

Cheshire West and Chester

Section 19 Flood Investigation – Main Report (January 2021 Storm Christoph Flooding Event)

September 2022

5150735-DG-0047



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Glossary

AEP	Annual Exceedance Probability ¹
the Trust	Canal & River Trust
CSO	Combined Sewer Overflow ²
CWaC	Cheshire West and Chester Council
EA	Environment Agency
FCERM	Flood and Coastal Erosion Risk Management
FDL	Flood Defence Level
FRR	Flood Risk Regulations (2009)
FWMA	Flood Water Management Act
GIS	Geographic Information System
LLFA	Lead Local Flood Authority
mAOD	Metres Above Ordnance Datum
PFRA	Preliminary Flood Risk Assessment
RMA	Risk Management Authority
UU	United Utilities
WRAP	Winter Rainfall Acceptance Profile

¹ The probability associated with a return period e.g. an event of return period 100 years (T=100), has an AEP of 1/T or 0.01 (1%)

² Combined Sewer Overflows allow the controlled discharge of sewerage to an open watercourse during high rainfall events to reduce the risk of flooding to people and property

Introduction

Cheshire West and Chester Council has commissioned Atkins (member of the SNC-Lavalin Group) to undertake a Section 19 flood investigation report in response to the January 2021 Storm Christoph flooding event. This report is required to inform the Council and affected residents and businesses of progress including recommendations for review and improvement.

Executive Summary

The purpose of this Section 19 Flood Investigation Main Report is to lay out the background, conditions and details of the flooding that occurred during Storm Christoph (19 – 21 January 2021) in the administrative area of Cheshire West and Chester Council; referred to as the borough. Furthermore, it identifies the flood mechanisms and flood infrastructure performance that occurred during this flood event; provide a strategic overview of the Risk Management Authority (RMA) responses; and provide a full list of recommended actions.

A Section 19 flood investigation is undertaken to identify and investigate whether the RMAs exercised their risk management functions as per Section 19 (1) of the Flood and Water Management Act (FWMA, 2010) and adhered to the Flood Risk Regulations (2009).

The RMAs and stakeholders identified are Cheshire West and Chester Council (CWaC), as the Lead Local Flood Authority (LLFA); Highways Authority; Environment Agency (EA); United Utilities (UU); the Canal & River Trust (C&RT); riparian owners and local residents; the Police, Fire and Rescue service; and local Parish Councils.

Areas Affected

Flooding was reported in 28 separate areas across the borough which affected approximately 436 residential and commercial properties of which 195 experienced internal flooding. During Storm Christoph 141 properties had to be evacuated in face of rising water to ensure their safety.

Some affected areas were affected by a single source of flooding whereas other areas were affected by multiple sources for which determining potential mitigation measures are likely to require additional investigation or assessment.

Sources of Flood Risk

During Storm Christoph flooding occurred as a result of out of bank flow from watercourses, overland flow and surface runoff, surface water ponding and surcharging of the drainage systems providing surface, highway and combined drainage. Each of the areas were affected by one or multiple sources of flooding.

Flooding as a direct result of water escaping river channels and causing flooding to property and infrastructure occurred in Acton Bridge and Weaverham, Ashton Hayes, Blacon, Ellesmere Port, Farndon, Northwich, Tattenhall, Winsford and Tilston. Flooding was not necessarily the only source of flooding at these locations, further details are provided within the individual chapters.

Surcharging of drainage networks (including highway, surface and combined) occurred in Acton Bridge and Weaverham, Ashton Hayes, Antrobus, Blacon, Davenham, Ellesmere Port, Hooton, Northwich, Saughall, Tattenhall, Willaston and Tarpoley.

Overland flow from surface water runoff contributed to flooding at Acton Bridge and Weaverham, Ashton Hayes, Antrobus, Davenham, Great Barrow, Hooton, Mickle Trafford, Northwich, Saughall, Upton Park, Kingsley, Kelsall and Tilston.

The areas that experienced highway flooding only, and no damage to property, included Comberbach, Dutton, Great Boughton, Guildon Sutton, Lach Dennis and Lostock, Sproston and Wettenhall.

This main report includes a separate section for each of the areas affected by flooding. These sections will provide a background to the flood risk and water management assets in each area, a summary of what occurred during Storm Christoph and what was affected along with a list of the actions taken to date and recommendations to either investigate or mitigate the impact of flooding.

Summary of Recommendations

Since the October 2019 flood event there has been a collaborative effort by all RMAs to improve the way that flooding within the borough is mitigated and how it is managed during an event. Many of the recommendations from the October 2019 Section 19 report continue to be implemented and have been reiterated within the recommendations of this Section 19 investigation for Storm Christoph.

Each of the individual area sections identify recommendations specific to those areas.

1. Section 19 – Investigation Requirement

The Flood and Water Management Act 2010 provides for better, more comprehensive management of flood risk for people, homes and businesses, helps safeguard community groups from unaffordable rises in surface water drainage charges, and protects water supplies to the consumer. Serious flooding can happen at any time. Climate projections suggest that extreme weather will happen more frequently in the future. This Act aims to reduce the flood risk associated with extreme weather.

<https://www.gov.uk/guidance/flood-risk-management-information-for-flood-risk-management-authorities-asset-owners-and-local-authorities>

The Flood and Water Management Act (FWMA, 2010) defines the lead local flood authority for an area as the unitary authority or the county council.

Under Section 19 of the act:

- (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.

Storm Christoph and the resultant flooding incident that occurred in Cheshire West and Chester in January 2021 is considered to have met the criteria for Formal Investigation as defined in Section 19 of the FWMA (2010).

In addition to the FWMA (2010), the FRR (2009) were introduced by Government in 2009. CWaC as a LLFA is required to implement its provisions.

As a result of the FRR (2009), the LLFA has a duty to prepare a number of documents, including:

- Preliminary Flood Risk Assessment (PFRA).
- Flood hazard and risk maps.
- Flood Risk Management Plans.

This Section 19 report contributes to the continual development of flood hazard / risk maps and Flood Risk Management Plans.

2. Identification of Risk Management Authorities (RMAs) and Stakeholders

For managing flooding, the legal framework is distributed to multiple agencies. The responsibilities of each of the agencies are summarised below.

2.1. Cheshire West and Chester Council (CWaC)

CWaC is the LLFA and the Highways Authority for the area of this Section 19 investigation. CWaC is an RMA. The LLFA is responsible for developing, maintaining and applying a strategy for local flood risk management from the following sources:

- Surface water (pluvial)
- Groundwater
- Ordinary watercourses (fluvial)
- Highways drainage
- Canals.

The FWMA (2010) outlines the LLFA's powers to designate structures and features that affect flooding, in order to provide protection to assets that are relied upon for flood risk management from the aforementioned flooding sources. Once a feature is designated, the owner must seek consent from the authority to alter, remove or replace it (FWMA (2010) Schedule 1, Section 1).

The LLFA liaises regularly with the EA, as well as the other RMAs, to ensure that all sources of flooding in their administrative area are managed appropriately.

District and Borough Councils can carry out flood risk management works on minor watercourses, working with the LLFA. Through the planning processes, they control development in their area, ensuring that flood risks are effectively managed.

CWaC are the Highway Authority within the administrative area of the reported flooding locations. Under Section 41 of the Highways Act (1980), CWaC are responsible for maintaining adopted highway drainage and roadside ditches and must ensure that road projects do not increase flood risk. Highway maintenance includes that of the road drainage networks (drains and gullies). Highway drainage is designed to drain the highway area and not to take overland flows from surrounding land and fields.

Under the Civil Contingencies Act (2004), CWaC are a Category 1 Responder and therefore have the statutory duty to put into action emergency plans and assess local risks to inform the emergency planning services. CWaC are also required to make information publicly available regarding civil protection matters, and to maintain arrangements to warn and advise the public in the event of an emergency.

2.2. The Environment Agency (EA)

The EA are responsible for taking a strategic overview of the management of all sources of flooding and coastal erosion and are responsible for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea. The EA is an RMA.

The EA have prepared strategic plans which set out how to manage risk, provide evidence (e.g. online flood mapping) and advise local and national Government. Section 165 of the Water Resources Act (1991) states the EA have permissive powers to undertake maintenance or emergency works on the aforementioned flooding sources. The FWMA (2010) outlines that the EA has powers to designate structures and features that affect flooding in order to protect assets that are relied upon for flood risk management for Main River and tidal sources.

The Environment Agency:

- provides and operates flood warning systems.
- carries out works to manage flood risk from the sea and main rivers.
- carries out works in estuaries to secure adequate outfalls for main rivers.
- carries out surveys to inform Flood Coastal Erosion Risk Management (FCERM) works.

- issues permits for works on or near main rivers, and works affecting watercourses, flood and sea defences and other structures protected by its byelaws.
- advises planning authorities on the implications of development proposals on flood risk.
- designates structures and features of the environment that affect flood or coastal erosion risk.
- has the right to enter private land to carry out FCERM works.

Under the Civil Contingencies Act (2004), the EA are a Category 1 Responder and therefore have the statutory duty to put into action emergency plans and assess local risks to inform the emergency planning services.

2.3. Water Companies

Welsh Water and United Utilities (UU) (as Sewerage undertakers) have a statutory duty under Section 94 of the Water Industry Act (1991) to provide, improve and extend such a system of public sewers (whether inside its area or elsewhere) and so as to cleanse and maintain those sewers as to ensure that that area is and continues to be effectually drained.

Welsh Water and UU are RMAs under the FWMA (2010) and is thus responsible for:

- managing the risks of flooding from their respective surface water, foul and/or combined sewer systems where the sewer flooding is wholly or partly caused by an increase in the volume of rainwater (including snow and other precipitations) entering or otherwise affecting the system.

Since the late 1970s, and with the first publication of Sewers for Adoption in 1980, sewer systems have typically been designed and constructed to accommodate a rainfall event with a 1 in 30-year return period. A severe event is classified by Ofwat as a rainfall event which exceeds a 1 in 20 return period. During severe weather events that exceed the design capacity of the infrastructure, it is more likely that the sewer system would be unable to cope and the chances of significant system surcharge or flooding would be greater.

Welsh Water and UU are a Category 2 responder under the Civil Contingencies Act (2004) and therefore have the responsibility to co-operate and share information with Category 1 responders to inform multi-agency planning frameworks.

2.4. Canal & River Trust (C&RT)

C&RT is a charity set up in 2012 to care for England and Wales' 200-year-old waterways, holding them in trust for the nation forever. It has responsibility for over 3,200km of navigable canals and rivers, together with bridges, tunnels, aqueducts, docks and reservoirs, along with museums and archive collections. C&RT is not identified in the FWMA as an RMA and:

- C&RT is not a Category 1 or 2 responder as defined by the Civils Contingencies Act 2004.
- C&RT does not have any specific statutory responsibilities in relation to flooding.

C&RT is not an RMA and have been consulted as a key stakeholder given responsibility for navigation assets that interact with the river and C&RT may therefore provide specific assistance in the event of a flood incident and support requests for input in a Section 19 flood investigation.

2.5. Riparian Owners

Riparian owners are those who own land or property adjacent to a watercourse. Riparian owners are not an RMA, though are considered relevant stakeholders. Riparian owners have a responsibility to:

- report an incident
- let water flow naturally
- prevent pollution
- protect wildlife
- maintain the bed and banks of the watercourse
- maintain any owned structures, such as trash screens, outfalls, flap valves, sluices and culverts

Section 25 of the Land Drainage Act (1991) outlines that where the flow of a watercourse is obstructed; the riparian owner is responsible to resolve the condition. Section 28 of the Land Drainage Act (1991) outlines the responsibility of the riparian owner to undertake maintenance of their watercourse if it is impeding the flow of water.

Riparian owners must let water flow through their land without obstruction and must accept flood flows through their land. Riparian owners have no duty in common law to improve the drainage capacity of a watercourse. Further information is contained within the EA guidance document *Owning a watercourse* (2018).

2.6. Local Residents and Businesses

Residents and businesses who are aware that they are at risk of flooding should take action to ensure that they and their properties are protected. Local residents and businesses are not an RMA, though are considered relevant stakeholders.

Residents and businesses should report flooding incidents or potential problems (such as blockages or sewer collapse) to the water authority or LLFA.

2.7. Cheshire Police, Fire and Rescue Service

The Police, Fire and Rescue Services are a Category 1 Responder under the Civil Contingencies Act (2004) and therefore have a responsibility, along with other organisations for developing emergency plans, contingency plans and business continuity plans to help reduce, control or ease the effects of an emergency. The Police, Fire and Rescue Services are not an RMA; however, are considered relevant stakeholders.

2.8. Parish Councils

Parish Councils are an elected local authority responsible for civil parishes. The responsibilities of the Parish Councils fall into three broad categories: representing the local community, delivering services to meet local needs, and improving quality of life and community well-being. In terms of flood risk, Parish Councils can play an important role in preparing flood plans, raising funding for flood resilience and flood defence schemes, and gathering information and reporting on flood events.

Some areas of the Cheshire West and Chester borough are represented by Parish Councils. The local Parish Councils are not an RMA; however, are considered relevant stakeholders.

3. Catchment Characteristics

Around 340,500 people live in the borough of Cheshire West and Chester, a third of which live in rural areas. The borough covers approximately 906 km² of land and is characterised by attractive countryside, varied landscapes and diverse settlements ranging from the historic city of Chester, the towns of Ellesmere Port, Northwich and Winsford to small rural hamlets. Chester is the central urban area of the borough.

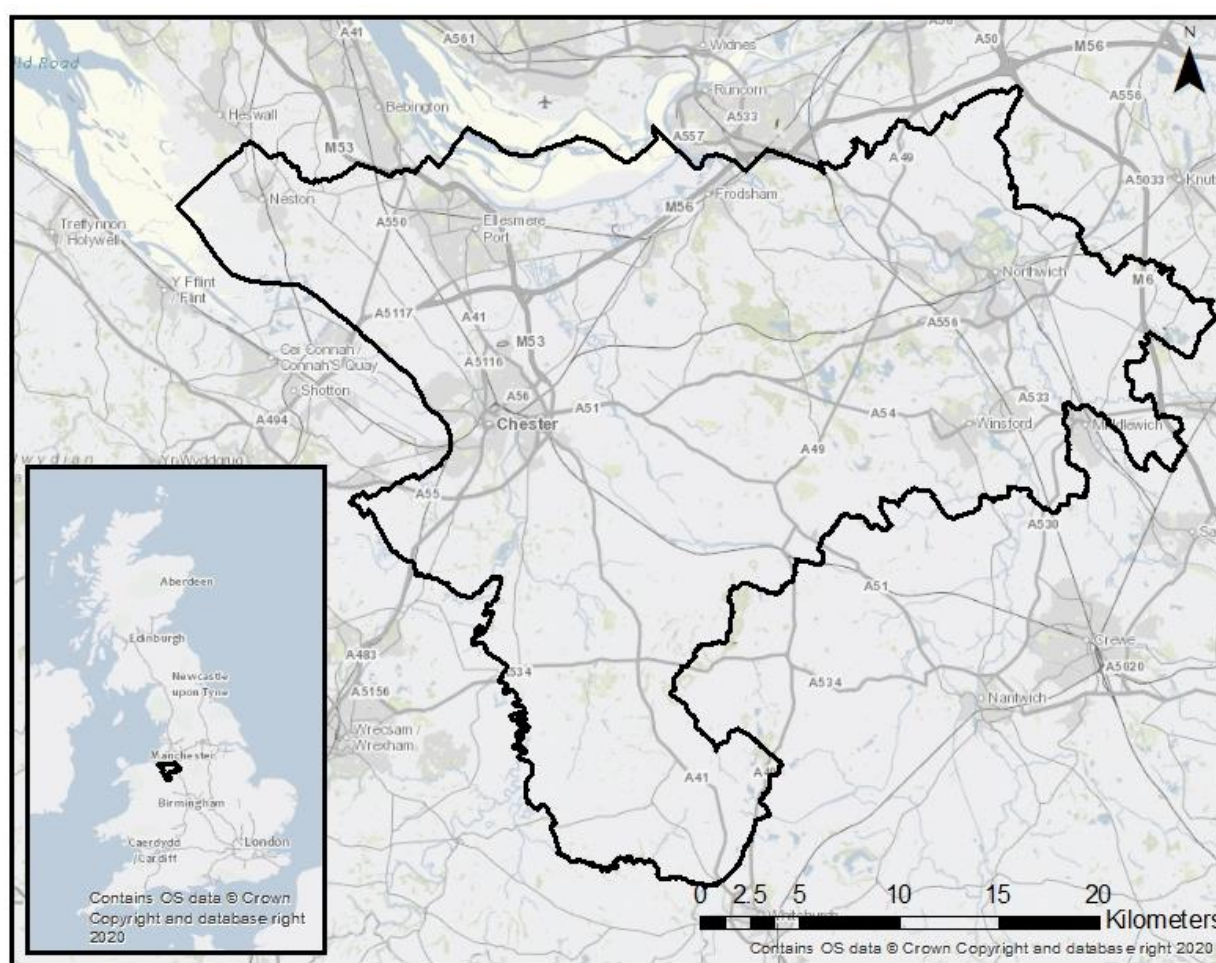
3.1. Land Use

The borough is divided into 46 wards and 166 civil parishes. The borough is one of four districts in the county of Cheshire, located in north-west England. Industries which provide the majority of employment in the borough include agriculture, health, retail, manufacturing and professional.

The borough has well established river infrastructure, including the Manchester Ship Canal, Shropshire Union Canal, Trent and Mersey Canal and the Weaver Navigation. Originally developed to transport locally produced salt, the Anderton Boat Lift near Northwich links the River Weaver with the Trent and Mersey Canal. The River Weaver, River Gowy, River Dee and River Dane are the most significant main rivers through the borough. The River Mersey also flows along part of the northern border.

The borough is served by good transport links including railway, major highways and cycling paths. There are nine rail lines with Chester as the main rail hub in the borough. The M6 to the east of the borough, the M56 and M53 are the three motorways in the borough which provide connections to nearby Liverpool, Manchester, Warrington and surrounding areas.

Figure 3-1 - Cheshire West and Chester Borough

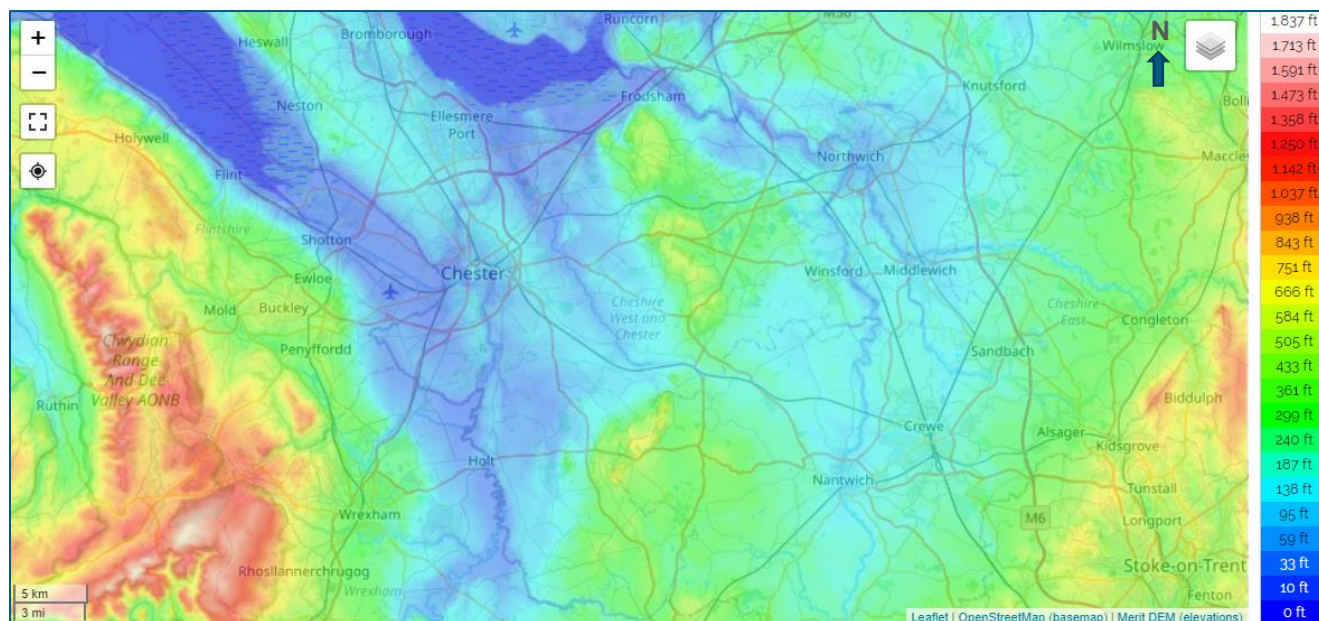


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3.2. Topography

Cheshire West and Chester is connected to the Irish Sea by the River Dee to the northwest and the River Mersey. The topographic map below indicates that the borough is characterised as a low, flat plain with a series of small ridges. The Cheshire Plain extends from the Mersey Valley in the north to the south past the borough boundary to the Shropshire Hills. The plain is bordered by the foothills of the Pennines to the northeast and the hills of the Welsh borders to the west.

Figure 3-2 - Topography of Cheshire West and Chester



Source – Topographic-maps, 2021 <https://en-gb.topographic-map.com/maps/dqge/Cheshire-West-and-Chester/>

3.3. Soils and Geology

Identification of the geology and soils underlying an area aids in determining the characteristics associated with both surface and ground water flooding. To assess if a flood alert/warning is required, this also helps develop a prediction to the time of concentration between the rainfall event and receiving watercourse.

The area of land in which the borough is situated on can be divided into the following layers:

- Soils
- Superficial Deposits
- Parent Material
- Bedrock

3.3.1. Soils

The Wallingford Procedure Geological Survey Map identifies that the Northwich area is predominantly Class 4 soil, Class 1 in the central area of the borough and a small amount of Class 3 near the Mersey, of the Winter Rainfall Acceptance Potential (WRAP) classification. The characteristics of these classes are outlined in the soil class characteristics table below.

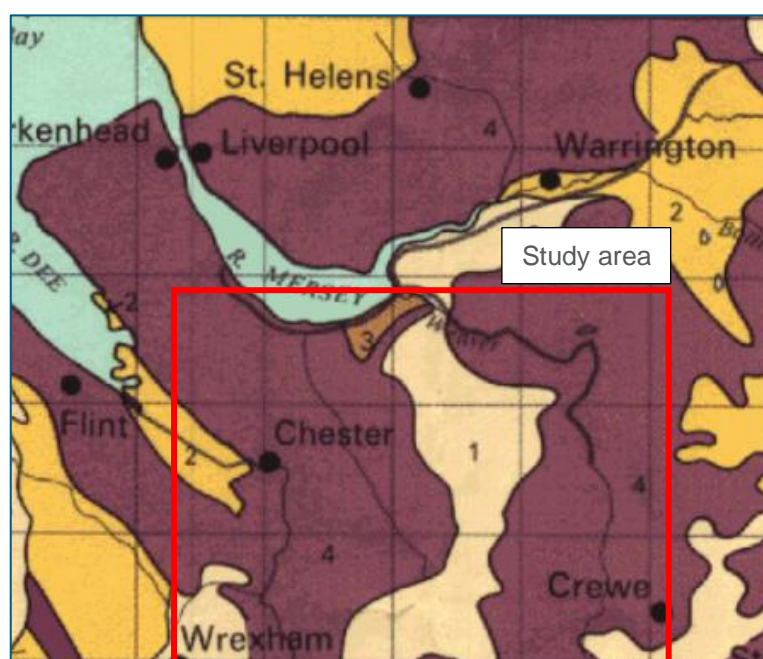
Table 3-1 - Soil Type Characteristics

W.R.A.P Class	General Description of Map Units
1	<ul style="list-style-type: none"> Well drained permeable sandy or loamy soils and shallower analogues over highly permeable limestone, chalk, sandstone or related drifts. Earthy peat soils drained by dikes and pumps. Less permeable loamy over clayey soils on plateaux adjacent to very permeable soils in valleys.
2	<ul style="list-style-type: none"> Very permeable soils with shallow groundwater. Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils. Moderately permeable soils, some with slowly permeable subsoils.
3	<ul style="list-style-type: none"> Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England. Permeable soils with shallow groundwater in low lying areas. Mixed areas of permeable and impermeable soils, in approximately equal proportions.
4	<ul style="list-style-type: none"> Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.
5	<p>Soils of the wet uplands with:</p> <ul style="list-style-type: none"> Peaty or humose surface horizons and impermeable layers at shallow depth. Deep raw peat associated with gentle upland slopes or basin sites. Bare rock cliffs and screes Shallow, permeable rocky soils on steep slopes

Source – National Water Council (1981)

Figure 3-3 - Soil Type Map of CWaC Area - Winter Rain Acceptance Potential Soil Map

Based on the New Wallingford Procedure Runoff Model



Source – National Water Council (1981)

3.3.2. Superficial Deposits

Underlying the soil, the superficial deposits are mostly till (Diamicton), alluvium along watercourses (clay, silt and sand), and glacial sand and gravel.

Superficial Deposits map of CWaC Area is contained in Appendix A.1.

3.3.3. Parent Material

Underlying the superficial deposits, the parent materials are Glacial till, Quaternary marine/ estuarine sand and silt, Glaciofluvial deposits, patches sandstone, mudstone and sand/gravel floodplain.

Parent Material map of CWaC Area is contained in Appendix A.2.

3.3.4. Bedrock

Underlying the parent material, the bedrock is Triassic Rocks – mudstone, siltstone and sandstone east of Delamere. Chester and Ellesmere Port has bedrock of sandstone and conglomerate, interbedded.

Bedrock map of CWaC Area is contained in Appendix A.3.

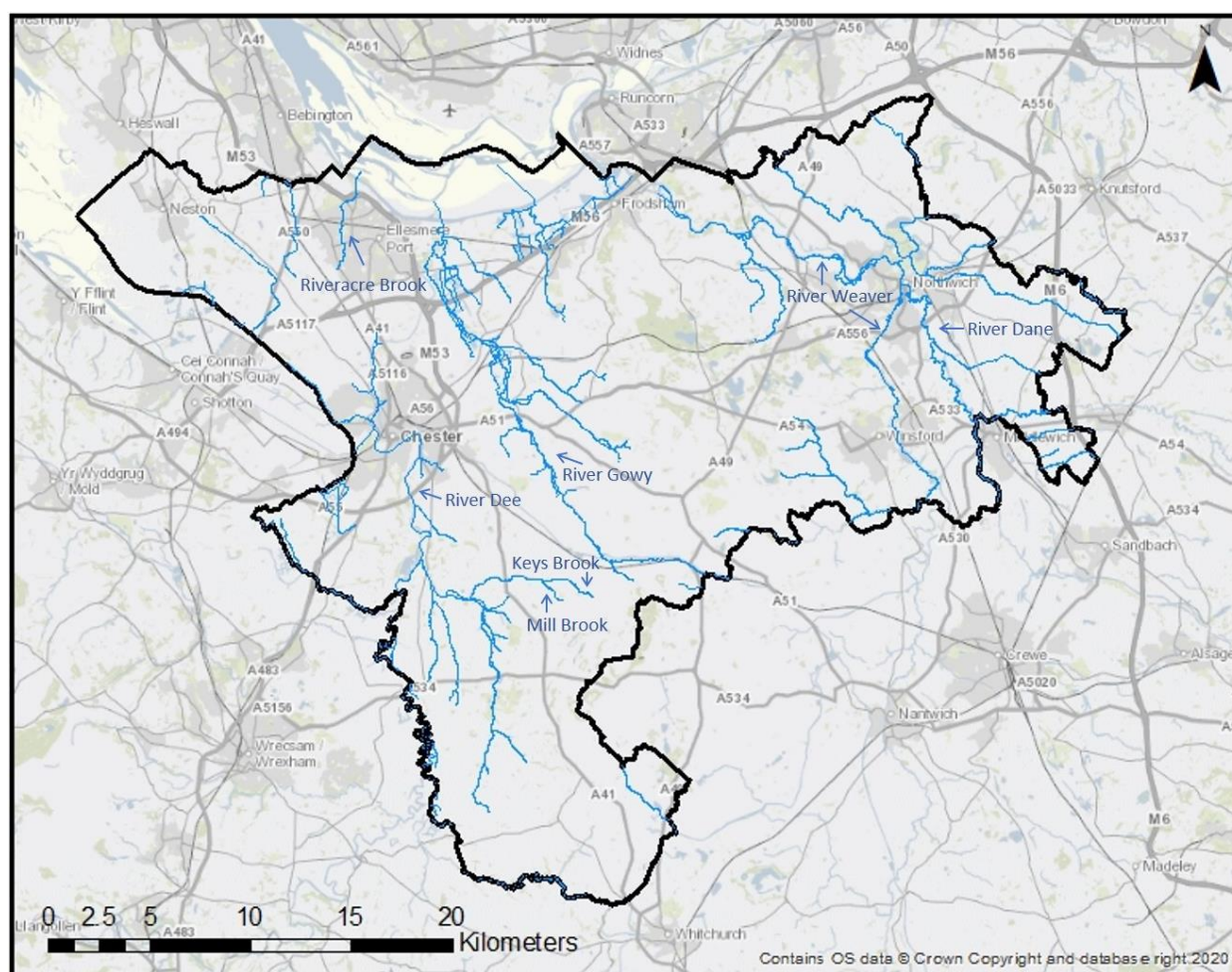
3.4. Watercourse Network

3.4.1. Main Rivers

There are a number of main rivers that flow through the Cheshire West and Chester borough, and that were affected by the flooding in January 2021, for which the Environment Agency have jurisdiction. These are:

- River Dane – Northwich town centre
- River Weaver – Northwich town centre, Winsford, Acton Bridge & Weaverham
- River Dee - Farndon, Chester Moorings, Blacon
- Finchett's Gutter and Highfield Drain - Blacon
- Mill Brook and Keys Brook – Tattenhall
- Small Brook and Crowton Brook – Crowton
- Rivacre Brook – Ellesmere Port
- River Gowy – Great Barrow

Figure 3-4 - Main River Map



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3.4.2. Ordinary Watercourses

Ordinary watercourses are any watercourses that are not designated Main River, they vary in size and can include rivers, streams, ditches, drains, culverts, cuts, dikes, sluices, sewers and passages through which water flows. There are a number of ordinary watercourses in the affected areas which are highlighted on the affected area maps in each section.

3.4.3. Canals/Navigable Waterways

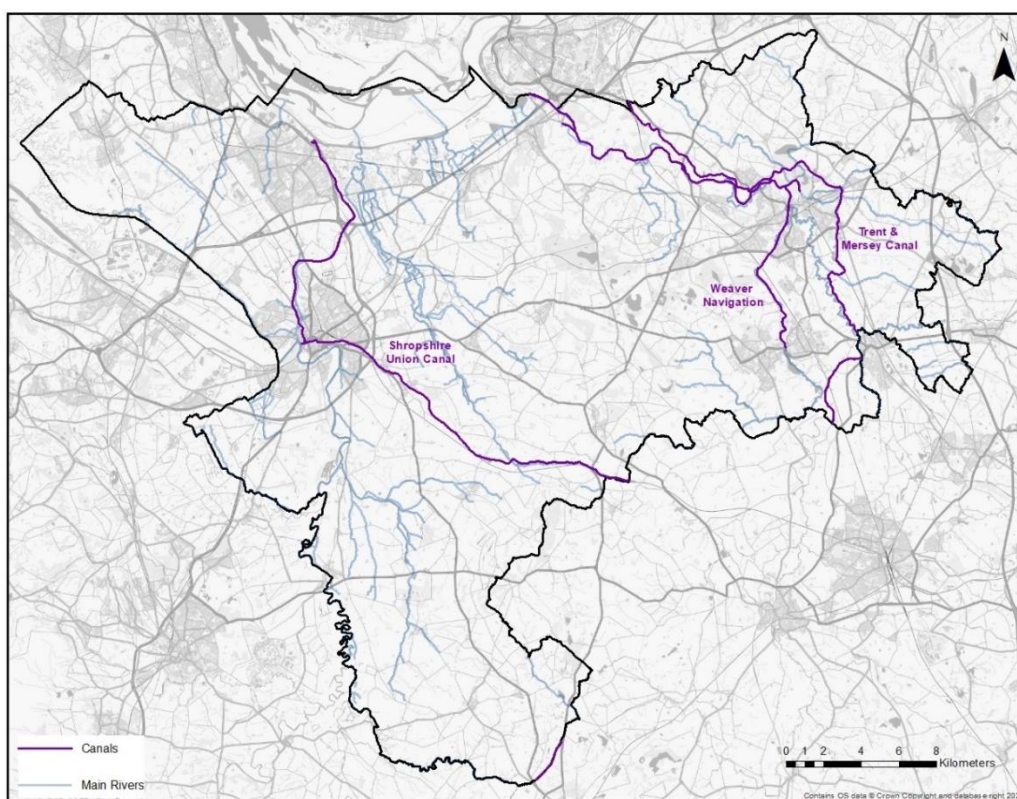
Though not a canal, the River Weaver Navigation runs through Northwich Town Centre. The River Weaver Navigation runs from Winsford Bridge to the Manchester Ship Canal at Weston Marsh Lock and Weston Point Docks and connects to the Trent and Mersey Canal via Anderton Boat Lift.

In Cheshire West and Cheshire, the Trent & Mersey Canal & River Weaver run parallel to each other. The Trent and Mersey Canal is a 150 km, which runs through Derbyshire, Staffordshire and Cheshire.

To the west of the borough, the Shropshire Union Canal runs through Chester, connecting Ellesmere Port on the River Mersey to Autherley Junction, near Wolverhampton.

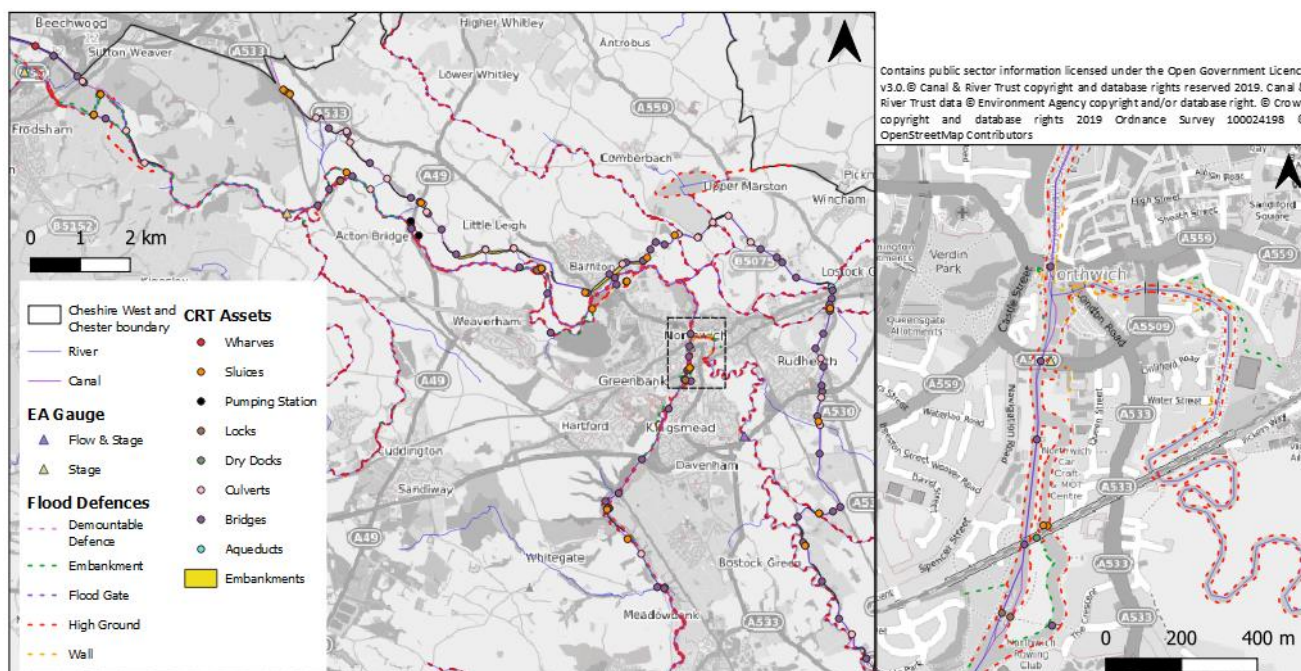
These canals and navigable waterways have associated locks and sluices, that act as flow control features within the waterways. The defences and assets along the Weaver Navigation are shown in Figure 3-6.

Figure 3-5 - Navigable Waterway Map Cheshire West and Chester Council



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Figure 3-6 - River Weaver defences and structures



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3.5. Flood Risk

Flood risk across Cheshire West and Chester borough comprises of fluvial flooding (river flooding) as well as surface water flooding from run-off due to limited open spaces or greenfield areas.

The combined foul and surface water sewers are at risk of surcharge (overloading of the sewer beyond its design capacity), as well as drain blockage.

The risk of flooding from canals is considered residual and would occur from leakage, collapse of structures, overtopping or blockage of conduits. However, canals can also act as conveyance routes (taking excess flows into other locations), and that flooding from canals is usually due to excess inflows of water, such as land drainage and surface water run-off entering the canal and exceeding the physical capacity of the canal to contain the volume or flow.

These risks are evaluated and presented in detail in CWaC's Level 1 Strategic Flood Risk Assessment.

The risk of flooding from rivers and sea in Cheshire West and Chester are outlined in Figure 3-7- Figure 3-11.

Flood Zones shown on the EA's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of surface water flood risk, climate change and consequent changes in the future probability of flooding. The following table explains the Flood Zones which appear on the maps:

Table 3-2 - Flood Zone Definitions

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments area of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Source: EA, 2020 <https://www.gov.uk/guidance/flood-risk-and-coastal-change#flood-zone-and-flood-risk-tables>

Northwich town centre area is largely within the EA's Flood Zones 2 and 3 and is at risk from fluvial flooding from the River Weaver and River Dane. Areas within North Frodsham, close to where the River Weaver joins the River Mersey are also within Flood Zones 2 and 3.

Areas east of Ellesmere Port, are located within Flood Zones 2 and 3 associated with the River Gowy, as well as some smaller towns further upstream such as Bridge Trafford.

Parts of west and southeast Chester, along the River Dee, are also located within Flood Zone 2 and 3.

The EA Flood warning service also produces surface water flood risk maps. High risk (1 in 30yr Flood) means that each year this area has a chance of flooding of greater than 3.3%. Medium risk (1 in 100yr Flood) means that each year this area has a chance of flooding of between 1 and 3.3%. Low risk (1 in 1000yr Flood) means that each year this area has a chance of flooding of between 0.1 and 1%.

Surface water flooding, sometimes known as flash flooding, happens when heavy rain cannot drain away, is difficult to predict as it depends on rainfall volume and location, can happen on high ground and away from rivers and other bodies of water, and is more widespread in areas with harder surfaces like concrete.

The surface water flood risk for Cheshire West and Chester is shown in Figure 3-12 - Figure 3-15.

Figure 3-7 - Cheshire West and Chester flood risk map reference

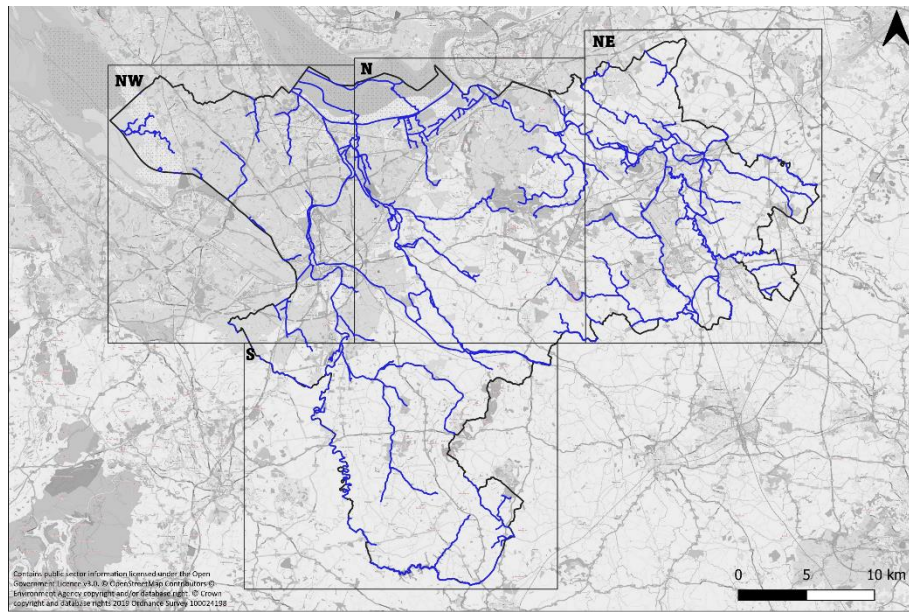


Figure 3-8 - Cheshire West and Chester (NW) Risk of Flooding from Rivers and Sea

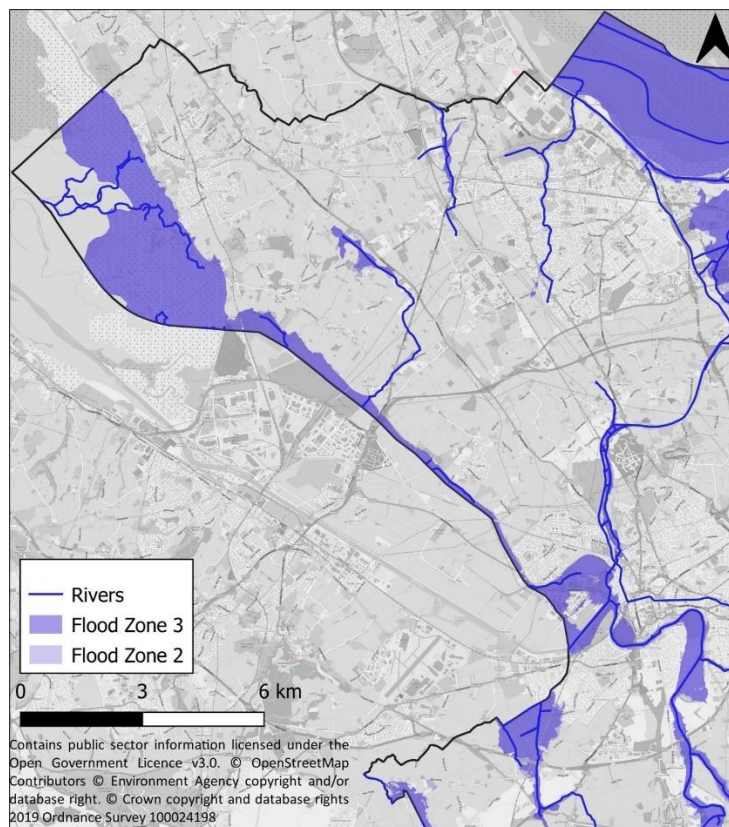


Figure 3-9 - Cheshire West and Chester (N) Risk of Flooding from Rivers and Sea

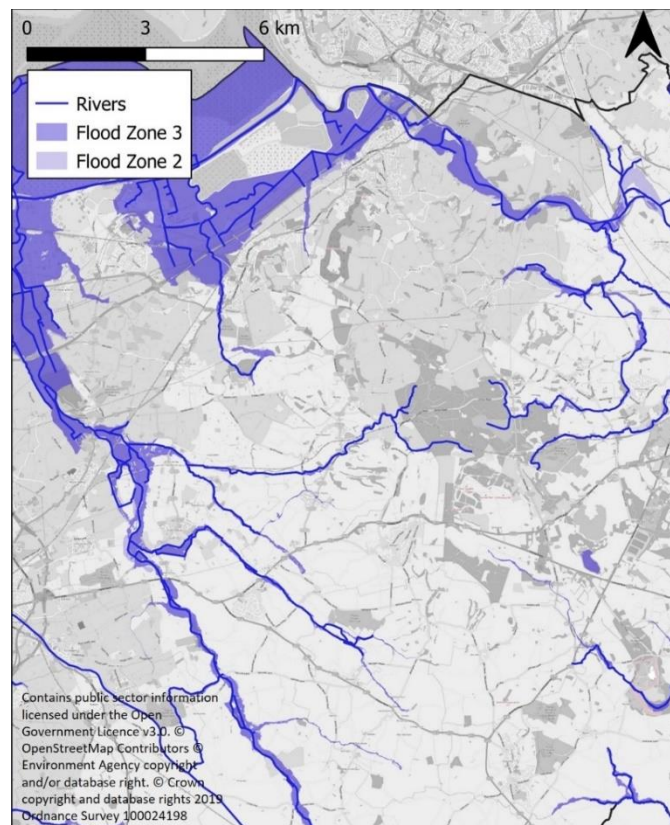


Figure 3-10 - Cheshire West and Chester (NE) Risk of Flooding from Rivers and Sea

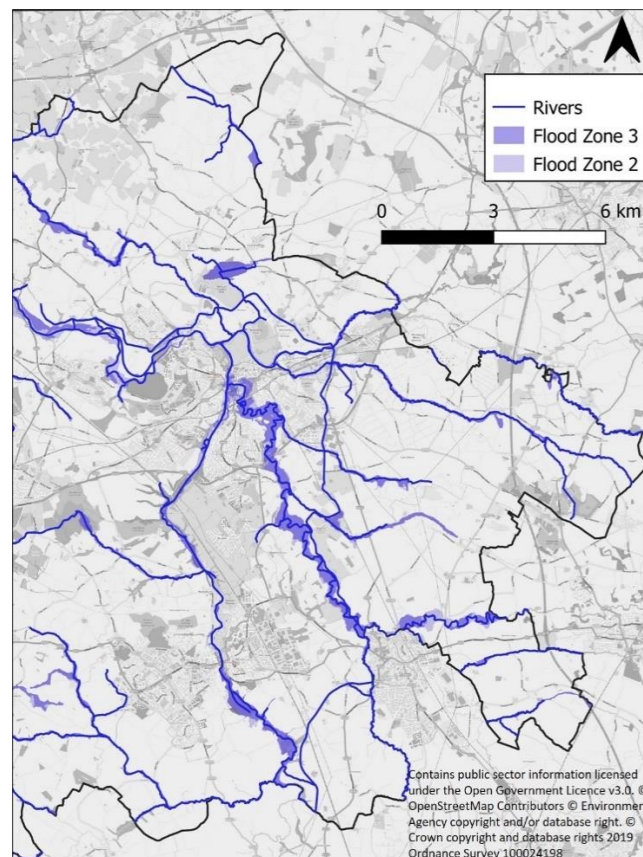


Figure 3-11 - Cheshire West and Chester (S) Risk of Flooding from Rivers and Sea

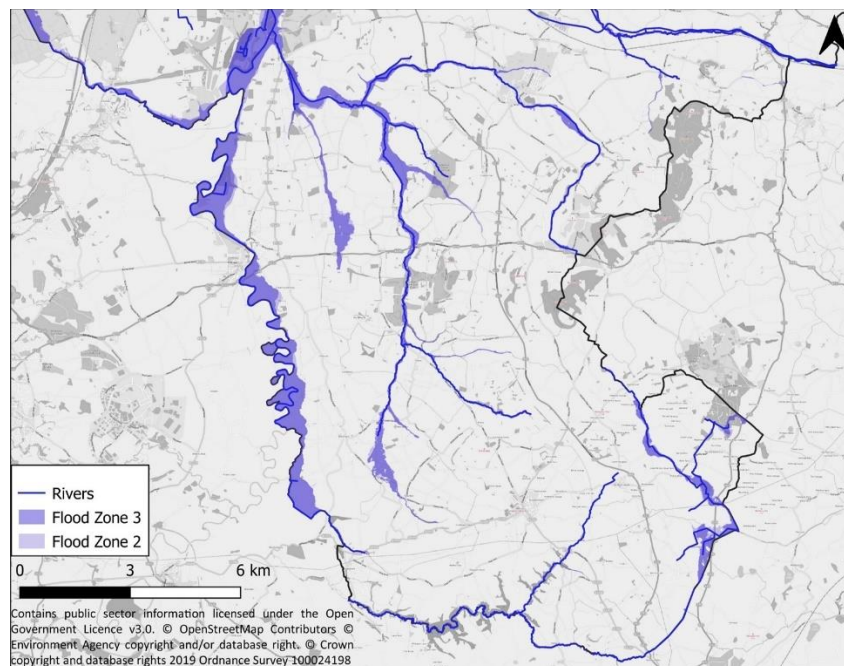


Figure 3-12 - Cheshire West and Chester (NW) Risk of Flooding from Surface Water

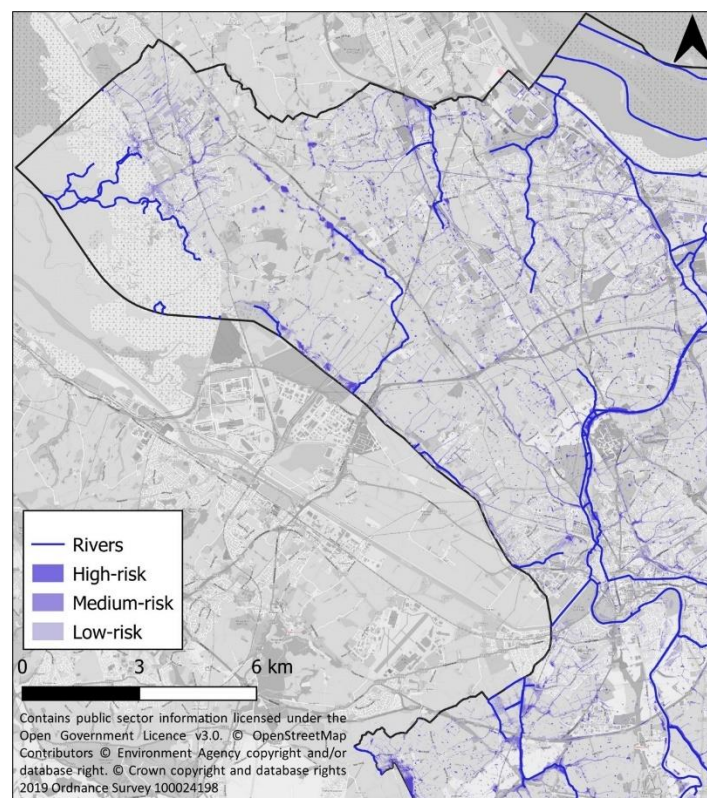


Figure 3-13 - Cheshire West and Chester (N) Risk of Flooding from Surface Water

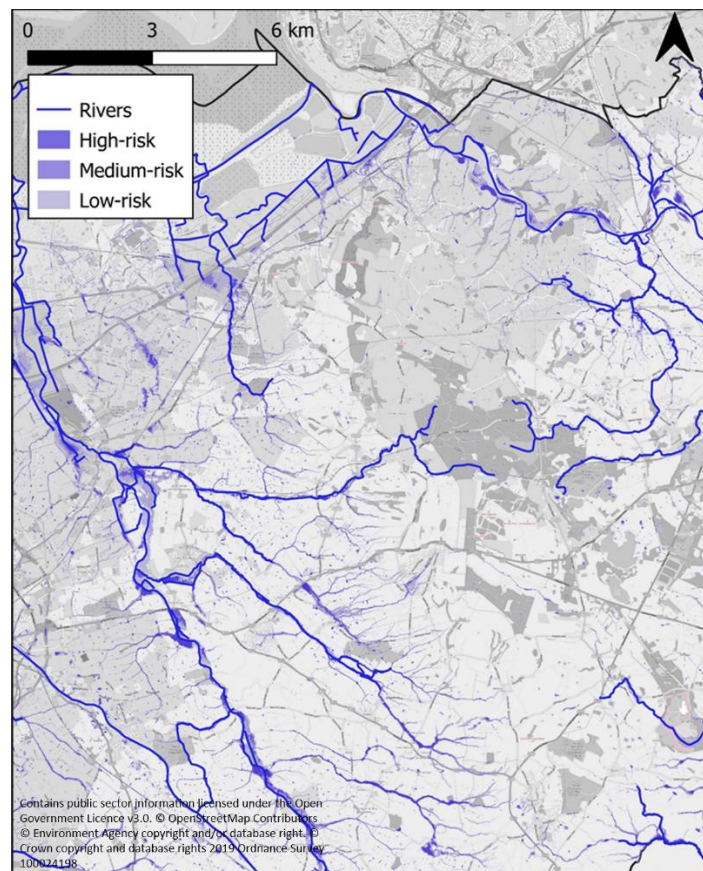


Figure 3-14 - Cheshire West and Chester (NE) Risk of Flooding from Surface Water

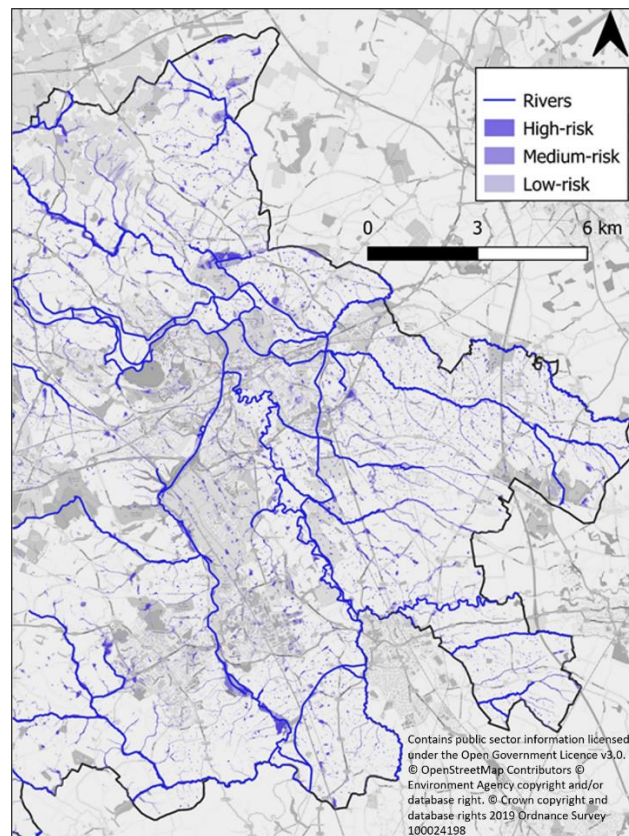
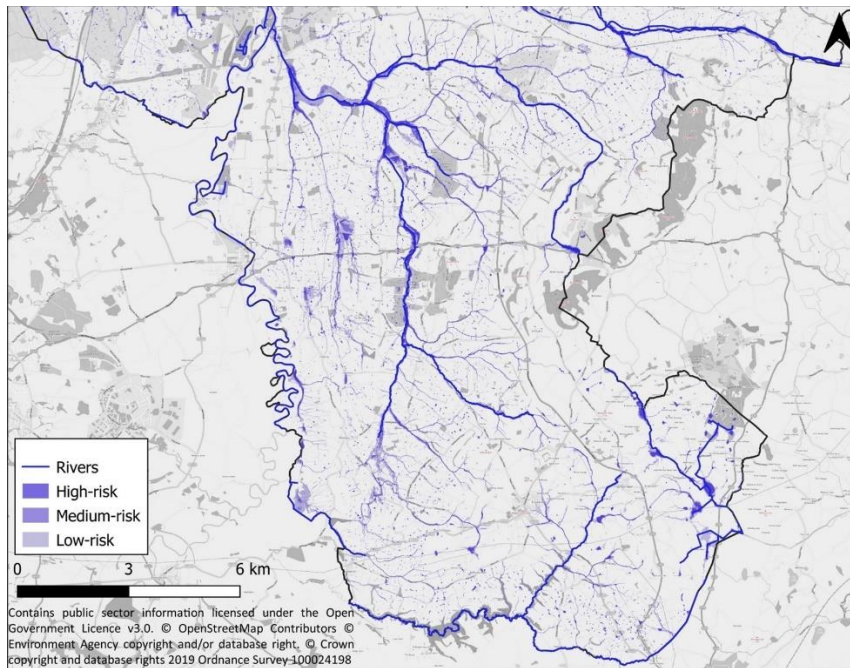


Figure 3-15 - Cheshire West and Chester (S) Risk of Flooding from Surface Water



3.6. Flooding History

There have been several recorded flood events in Cheshire West and Chester borough with the most severe occurring in 1946, and recent events occurring in 2000, 2012, 2015 and 2019. In October 2019, 23 properties were flooded internally, 8 externally and 8 highways over three distinct areas in and around Northwich.

The 1946 event was estimated to be in excess of a 1 in 100 probability flood event and the flooding was widespread. Historic flooding for each area has been included in the specific area sections.

4. Data Collection Summary

CWaC, as the LLFA, collected data and began consultations with the RMAs, affected property owners and the public upon subsidence of the flooding. The following sections provide an outline to the process followed.

4.1. Consultation

Each of the following parties involved with the flood incident were contacted to provide information. Table 4-1 provides a summary of the information shared with CWaC.

Table 4-1 - Data Provided through Consultation

Consultee	Data Requested/ Information Provided
Cheshire West and Chester Council	<ul style="list-style-type: none"> • Emails regarding flooding sent to LLFA • Multi-agency flood de-brief meeting notes • Photos of flood incidents • Waitrose (Northwich) indicative drainage plan • Highway gully plan • Road closure incidents • Agendas, minutes, papers and workload of Flood Risk Action Group (FRAG)
Environment Agency	<ul style="list-style-type: none"> • Flood alerts and warnings issued in the affected areas • Plans of EA flood defences in the affected areas • Correspondence with residents and other correspondence • Evidence review and flood event timeline including incident response • Rain and river gauge data
United Utilities and Welsh Water	<ul style="list-style-type: none"> • Maps of assets within affected areas • Timeline and performance summary of assets during flood event including incident response • The design criteria of the assets in the affected areas (e.g. design flow return periods and flood levels for water sensitive equipment in pumping stations) • Notifications received, observations and actions of UU staff during the event
Canal & River Trust	<ul style="list-style-type: none"> • Timeline and performance summary of assets during flood event for the affected areas • Operation and maintenance plans of relevant assets, and condition assessments if available
Met Office	<ul style="list-style-type: none"> • UK Monthly Climate Summary October 2019 • October 2019 Rainfall
Local Parish Councils and Flood Action Groups	<ul style="list-style-type: none"> • Photographs and anecdotal evidence • Flood outlines • Information regarding community projects to manage flood risk
Local Residents and Businesses	<ul style="list-style-type: none"> • Photographs and anecdotal evidence • Flood outlines

4.2. Data Review

Data collected confirmed the extents of flooding at each of the 28 affected areas within the Cheshire West and Chester borough. Incident response and conditions of the weather event have been reviewed as part of this investigation.

Topographic survey and GIS data of the relevant assets were requested in order to map these against the flood outlines of the event.

4.3. Site Investigations

Northwich resilience Meetings between the EA, UU and CWaC took place from February 2021 onwards in response to Storm Christoph to share understanding of what occurred during the event and to inform what actions need to be undertaken, primarily on a temporary basis.

Cheshire West and Chester constituted a Flood Risk Action Group (FRAG) to monitor the progress of the implementation of recommendations outlined in the Northwich 2019 S19 report; and to monitor the progress of the main S19 report for Storm Christoph across the borough. This group has received evidence and comment from interested stakeholders in the Northwich area and relevant RMAs.

CWaC and Atkins undertook site investigations in June and July 2021 to refine the understanding of the area's physical characteristics and to:

- Understand the area's topography and historic flood mechanisms
- Engage with local residents and businesses to capture local knowledge of the flood event
- CWaC have undertaken a letter drop consultation with affected business within Northwich

Residents and businesses directly affected by flooding were notified in advance of the site visits either verbally in person or through written communications. Local knowledge was captured through site consultations and shared notes, sketches and photographs.

5. Flood Incident Details

This section provides a summary of the environmental conditions that led to flooding in the January 2021 event.

The following information has been reviewed:

- EA Water Situation Reports – a monthly national report
- Met Office Storm Christoph Report
- Met Office Monthly UK Climate Summary January 2021
- National Hydrological Monitoring Programme. 2021. Hydrological summary for the United Kingdom: January 2021. Wallingford, UK Centre for Ecology & Hydrology (CEH).

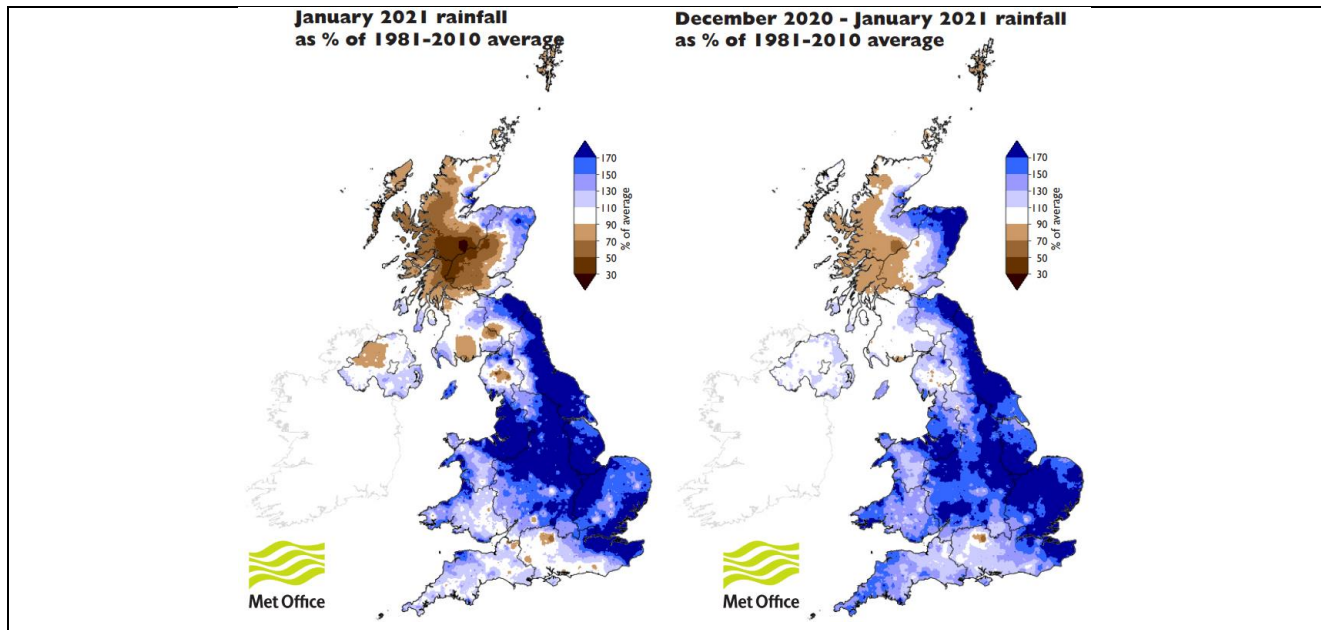
5.1. Rainfall Summary

Above average rainfall fell in December 2020 and January 2021 across most catchments in England.

- The rainfall total for North West England in January 2021 was 183mm representing 147% of the 1981 – 2010 long term average (CEH Hydrology report).
- Throughout January 2021 and December 2020, soils were wetter than average across almost the whole of England, with a soil moisture deficit (SMD) of less than 10mm in every region except London (EA Water Situation Report).

The start of January 2021 consisted of generally cold weather with wintry showers. After the 10th January 2021 it became milder and more unsettled, bringing about snow. During the third week it was very wet, particularly in the north west, where parts of Cheshire, Greater Manchester and Lancashire received approximately the January whole-month long-term average rainfall during the storm Christoph event (18th – 20th January 2021). From the 22nd January 2021 onward it was colder, with snow in many places (Met Office January Climate Summary).

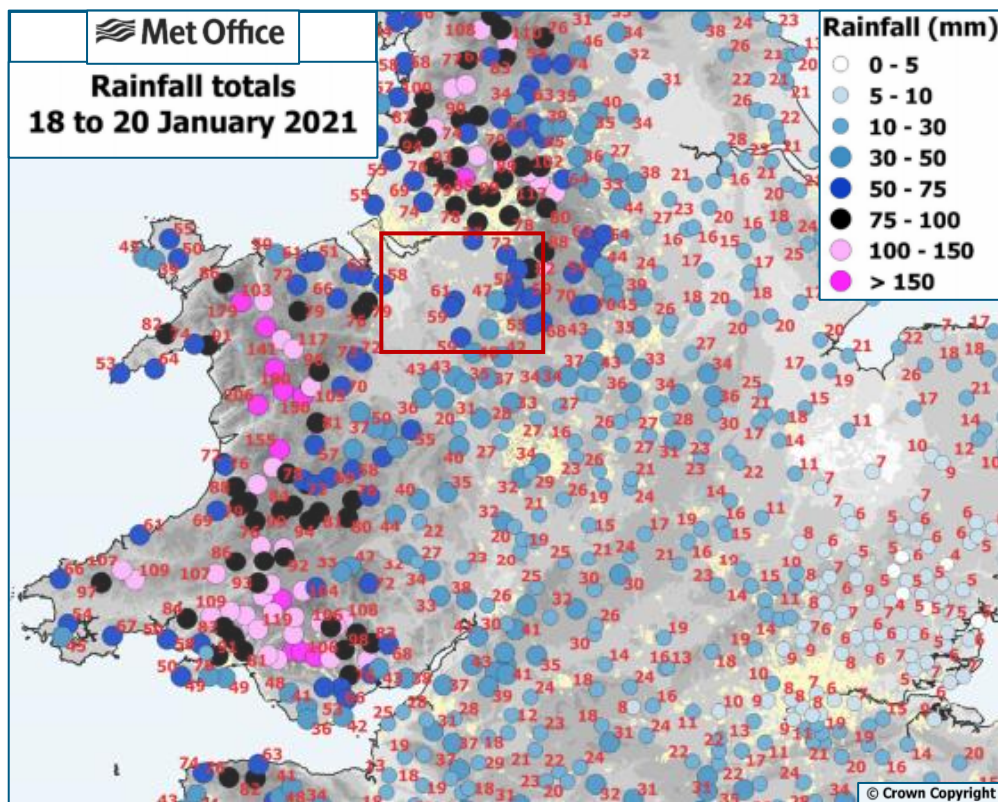
Figure 5-1 - Monthly rainfall across the UK



Source: UK CEH, 2021

For north-west England and North Wales Storm Christoph was one of the wettest 3-day periods on record. Figure 5-2 illustrates the rainfall over the period immediately prior to, and during, the flood event. It shows that high rainfall fell in the River Dane's upper catchment in the Peak District.

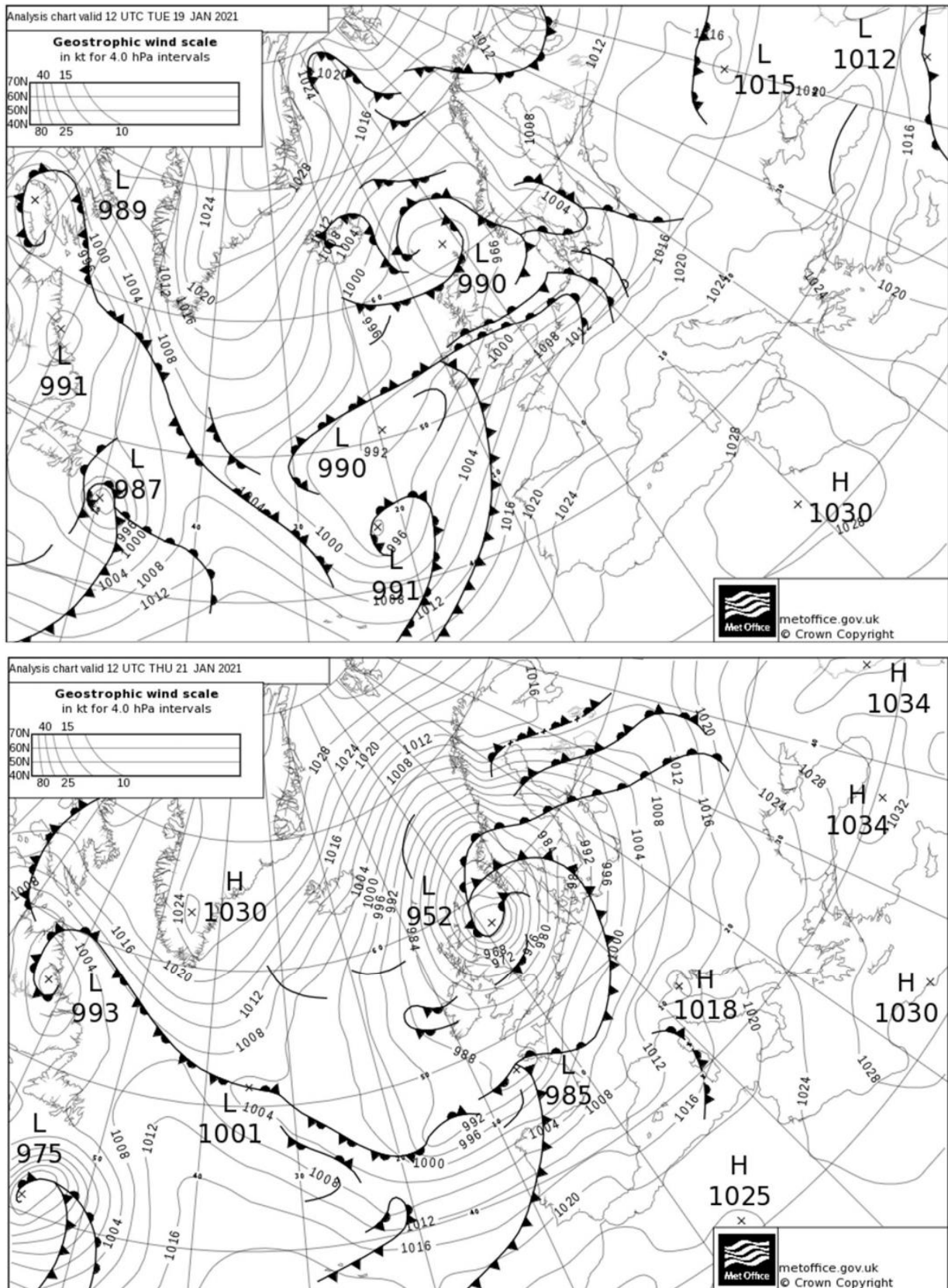
Figure 5-2 - Rainfall totals 18 to 20 January 2021



Source: Met Office Storm Christoph Report

The Met Office analysis data and charts show storm Christoph and associated fronts moving across the UK from the 19th – 21st, with the low deepening as the storm moved north-east across the North Sea (Figure 5-3).

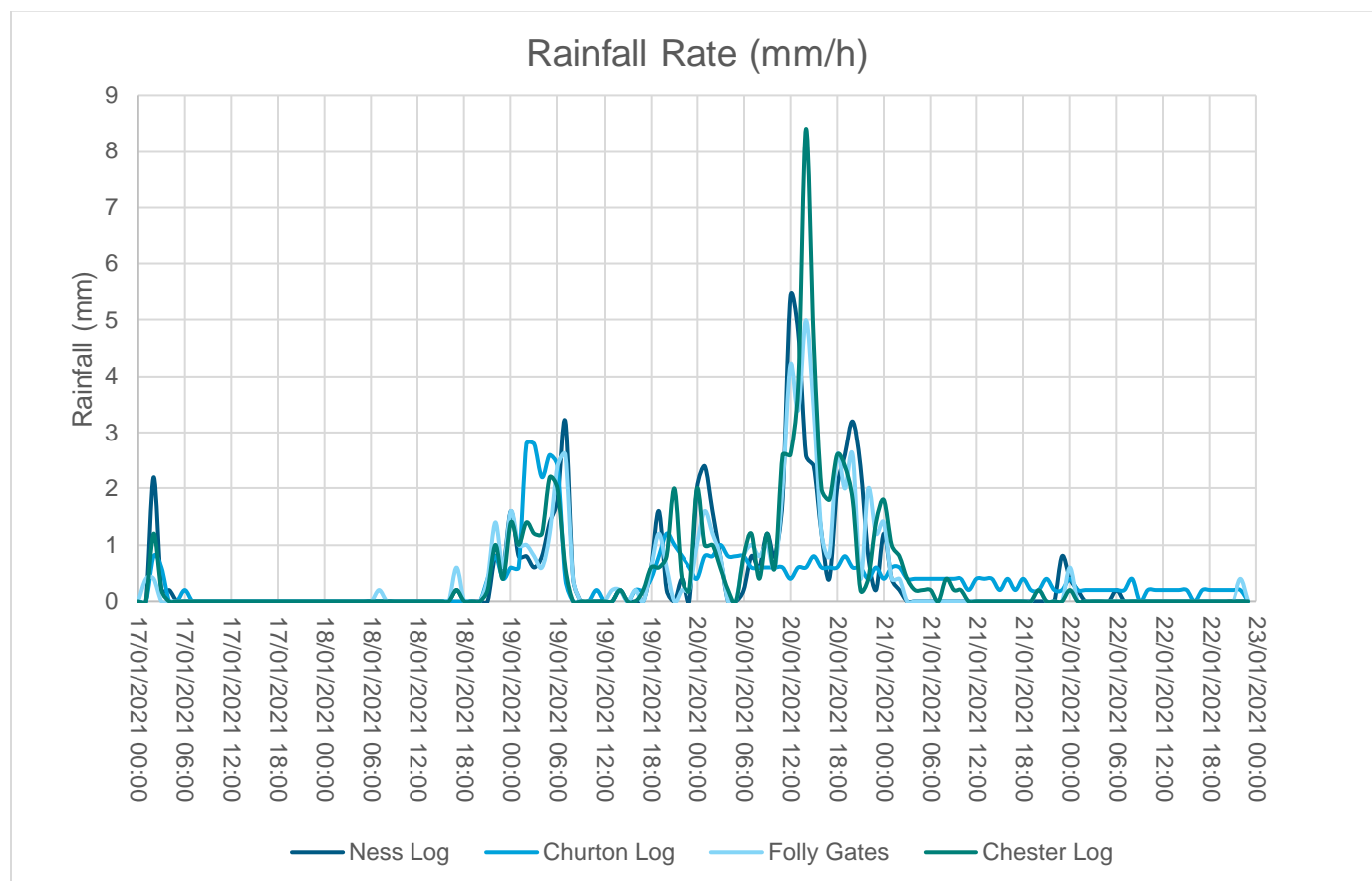
Figure 5-3 - UK Weather Summary 19-21 January 2021



Source: Met Office Storm Christoph Report

Figure 5-4 presents graphs of the Environment Agency rain gauge data recorded during this period. Table 5-1 presents rainfall totals from the rain gauge data for this event. Figure 5-5 provides a location plan of these gauges.

Figure 5-4 - Rain Gauge Data

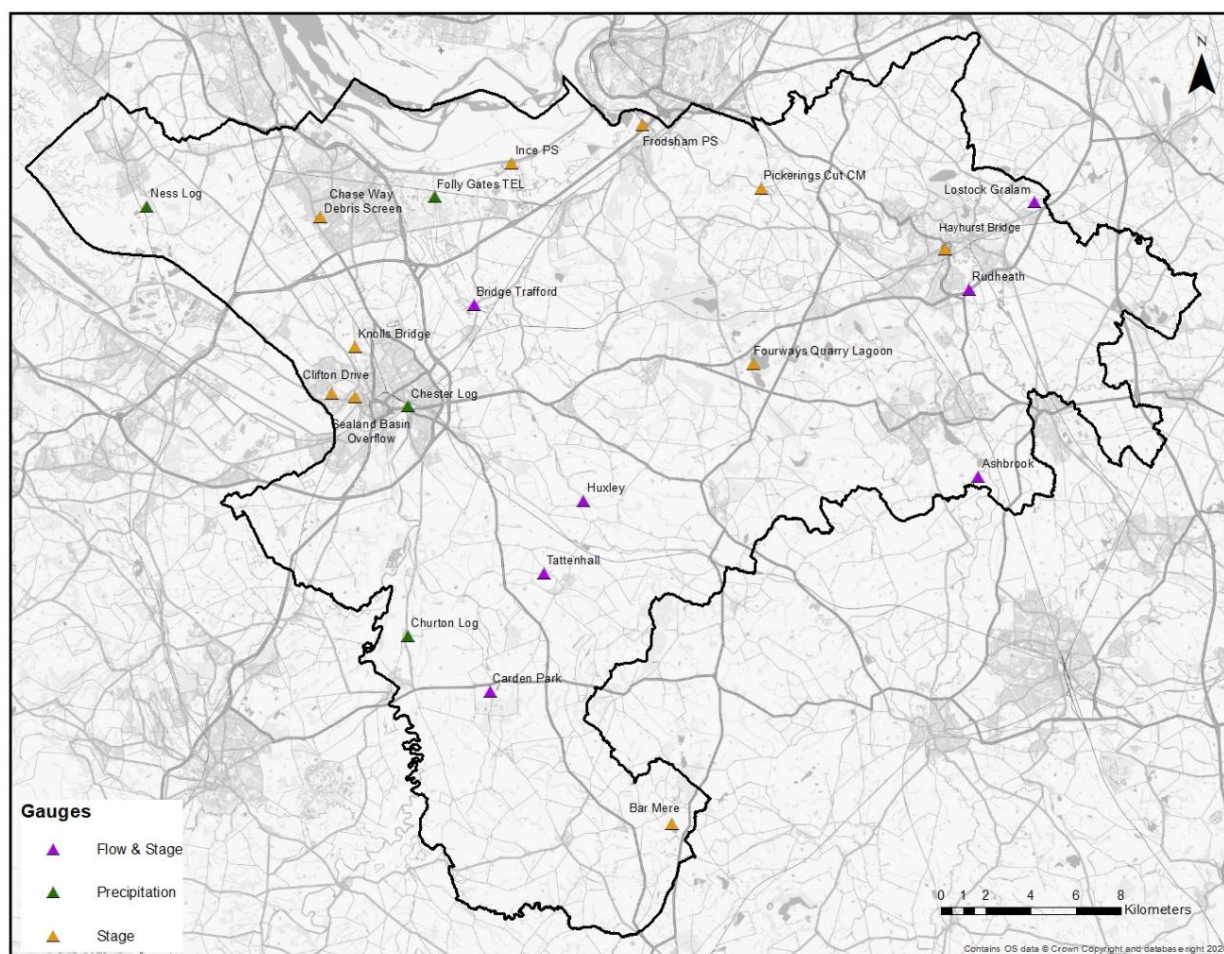


Source: Environment Agency, 2021

Table 5-1 – Rainfall Summary

Station	Event Rainfall Total (mm) from 17/01/21 0:00 to 22/01/21 23:59
Ness Log	62.2
Churton Log	52.0
Folly Gates	62.0
Chester Log	68.6

Figure 5-5 - Gauge Location Map



5.2. Watercourse Data

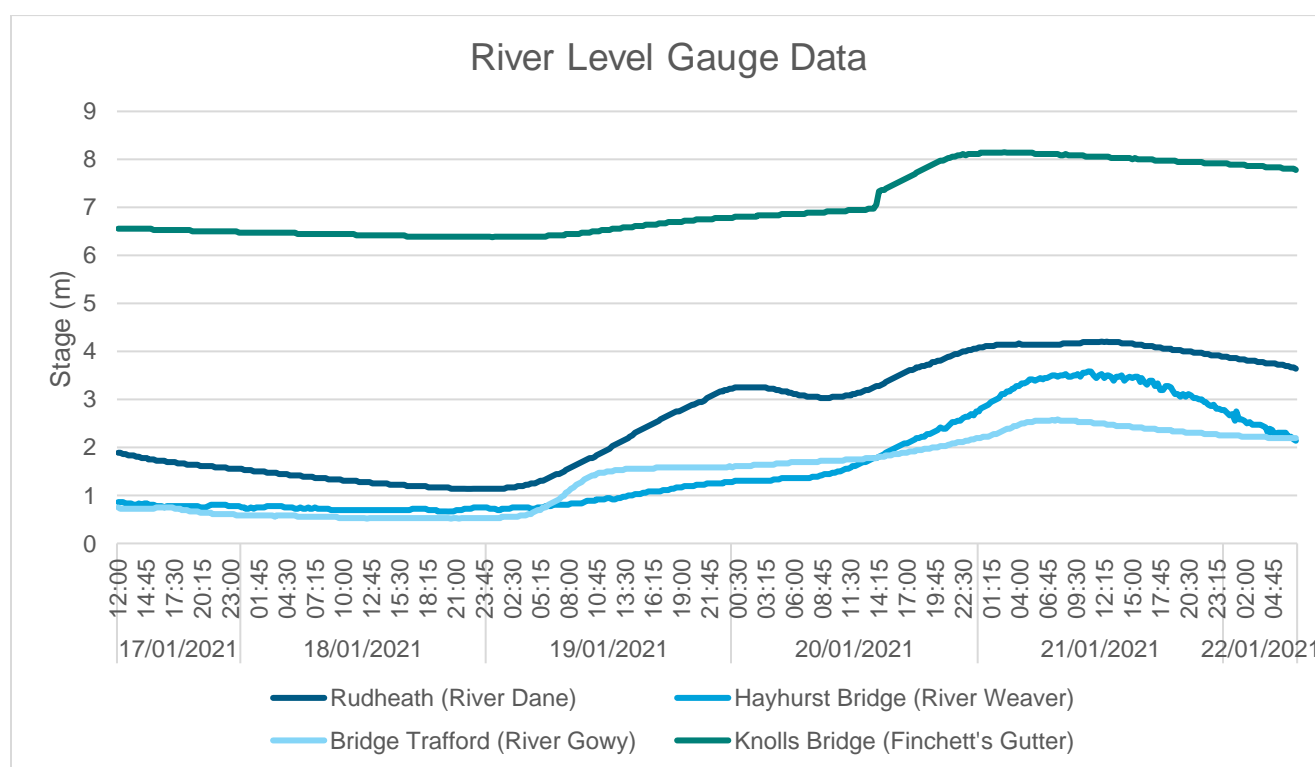
River flows were substantially above average in January 2021, monthly mean river flows being classed as exceptionally high or notably high at over half of indicator sites. These sites are constantly monitored by the EA to gauge river flows across the country (Water report, EA).

Table 5-2 provides details of the river gauges which have hydraulic connectivity and relevance to the areas affected by flooding. Figure 5-5 shows the location of these gauges, and Figure 5-6 indicates the river level at the gauge locations over the period of Storm Christoph flooding.

Table 5-2 - River Gauge Stations

Station	Comment
Rudheath River Dane Station No. 681210 366757, 371787	The usual range of the River Dane at Rudheath is between 0.24m and 2.40m. It has been between these levels for 90% of the time since monitoring began. 19/01/21: the water levels exceeded the above range. The highest level recorded during the storm Christoph event was 4.20m. Flooding was reported in the nearby areas of the River Dane and Weaver confluence.
Hayhurst Bridge River Weaver Station No. 680525 365682, 373589	The usual range of the River Weaver at Hayhurst Bridge is between 0.51m and 1.50m. It has been between these levels for 90% of the time since monitoring began. 20/01/21: the water levels exceeded the typical range. The highest level recorded during the storm Christoph event was 3.58m.
Bridge Trafford River Gowy Station No. 684027 344810, 371119	The usual range of the River Gowy at Bridge Trafford is between 0.20m and 1.60m. It has been between these levels for 90% of the time since monitoring began. 19/01/21: the water levels exceeded the above range. The highest level recorded during the storm Christoph event was 2.57m.
Knoll's Bridge Finchett's Gutter Station No. 67639 339540, 369255	Finchett's Gutter is a tributary to the River Dee, typical ranges for Knoll's Bridge are not known. 20/01/21: Stage increased rapidly to a maximum recorded level of 8.15m. Flooding was reported in the nearby area of Blacon.

Figure 5-6 - River Level Gauge Data



Source: EA River Level Gauge Data

5.3. Weather/Flood Warning

The FWMA (2010) dictates that the EA has permissive powers, but not a statutory duty, to issue flood warnings to communities at risk of flooding. Northwich and surrounding areas are covered by the EA's Flood Warning service and Flood Alert Areas. The Flood Warning Area is applicable to all Main Rivers. Flood Alert Areas are applicable to all Main Rivers and some adjacent discrete watercourses. There is currently no formal flood warning system for surface water flooding or sewer flooding.

The table below shows the warnings and alerts that were issued by the EA in the area from the 18th January 2021 to the 22nd January 2021.

Table 5-3 - EA Flood Alerts and Warning Summary

Alert/Warning	Code	Name	Date	Time
Alert	013WAFWE	Weaver catchment including Nantwich, Frodsham, Crewe, Winsford and Northwich	18/01/21	19:38
Alert	013WAFWI	Wirral catchment with Heswall, Ellesmere Port, Bebington, Hoylake and Wallasey	18/01/21	20:34
Alert	013WAFDEE	River Dee catchment in England from Whitchurch to Chester	19/01/21	20:10
Warning	013FWFCH41	River Weaver at Acton Bridge and Weaverham	19/01/21	21:57
Warning	013FWFCH24	River Weaver at Northwich Marina	20/01/21	09:30
Warning	013FWFCH34	Weaver Navigation at Winsford	20/01/21	09:33
Warning	013FWFCH32	Rivacre Brook at Great Sutton	20/01/21	14:29
Warning	013FWFCH48	Weaver Navigation at Sutton Dock	20/01/21	16:01
Warning	013FWFCH42	River Weaver at Little Leigh and Higher properties in Acton Bridge and Weaverham	20/01/21	18:18
Warning	013FWFCH26	River Weaver at Navigation Road and Marine Approach	20/01/21	21:49
Warning	013FWFCH40	River Weaver at Anderton	20/01/21	21:50
Warning	013FWFCH50	English River Dee at Farndon	21/01/21	00:10
Severe Warning	013FWFCH50	English River Dee at Farndon	21/01/21	10:19
Warning	013FWTTCH17	Tidal River Dee from Grosvenor Bridge to the Groves	22/01/21	06:49

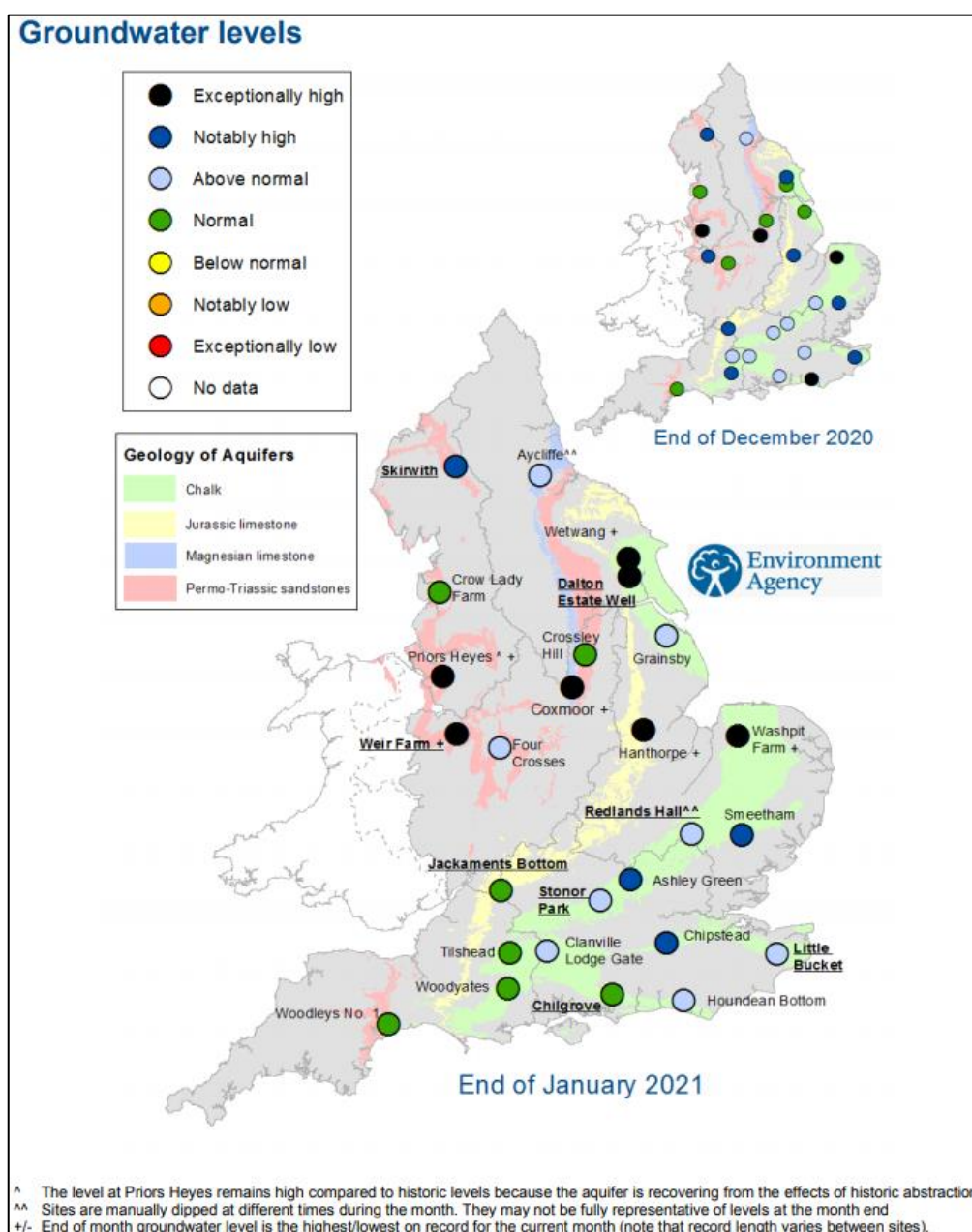
There are three flood warning codes depending on the severity of flooding expected. They are also issued at different intervals in advance of flooding, based on forecast level thresholds set at warning gauges:

- A Flood Alert might be issued two hours to two days in advance of flooding and means that flooding is possible and to tell recipients to be prepared.
- Flood Warnings mean that flooding is expected, and immediate action is required, these are often issued half an hour to two hours in advance of flooding.
- Severe Flood Warning means that there is a risk of severe flooding and there is a danger to life. It is used when flooding poses a significant risk to life or significant disruption to communities.

5.4. Groundwater Conditions

Groundwater levels throughout England were classed as above normal or higher for all sites reported on in the EA Water report for the time of year. Exceptionally high groundwater levels were recorded at over a quarter of sites and 6 sites recorded the highest end of January levels on record, including Prior Heyes (West Cheshire sandstone). However, it should be noted that levels at Prior Heyes are considered high compared to historic levels because the aquifer is recovering from the effects of historic abstraction (Water Report, EA).

Figure 5-7 - Groundwater levels January 2021



Source: EA, Water Situation report January 2021

There are several groundwater monitoring stations in the Cheshire West and Chester borough. Figure 5-8 shows three monitoring stations spread across the borough and their respective groundwater levels over the 2020-2021 period are shown in Figure 5-9.

Figure 5-8 - Location map of groundwater monitors

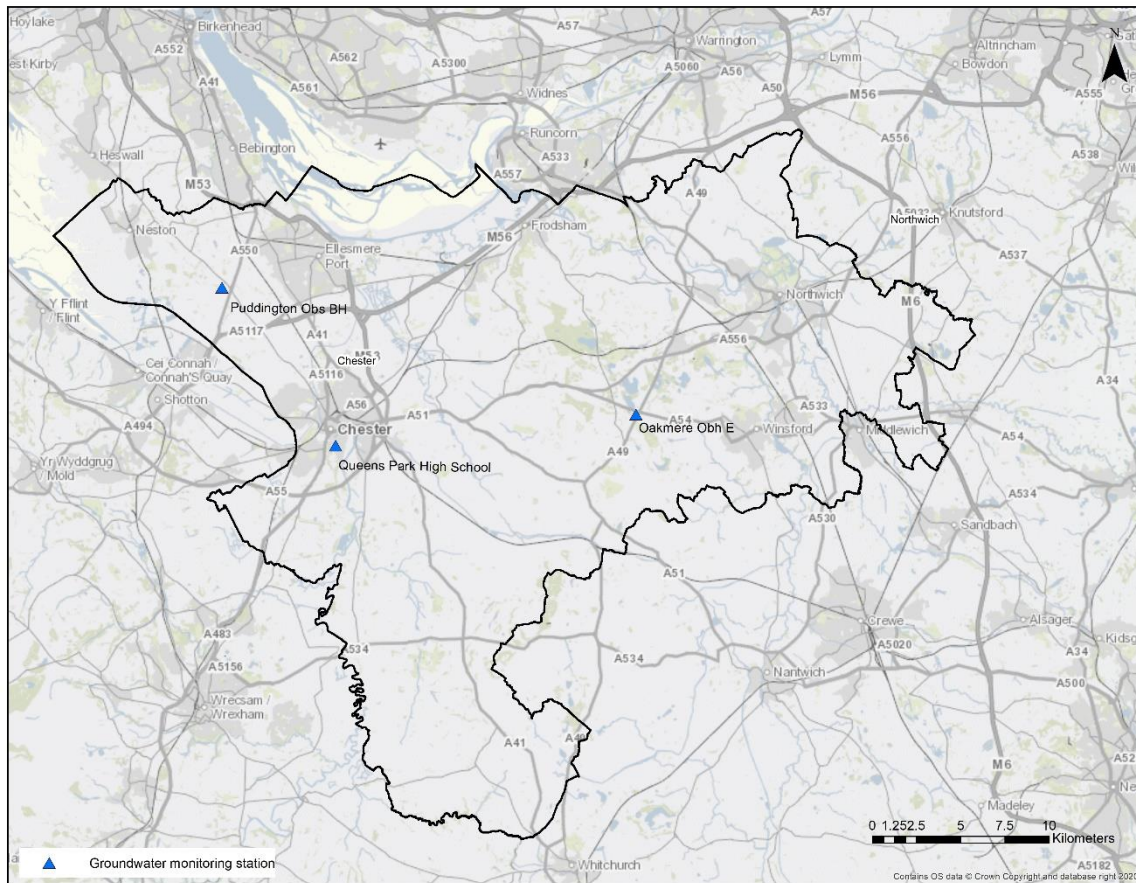
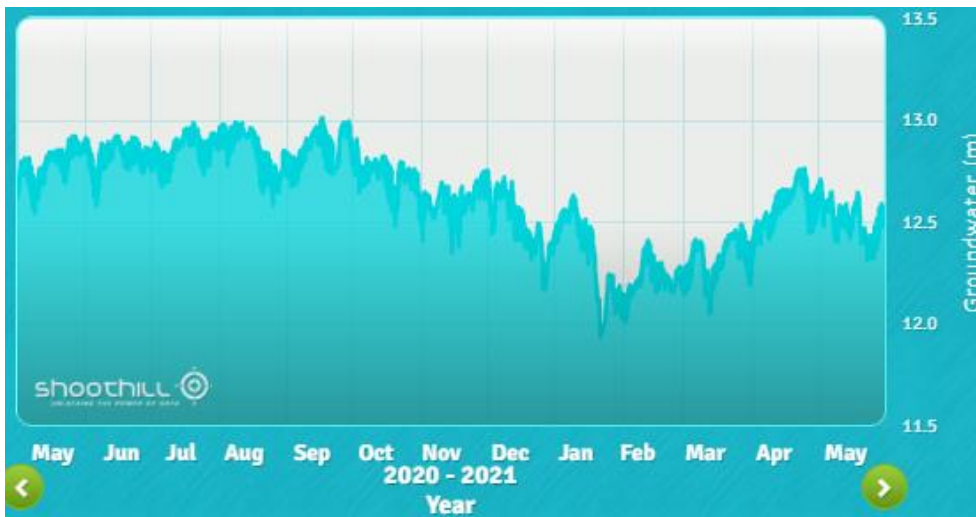


Figure 5-9 - Groundwater monitoring data



Oakmere Obh E



Queens Park High School



Puddington Obs BH

Source: Flood Assist, 2021

By inspection, the results above indicate that the groundwater levels at the time of the flood event varied across the borough. Groundwater levels at Oakmere Obh E were high throughout winter leading up to the Storm Christoph event. At Queens Park High School groundwater levels peaked during the winter and appeared to be falling in the lead up to the Storm Christoph event. The groundwater levels at Paddington appeared to be more stable approaching the Storm Christoph event. The levels at these boreholes define only 3 points within the borough and therefore are unlikely to be representative of levels across the borough.

6. Flooding Review

Key statistics for the whole borough are summarised in Table 6-1, area specific information is provided in the area sections of this report 28 separate areas have been affected by the flooding in January 2021. A detailed timeline of the flood event can be found in each area specific section.

Table 6-1 - Flood Impact Summary

Area of Risk	Residential properties affected:	Commercial properties affected:	Number of properties evacuated:	Number of properties flooded:	Number of domestic properties flooded:	Number of commercial properties flooded:
Ashton Hayes	11	0	3	7	7	0
Kelsall	1	0	0	1	1	0
Blacon	24	7	15	27	20	7
Upton	2	0	0	1	1	0
Chester Moorings	11	6	0	0	0	0
Great Barrow	7	1	0	4	3	1
Great Boughton	1	0	0	0	0	0
Farndon	24	0	4	3	3	0
Ellesmere Port	30	0	7	18	18	0
Hooton	39	1	7	12	11	1
Northwich town centre	94	65	63	47	1	46
Acton Bridge, Weaverham, Little Leigh & Crowton	34	2	20	29	28	1
Saughall	8	0	2	2	2	0
Tattenhall	19	6	6	20	15	5
Davenham	11	0	0	5	5	0
Mickle Trafford	2	0	0	1	1	0
Tilston	2	0	0	2	2	0
Guilden Sutton (Highway only)	0	0	0	0	0	0
Tarporley	5	0	0	3	3	0
Wettenhall (Highway only)	0	0	0	0	0	0
Willaston	3	0	2	3	3	0
Winsford	0	17	12	8	0	8

Area of Risk	Residential properties affected:	Commercial properties affected:	Number of properties evacuated:	Number of properties flooded:	Number of domestic properties flooded:	Number of commercial properties flooded:
Sproston	0	1	0	0	0	0
Antrobus	2	0	0	2	2	0
Comberbach (Highway only)	0	0	0	0	0	0
Kingsley	1	0	0	1	1	0
Dutton	0	0	0	0	0	0
Lach Dennis & Lostock (Highway only)	0	0	0	0	0	0
Totals:	330	106	141	195	126	69

Actions taken since Storm Christoph are provided in each Area Section.

7. Area Specific Reports

The area specific reports are in Appendix B for the following areas:

- Acton Bridge and Weaverham (including Crowton, Little Leigh, Pickerings Lock, Acton Bridge, Dutton and Weaverham)
- Antrobus
- Ashton Hayes
- Blacon
- Davenham
- Ellesmere Port
- Farndon
- Great Barrow
- Hooton
- Kelsall
- Kingsley
- Mickle Trafford
- Northwich
- Saughall
- Tarpoley
- Tattenhall
- Tilston
- Upton Park
- Willaston
- Winsford

7.1. Highway Flooding

The following areas were affected by flooding during Storm Christoph but this flooding was restricted to highways, no internal flooding to property was experienced. Therefore, separate main reports have not been produced for:

- Chester Moorings
- Comberbach
- Dutton
- Great Boughton
- Guildon Sutton
- Lach Dennis and Lostock
- Sproston
- Wettenhall

8. Contacts and Useful Links

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
Welsh Water	Report a sewer flooding or sewerage emergency 0800 085 3968 Contact Dŵr Cymru Welsh Water (dwrcymru.com)
Flooding from a Burst Water Mains	
United Utilities	Report a leak 0800 330033 www.unitedutilities.com
Welsh Water	Report a leak 0800 052 0130 Contact Dŵr Cymru Welsh Water (dwrcymru.com)
Flooding from the Public Highway, Drains or Ordinary Watercourses (Non-Main River)	
Cheshire West and Chester Council	<p>The Council is responsible for dealing with carriageway flooding and flooding from highway drains.</p> <p>Call us on 0300 123 7 036 if you see dangerous flooding on a road or the flood is putting homes at risk.</p> <p>If a gully is blocked but not causing dangerous flooding it will be cleansed as part of the routine cleansing programme.</p> <p>https://www.cheshirewestandchester.gov.uk/residents/contact-us/report-it/potholes-and-road-faults.aspx</p>
Flooding from a Main River	
Environment Agency	<p>General enquiries 03708 506 506 (Mon-Fri, 8am – 6pm)</p> <p>Incident hotline 0800 80 70 60 (24-hour service)</p> <p>Floodline 0345 988 1188 (24-hour service)</p> <p>General enquiries email enquiries@environment-agency.gov.uk</p>
Flooding or Breach of a Canal	
Canal & River Trust	General enquiries 0303 040 4040 (Mon-Fri, 9am – 5pm)

	Emergency hotline 0800 47 999 47 (24-hour service)
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Useful Web Resources

The following web links contain useful information about being prepared, understanding flood risk and reporting drainage issues to CWaC.	
Being Prepared	
Prepare for a flood and get help during and after:	www.gov.uk/prepare-for-a-flood/get-help-after-a-flood
Prepare a Checklist and Action Plan (National Flood Forum)	https://nationalfloodforum.org.uk/about-flooding/preparing/checklist-action-plan/
Make a personal flood plan:	www.gov.uk/government/publications/personal-flood-plan
Prepare your property for flooding:	www.gov.uk/government/uploads/system/uploads/attachment_data/file/451622/LIT_4284.pdf
Flood information and resources:	https://thefloodhub.co.uk/
Understanding Flood Risk and Flood Warnings	
Check current flood warnings and river levels:	www.gov.uk/check-if-youre-at-risk-of-flooding
Sign up for flood warnings:	www.gov.uk/sign-up-for-flood-warnings
Finding Utility Provider	
Find your water and sewerage company	http://ccwater.custhelp.com/app/answers/detail/a_id/418

Bibliography

1M DTM LiDAR Data, Main River Map, Flood Zone Definitions, Flood Risk Map, Surface Water Flood Risk Map – Environment Agency, Open Source, 2020.

Flood Defences Location Plan, Rain and River Gauge Data, Water Situation Report October 2019, Flooded Properties Location Plan- Environment Agency, 2019.

Soil Type Characteristics and Map - National Water Council, 1981.

Navigable Waterway Maps - Canal and River Trust, Open Source, 2020.

Surface Water Flood Map – Northwich Town Centre, Pumping Station Location Plan, Outfall Location Plan, Baron's Quay Pumping Station Arrangement, Dock Road Pumping Station Arrangement - United Utilities, 2020.

CWaC Highway Gully Location Plan – Cheshire West and Chester Council, 2020.

Waitrose Drainage Plans – Healey Consulting, 2013.

Monthly Rainfall across England and Wales, UKPP Radar Data – Met Office, 2019.

Rainfall totals 9am 24 Oct to 9am 27 Oct 2019, October Rainfall 2019 Report – Met Office, 2019.

Groundwater levels data – Flood Assist, 2020.

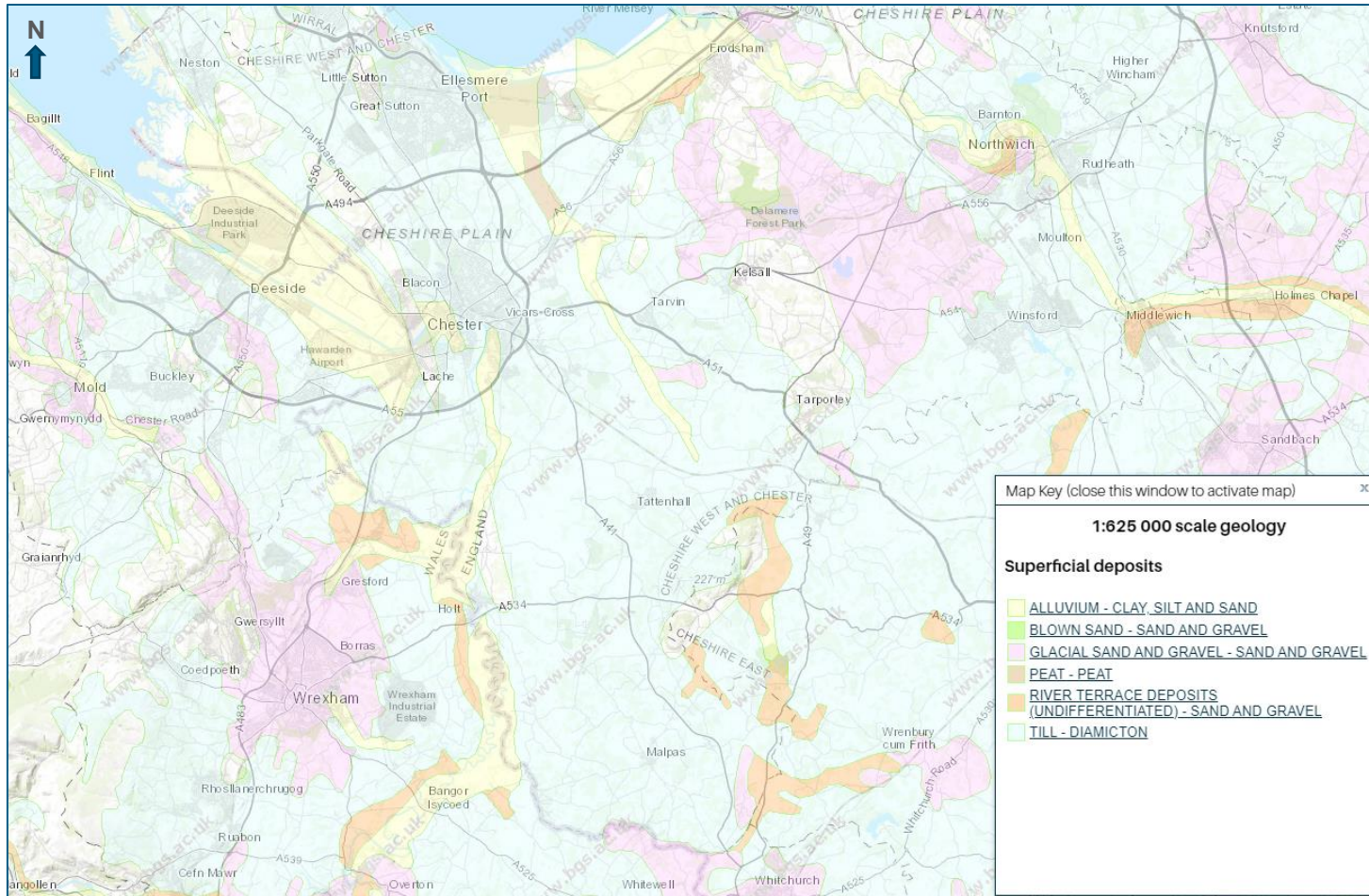
Lower Weaver October 2019 Calibration Summary Final Report, September 2019. JBA Consulting on behalf of the Environment Agency by JBA Consulting.

Appendices



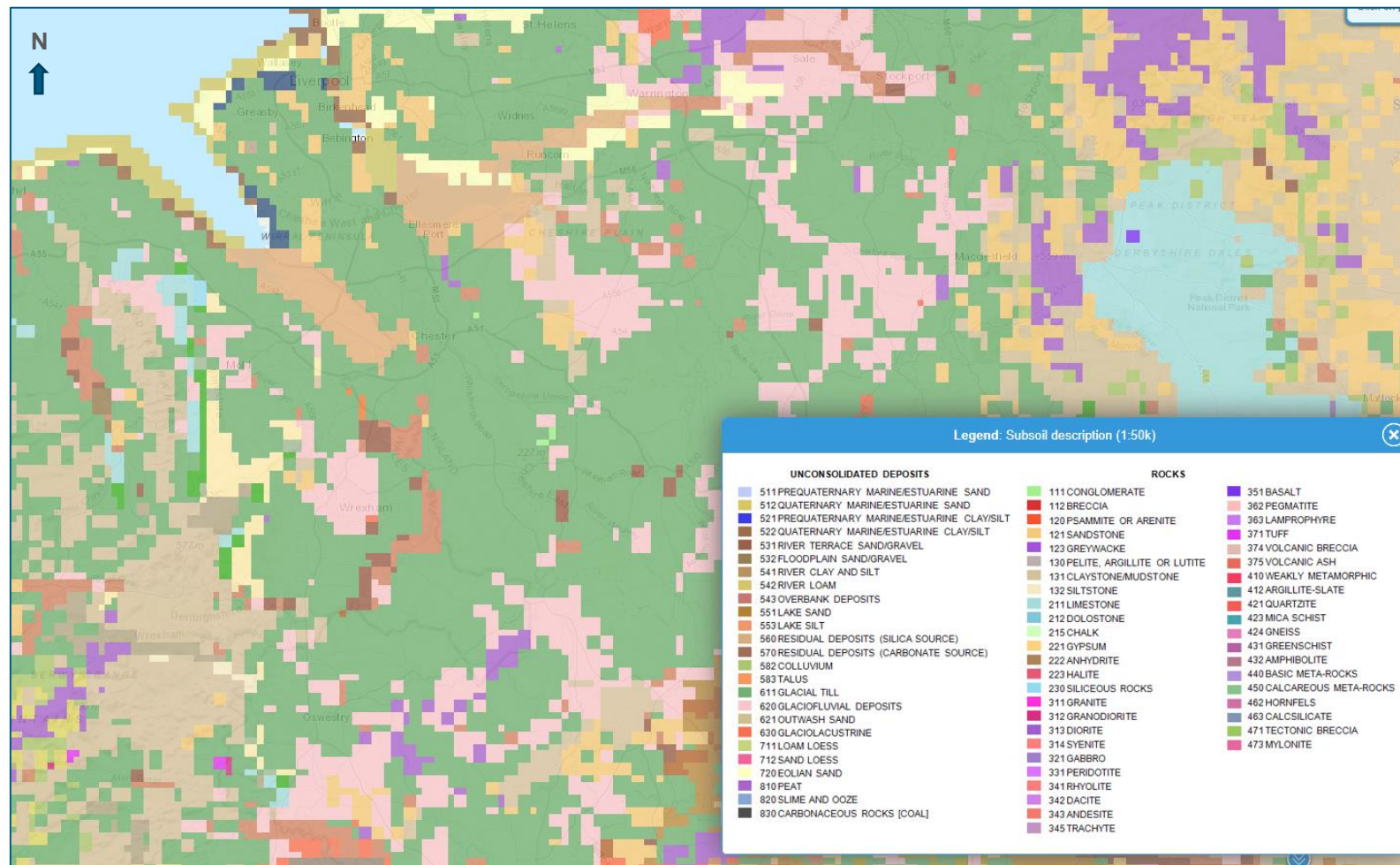
Appendix A. Geology and Soils Maps

A.1. Superficial Deposits Map



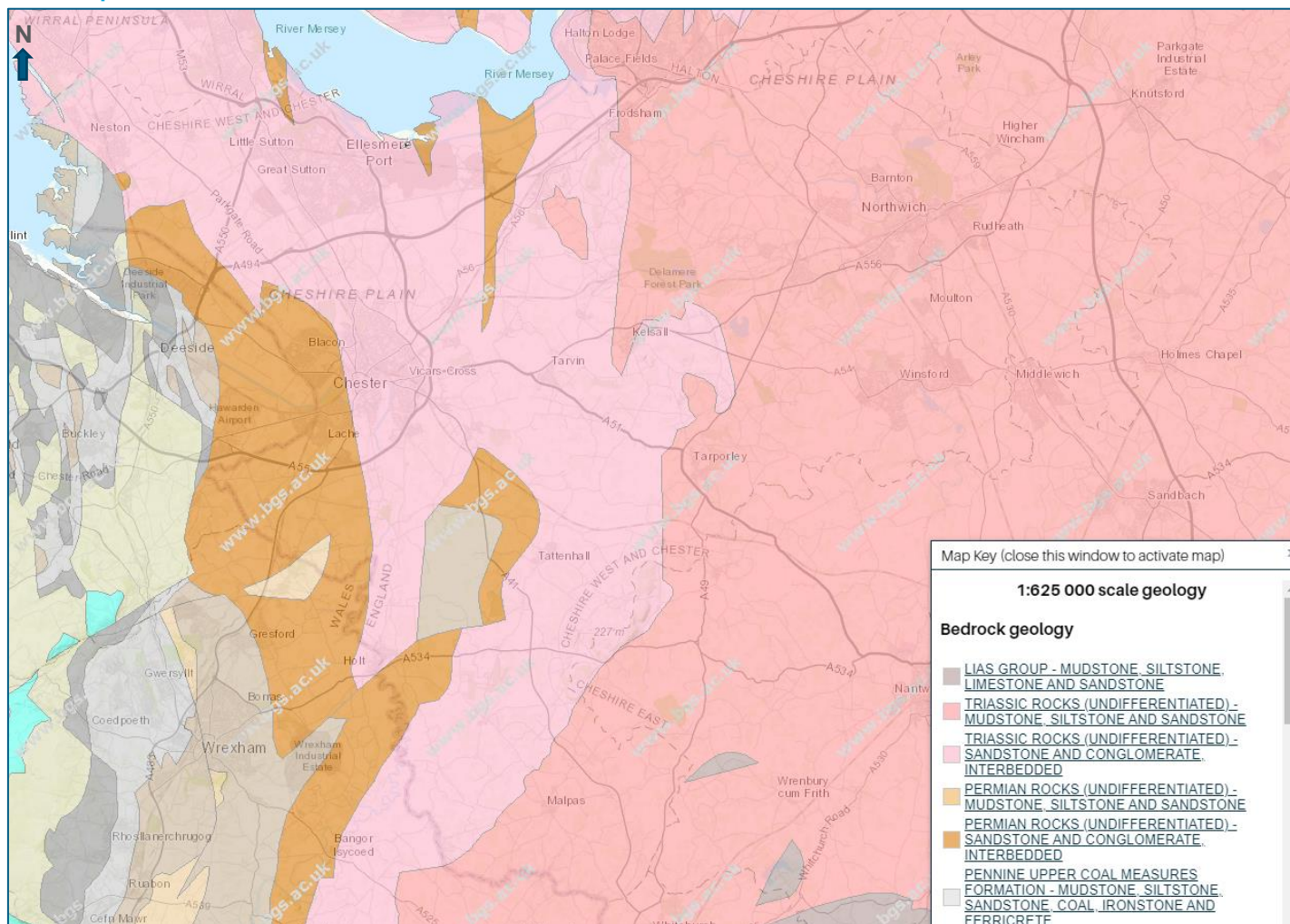
Source: GeoIndex Onshore Data Sources (www.bgs.ac.uk)

A.2. Parent Material



Source: GeoIndex Onshore Data Sources (www.bgs.ac.uk)

A.3. Bedrock Map



Source: GeoIndex Onshore Data Sources (www.bgs.ac.uk)

Appendix B. Area Specific Reports