensure that the flow through this section is maintained.
Environment Agency	Investigate Lower Mill, River Dean. Flooding mechanism and existing fluvial controls

*(United Utilities/Environment Agency/Land owners)

4.5 River Bollin Catchment

The image below shows the area that drains onto the River Bollin.

Figure 48 The River Bollin Catchment

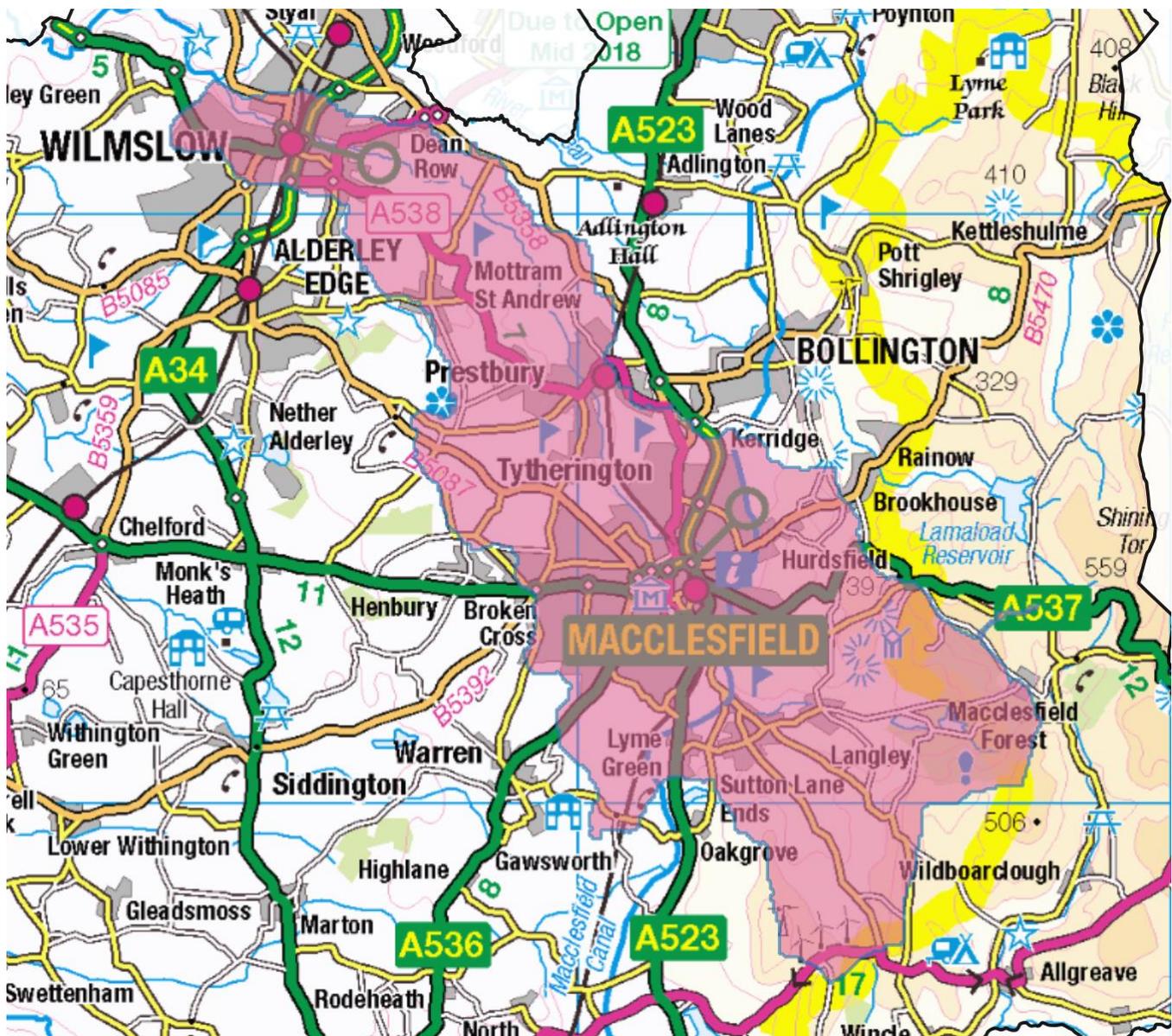


Table 15 Number of properties reported* flooding in River Bollin Catchment

No. of properties reported	July 2019
Internal Flooding Residential**	5
Internal Flooding Businesses	0

*formally reported to the Lead Local Flood Authority, Environment Agency and/or United Utilities

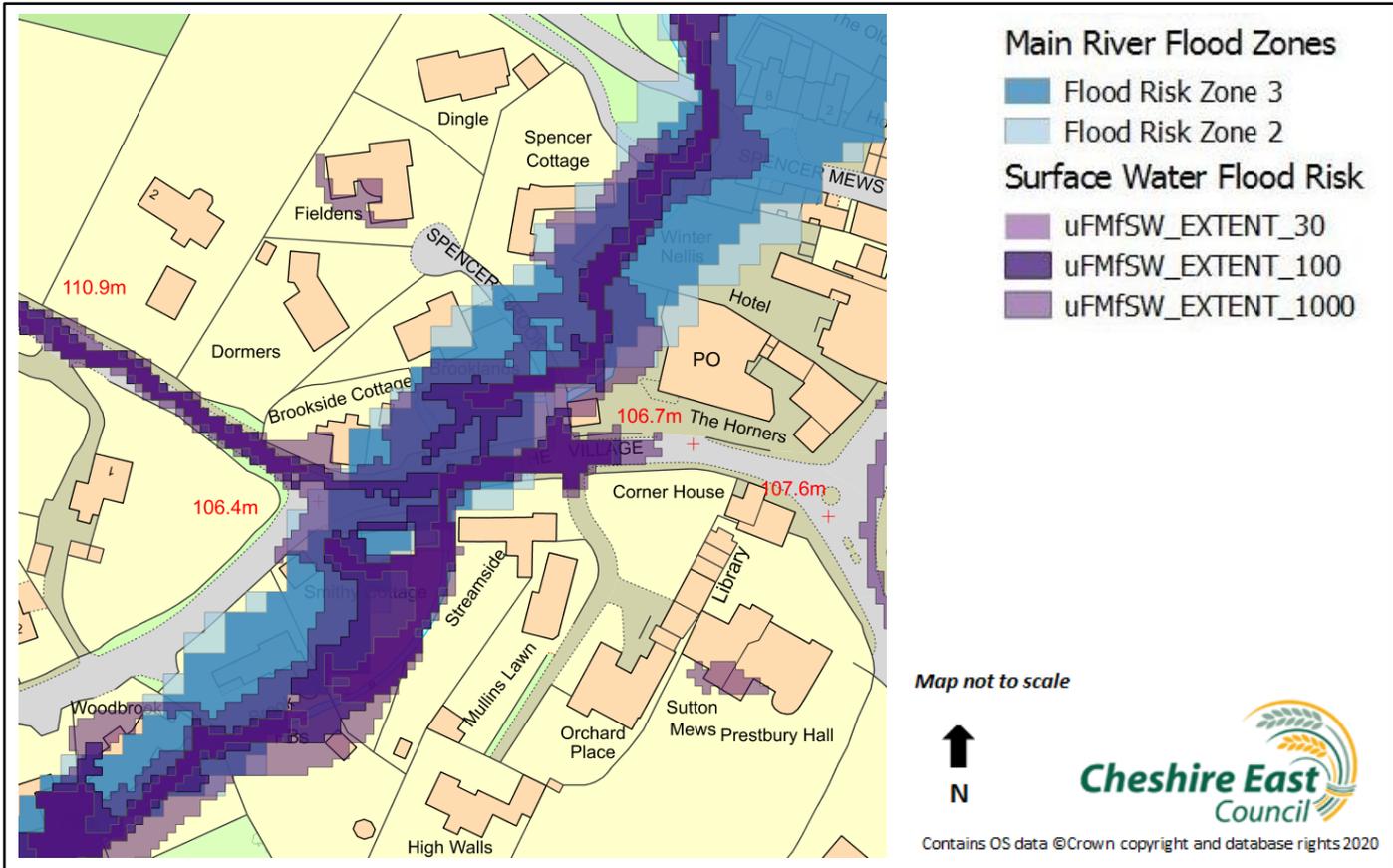
** Internal flooding residential refers to reports of (internal property flooding, including integrated garages. This does not include: uninhabitable cellars, detached garages and gardens

4.5.1 Description of flooding at Prestbury

Prestbury was affected by surface water flooding, with some residents experiencing property flooding and more narrowly avoiding water ingress into properties.

In the area known as The Village, surface water attempted to flow into Spencer Brook which is a Main River. In areas where this is prevented water will pond and accumulate. As the water levels in Spencer Brook rise, any surface water drainage system which outfall to this watercourse may not be able to do so.

Figure 49 Spencer Brook, Prestbury

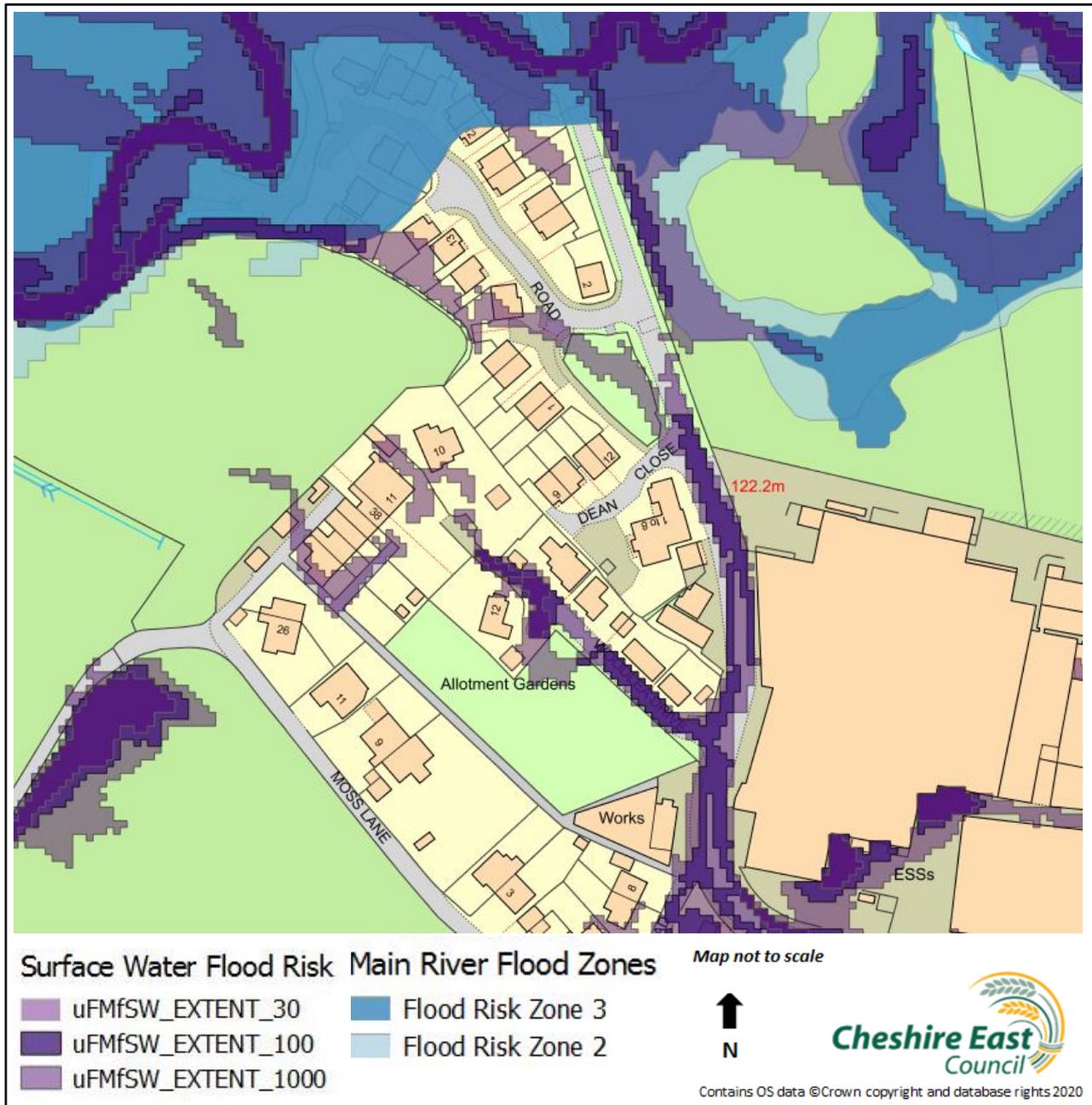


4.5.2 Woodlea Drive (surface water)

Woodlea Drive is a short cul-de-sac of five houses with two further houses off a short drive at its 'closed' end. It runs slightly downhill off Albert road and has seven grids for collecting surface water. This should be perfectly adequate.

However in both the heavy rains of August 1st and 9th the area outside the bottom two houses was flooded by several inches; further, the flooding continued to the houses down the drive at the end. The water reached the front door of one of the properties, as it subsided the flood water deposited silt and sewer waste.

Figure 50 River Dean, Woodlea Drive



4.5.3 River Bollin Catchment - RMA Responses

Table 16 Response Timeline River Bollin Catchment

Date & Time	RMA	Response
28/09/2019 10:24	Environment Agency	EA Flood alert issued
28/09/2019 12:42	Environment Agency	EA Flood alert issued
31/07/2019	Cheshire Fire and Rescue	Cheshire Fire and Rescue Service attended a total of 42 flooding related incidents in and around Poynton, Bollington and Wilmslow
31/07/2019	Environment Agency	Surface water flooding wasn't reported to the EA, so they were unaware
31/07/2019	Cheshire East Highways	Attended site
12/08/2019	Environment Agency	Community Information Officers sent to Bollington to verify flooding onsite
13/08/2019	Environment Agency	Community Information Officers sent to Bollington to verify flooding onsite
14/08/2019	Environment Agency	Community Information Officers sent to Bollington to verify flooding onsite

4.5.4 River Bollin Catchment - Site Specific Recommendations

Based on the analysis for July 2019 flooding events, the following actions are recommended to the locals RMAs.

Table 17 Recommended actions for the River Bollin Catchment

RMA	Recommended Action
Cheshire East LLFA	Formal enforcement action taken where required by the Council under Land Drainage Act 1991. Situation will be monitored.
CEC as LLFA in conjunction with partners as applicable*	Investigate feasibility of flood mitigation measures with partners.

*(United Utilities/Environment Agency/Land owners)

4.6 Other Impacts

4.6.1 Borough Road Closures

Road closures were in place during the flood event across Cheshire East including:

- Anglesey Drive, Poynton
- Bonis Hall Lane, Poynton – closed in both directions due to flooding
- Moggie Lane, Higher Poynton, following up on Police request due to the water compromising the bridge parapet.
- A555 - The section of the A555 between the Oil Terminal roundabout and the A6. The section between the Oil Terminal roundabout, heading down Woodford Road to the A34
- Styal Road, Wilmslow - closed in both directions
- Flash Lane, Astbury - closed in both directions
- Fol Hollow, Congleton - closed in both directions
- Mill Lane, Adlington - closed in both directions
- Moggie Lane, Higher Poynton - closed in both directions due to collapse of the bridge at the junction with Narrow Lane
- Skellorn Green Lane, Adlington - closed due to flooding at the junction with Street Lane and Cawley Lane
- A555 Manchester Airport link road
- Moggie Lane Bridge, Poynton
- London Road, Poynton
- Park Lane, Poynton
- Clumber Road, Poynton
- Ingersley Road, Bollington

4.6.2 Rail Closures

Train services affected between Manchester Airport and Wilmslow.

5 General actions by Risk management Authorities across Cheshire East during/post flooding 28th July onwards

Date & Time	RMA	Response
31/07/2019	Environment Agency	EA Flood alert issued
31/07/2019	Environment Agency	EA Flood warning issued
31/07/2019	Police	A major flooding incident has been declared
31/07/2019	Police	Emergency refuge centre opened in Handforth
31/07/2019	Police	Emergency refuge centre opened in Poynton
31/07/2019	Cheshire East Highways	Attended site
31/07/2019	Cheshire Fire and Rescue	Cheshire Fire and Rescue Service attended a total of 42 flooding related incidents in and around Poynton, Bollington and Wilmslow
31/07/2019	Environment Agency	Attended site
31/07/2019	United Utilities	Attended site
31/07/2019	Lead Local Flood Authority	Attended site Attended site
31/07/2019	Cheshire East Highways	Attended site
01/08/2019 am	Multi-Agency Meeting (SRCG 1)	Strategic recovery co-ordination group (Various teams from Cheshire East Council, Environment Agency, Police, Fire & Rescue, Public Health England, British Red Cross, RED North.
01/08/2019 pm	Multi-Agency Meeting (SRCG 2)	Strategic recovery co-ordination group (Various teams from Cheshire East Council, Environment Agency, Police, Fire & Rescue, Public Health England, British Red Cross, RED North, Warrington Borough Council, Meteorological Office.
02/08/2019	Multi-Agency Meeting (SRCG 3)	Strategic recovery co-ordination group (Various teams from Cheshire East Council, Environment Agency, Police, Fire & Rescue, RED North.
06/09/2019	CEC & UU	Incident response meeting
07/08/2019	Multi-Agency Meeting (SRCG 4)	Strategic recovery co-ordination group (Various teams from Cheshire East Council, Environment Agency, Police, Fire & Rescue, Public Health England, British Red Cross, RED North.
12/08/2019	Multi-Agency Meeting (SRCG 5)	Strategic recovery co-ordination group (Various teams from Cheshire East Council, Environment Agency, Police, RED North.
15/08/2019 1-7pm	Multi-Agency	Multi-Agency Drop in session, Civic Centre in Poynton attended by approximately 300 residents
04/09/2019	Mult Agency	Mult Agency Drop in session, Bollington Civic Centre attended by approximately 80 residents
12/09/2019 3-7pm	Multi-Agency	Multi-Agency Drop in session, Library in Wilmslow attended by 11 residents
20/08/2019	Multi-Agency Meeting (SRCG 6)	Strategic recovery co-ordination group (Various teams from Cheshire East Council, Environment Agency and Police.
13/09/2019	Multi-Agency Meeting (SRCG 7)	Strategic recovery co-ordination group (Various teams from Cheshire East Council and Environment Agency.
13/09/2019	Multi-Agency	Strategic recovery co-ordination group stood down from recovery phase to investigation phase.

6 Generic Recommendations for all Risk management Authorities and local communities

RMA	Recommended Action
Cheshire East Council as Emergency Planning	Invite affected town/parish councillors to strategic group multi-agency response meetings.
	Prepare a flooding factsheet, to be hosted online and printed and displayed following flood events in key locations via Town/Parish Councils. Paper copies to be printed by Town/Parish Councils and distributed on request.
	Continue to work with Town and Parish Councils to develop Community Resilience plans. Community Resilience Plans will require review to maintain currency, by local communities.
Cheshire East Highways	Maintain efficient operation of highway drains and structures
	Ensure necessary recovery works are carried out to local highway drains following flood event
Cheshire East Council as LLFA in conjunction with Environment Agency	Consider additional flood mitigation schemes in areas of known flood risk.
CEC as LLFA in conjunction with partners as applicable	Continue to manage flood risk from new development. Seek flood risk benefits from new development where possible
Environment Agency	Consider flood mitigation schemes for Poynton, Kettlethulme and Pott Shrigley, and other locations, including leading on potential Natural Flood Management for surface and ordinary watercourse flood risk as well as Main River.
Riparian Owners	Understand responsibilities of being a riparian owner: https://www.gov.uk/guidance/owning-a-watercourse#get-advice
	Monitor and maintain flow in watercourse, clear debris and screens when safe to do so and adhere to the rules regarding restricted development with 8m of a watercourse
Property Owners	Check your properties risk from fluvial flooding online: https://flood-map-for-planning.service.gov.uk/
	Check your properties risk from surface water flooding online: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map
	Prepare a flood plan and discuss this with all members of the household: https://thefloodhub.co.uk/

	<p>If you live in a flood risk area, make sure you have property flood insurance. If your premium or excess is too expensive, “Flood Re” could help you to access affordable cover: https://thefloodhub.co.uk/</p>
	<p>Consider installation of Property Level Protection such as flood doors, barriers, non-return valves, or air brick covers: https://thefloodhub.co.uk/</p>
	<p>Establish flood action groups. Guidance and support can be provided by The Flood Hub. Town/Parish Councils have access to existing community resilience plans, work together to ensure these documents are current and accessible</p>
<p>Communities and individuals</p>	<p>Do not to enter or walk in flood waters either as there are often hidden dangers under the surface, e.g., missing manhole covers or debris and may contain infectious organisms, including intestinal bacteria such as E. coli, Salmonella, and tetanus.</p>
	<p>Do not lift and leave manholes uncovered during flood events unless a) you are authorised to do and b) the hazard is clearly marked</p>
	<p>Do not drive into flood water that's a) moving and/or b) more than 10cm (4 inches) deep, unless you are in an emergency vehicle.</p> <p>Driving through flood water generates bow waves, which may increase flood impacts within your community and may damage your vehicle.</p>
	<p>Information service / Q&A be available on the both the Flood Hub https://thefloodhub.co.uk/ and Cheshire East Council https://www.cheshireEast.gov.uk/planning/flooding/flooding.aspx websites to assist in signposting residents to the relevant departments and agencies to resolve problems and respond to concerns.</p>

7 Conclusion

Based on the investigation of the flood event, the relevant Flood Risk Management Authorities (RMAs) across the area were the: Environment Agency, Cheshire East Council, Cheshire East Highways, Lead Local Flood Authority, and United Utilities in relation to the flooding from Main Rivers, ordinary watercourses, surface water and sewers in response to the rainfall events.

These agencies have exercised or have proposed to exercise the correct function in response to the flood, in accordance with their duties under the Flood and Water Management Act 2010 and other relevant UK legislation. Recommendations have been provided to each RMA on a site-specific basis; these are found under the relevant section of the report. The delivery of these actions will be heavily dependent on funding availability and other RMA priorities.

Some work has already been carried out or is already planned by the RMAs in response to the flooding events. The implementation of the recommendations will be monitored and implemented in line with the Cheshire East Council Local Flood Risk Management Strategy:

<https://www.cheshireeast.gov.uk/planning/flooding/floods-and-flood-risk/flood-risk-management.aspx>

Recommendations for local communities, residents and land owners are also included.

Appendix A – Contacts and useful websites

Key Flooding Contact Details: The following gives guidance on whom to contact about various types of flooding.

Always contact the emergency services first (**999**) if you or a family member is in immediate danger.

Flooding from a Public Sewer

United Utilities

Report sewer flooding 0345 6723 723

www.unitedutilities.com

Flooding from a Burst Water Mains

United Utilities

Report a leak 0800 330033

www.unitedutilities.com

Flooding from the Public Highway or Ordinary Watercourses (Non-Main River)

Cheshire East Highways Service

To report an incident 0300 123 5020

To report an incident out of working hours 0300 123 5025 (for use after 5pm and before 9am, including weekends.)

<https://www.cheshireeast.gov.uk/home.aspx>

Flooding from a Main River

Environment Agency

General enquiries 03708 506 506 (Mon-Fri, 8am – 6pm)

Incident hotline 0800 80 70 60 (24 hour service)

Floodline 0345 988 1188 (24 hour service)

General enquiries email enquiries@environment-agency.gov.uk

<https://www.gov.uk/government/organisations/environment-agency>

Useful Web Resources:

The following web links contain useful information about being prepared, understanding flood risk and reporting drainage issues to CEC.

Being Prepared

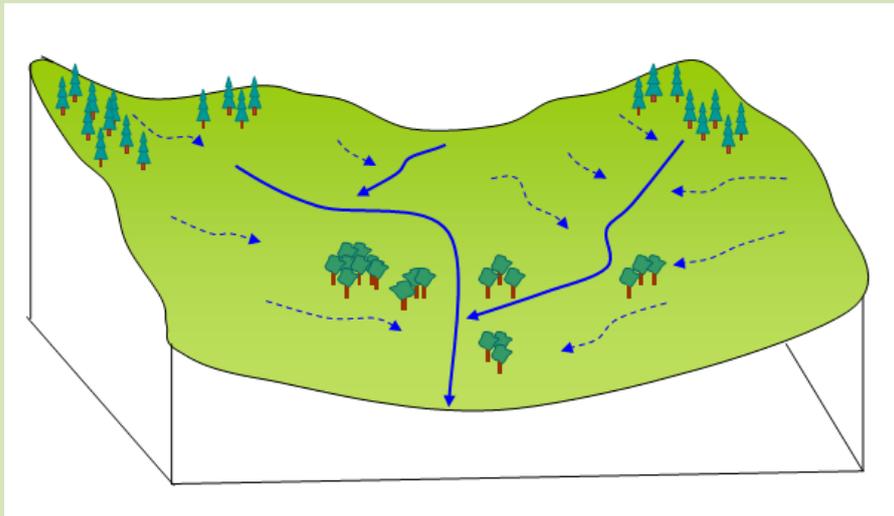
Prepare for a flood and get help during and after:

<https://www.gov.uk/government/publications/flooding-what-to-do-before-during-and-after-a-flood>

Be ready for flooding:	https://www.gov.uk/prepare-for-flooding
Make a personal flood plan:	https://www.gov.uk/government/publications/personal-flood-plan
Prepare your property for flooding:	https://www.gov.uk/prepare-for-flooding/future-flooding
Understanding Flood Risk and Flood Warnings	
Check current flood warnings and river levels:	https://www.gov.uk/check-flood-risk
Sign up for flood warnings:	https://www.gov.uk/sign-up-for-flood-warnings
Reporting a Flood	
Report flooding from a public highway to CEC:	To report an incident 0300 123 5020 To report an incident out of working hours 0300 123 5025 (for use after 5pm and before 9am, including weekends.)
Report a problem with a drain or a grid (also known as a gully):	To report an incident 0300 123 5020 To report an incident out of working hours 0300 123 5025 (for use after 5pm and before 9am, including weekends.)

Appendix B - Glossary

The glossary below defines some of the frequently used terminology within the flood risk management industry and this document.

Term	Definition
Annual Exceedance Probability (AEP)	Flood events are defined according to their likelihood of a particular flood occurrence in any one year. For example, a flood with an annual probability of 1 in 100 can also be referred to as a flood with a 1% annual probability. This means that every year there is a 1% chance that this magnitude flood could occur.
Bifurcation	The division of something into two branches or parts. Bifurcation channel is where the channel splits into two reaches.
Catchment Area	<p>When rain falls on an area of land, the water travels downhill and typically collects in ponds or travels on through a river. The area where this happens is called a Catchment Area. In a catchment area water can be collected through rain or drained by rivers or streams or manmade drainage systems. A catchment area can also be known as Drainage Basin</p> 
Category 1 Responders	Organisations at the core of the response to most emergencies (the emergency services, local authorities, NHS bodies). Category 1 responders are subject to the full set of civil protection duties.
CEC	Cheshire East Council
CEH	Cheshire East Highways Service
CFRS	Cheshire Fire and Rescue Service
EA	Environment Agency
Flood Risk Management Function	A function listed in the Act (or related Acts) which may be exercised by a risk management authority for a purpose connected with flood risk management.
FWMA (2010)	Flood and Water Management Act 2010
Very Low Flood Risk	Area with a very low probability of flooding from rivers (< 1 in 1,000 annual chance of flooding or <0.1%).
Low Flood Risk	Area with a low probability of flooding from rivers (between a 1 in 1000 and 1 in 100 annual chance of flooding or between 0.1% and 1%)
Medium Flood Risk	Area with a medium probability of flooding from rivers (between a 1 in 100 and 1 in 30 annual chance of flooding or between 1% and 3.33%).
High Flood Risk	Area with a high probability of flooding from rivers (> 1 in 30 annual chance of flooding or greater than 3.3%).
Instances of property flooding	This is a count of the reported incidents of internal property flooding that occurred across the event. Properties which were flooded twice are accounted for twice and therefore not a count of the number of properties.
LLFA	Lead Local Flood Authority
Main River	Main Rivers are usually larger streams and rivers, but some of them are smaller watercourses

Term	Definition
	of local significance. Main Rivers indicate those watercourses for which the Environment Agency is the relevant risk management authority.
Ordinary Watercourse	An ordinary watercourse includes every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than public sewer) and passage through which water flows which does not form part of a Main River. The Lead Local Flood Authority, District/Borough Council or Internal Drainage Board is the relevant risk management authority.
Return Period	Statistical measure used to represent the magnitude of an event. For example the probability of a flood in any one year may be expressed as 1% or 1 in 100 years. This does not mean that such a flood would occur every 100 years it is a statistical measure that suggests that in any given year, there is a 1% chance that it will happen, regardless of when the last similar event was. Or, put differently, it is 10 times less likely to occur than a flood with a 10% AEP or 1 in 10 years return period.
Riparian Owner	Owner of land adjoining, above or with a watercourse running through it who has certain rights and responsibilities, i.e. maintenance of the watercourse to prevent restrictions thus leading to fluvial flooding. https://www.gov.uk/guidance/owning-a-watercourse
SOP	Standard of Protection, protection offered by a defence/structure usually expressed as an annual exceedance probability
RMA	Risk Management Authority
uFMfSW_EXTEN_30	Updated Flood Map from Surface Water 30yr Return period
uFMfSW_EXTEN_100	Updated Flood Map from Surface Water 100yr Return period
uFMfSW_EXTEN_1000	Updated Flood Map from Surface Water 1000yr Return period
UU	United Utilities