2020 Flood Events:

Flood and Water Management Act

Section 19 - Investigation

Lichfield Road, A38, Branston



Figure 1: Flooding on the Lichfield Road section of the A38 (image source and rights belong to the Environment Agency)

This report has been prepared by Staffordshire County Council as Lead Local Flood Authority for Staffordshire County, under Section 19 of the Flood and Water Management Act 2010, with the assistance of Severn Trent Water and the Environment Agency.

This report is based on the information available at the time of preparation. Consequently, there is potential for further information to become available, which may lead to future alterations to the conclusions drawn in this report for which Staffordshire County Council cannot be held responsible.

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Executive Summary

When made aware of flooding, Staffordshire County Council (SCC), in its role as Lead Local Flood Authority (LLFA), has a duty to investigate the flood to determine the causes of the flooding and appropriate actions that may be undertaken by the relevant Risk Management Authorities (RMAs).

Several storms occurred across the Midlands region in 2020 that impacted many areas. These storms occurred as a result of European windstorms that became a series of extratropical cyclones bringing intense, short duration rainfall periods. In February 2020, a long duration, low-to-moderate intensity event, named Storm Dennis, led to severe weather warnings across much of Wales and the Midlands. As a result, a significant number of flooding incidents were recorded across Staffordshire, and reported to SCC, as well as nationwide.

SCC, in partnership with the Environment Agency, Severn Trent Water and appropriate Borough, District and Parish councils, have undertaken flood investigations in the areas where internal property flooding was reported, to determine the most likely cause of this flooding (surface water flooding, flooding from rivers, flooding from sewer infrastructure, and/or flooding from highway drainage).

This report focuses on flooding associated with Storm Dennis that internally affected several properties on Lichfield Road, south of the village of Branston, on the 17th of February 2020. The investigation undertaken has been summarised, outlining the flood extent and flow routes reported, the most likely cause of flooding, and the relevant actions that have been completed or are to be undertaken in the future.

Introduction

Several storms occurred in the Midlands in 2020 that resulted in associated widespread flooding to properties and highways across Staffordshire. As a result, SCC has undertaken investigations in the areas where flooding has occurred to determine the most likely cause of flooding (surface water flooding, flooding from rivers, flooding from sewer infrastructure, and flooding from highway drainage), in accordance with the 2010 Flood and Water Management Act.

This report focuses on the event that occurred on Lichfield Road, a section of the A38 south of the Staffordshire village of Branston, on February 17th 2020 as a result of Storm Dennis. This report aims to provide an investigation into the identified extent, flow routes reported, and potential causes of the flood event, as well as consider the next steps, if any, that need to be taken by the relevant RMAs.

Although this report specifically focuses on Lichfield Road, Branston, flooding associated with Storm Dennis resulted in 130 applications for grant support from residential and business properties across East Staffordshire. Many areas also experienced incidents in which five or more properties were internally flooded, reaching the criteria for a Section 19 investigation.

Lead Local Flood Authority

Following Royal Assent of the Flood and Water Management Act in 2010 (FWMA), Staffordshire County Council (SCC) became the Lead Local Flood Authority (LLFA) for Staffordshire. As such, SCC is responsible for the management of surface water food risk, groundwater flood risk and the flood risk from ordinary watercourses[1].

As LLFA, SCC is required to work in partnership with other agencies and authorities to manage flood risk. These agencies and authorities include, but not exclusively:

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

Section 19 Requirements

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

1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate

a) Which risk management authorities have relevant flood risk management functions, and

b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

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

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.

It should be noted that not all flooding will require a formal investigation and report.
SCC has, set out in its *Local Flood Risk Management Strategy*[2], the process which will be used to determine to what extent it considers is 'necessary or appropriate' to investigate and what constitutes a significant flood event.

Stage 1 is an initial assessment, sufficient to ascertain with some confidence the extent of the flooding consequences. The second stage is to carry out a detailed investigation of the sites where it has been deemed necessary and appropriate. Reporting and publishing is the third, and final, stage. These stages may be described as: -

- Stage 1: Initial assessment
- Stage 2: Section 19 Investigation
- Stage 3: Section 19 Report and publish

It follows that there will be requirements for coordination and cooperation between RMAs at each stage and, where required, following the outcome of a Section 19 Investigation. This will be undertaken via day-to-day officer communication, and through the LLFA's governance process for flood risk management.

Flood Investigation Methodology

SCC will undertake/coordinate a Flood Investigation in accordance with Section 19 of the Flood and Water Management Act (2010) when one or more of the following thresholds are exceeded.

Consequence Staffordshire Flood Investigation Thresholds

- Five or more residential properties are reported to have been internally flooded during a single flood event in one location;
- Two or more business properties are reported to have been internally flooded during a single flood event in one location, or;
- One or more items of critical infrastructure are reported to have been adversely affected during a single flood event in one location

SCC may investigate flooding outside these categories, but only when all outstanding issues with a higher priority have been considered. These guidelines set numerical thresholds, however, in recognition of the fact that all floods will be different; a certain amount of discretion will be required in order to implement this policy effectively. This policy only relates to how flood investigations will be prioritised and does not guarantee that any flood risk mitigation works will be installed at the locations where investigations are undertaken.

This report has been based on the number of reported incidents of flooding; however, it is likely that the actual number of incidents of flooding was higher than that reported.

This data is the best currently available and is being verified and quality checked for accuracy.

[2] https://www.staffordshire.gov.uk/environment/Flood-Risk-Management/Local-Flood-Risk-Management-Strategy.aspx

Investigation into Flooded areas

Step 1: During the Flood Event

SCC received a high number of calls during the event, which reported flooding of properties, gardens, and highways.

During the flood event, the LLFA coordinated with multiple Risk Management Authorities (RMAs) to ensure that flooding was managed effectively and the risk to people and properties was mitigated as far as reasonably practicable.

Step 2: Initial Investigations

Using call records, flooding investigation questionnaires and site visits, the LLFA identified the locations where flooding occurred.

Responses were received, providing personal accounts of the flood event including the estimated time, duration, extent, and depth with any other information which was felt pertinent.

Following receipt of the Flood Survey responses, the LLFA identified areas where at least one property experienced internal flooding.

Step 3: Detailed Investigation and Analysis

The LLFA conducted detailed investigation and individual location analysis of each of the areas generally where the thresholds for a Section 19 report, defined above, have been met. Namely, this occurs where 5 or more properties have experienced internal flooding. It should be noted that SCC have defined internal property flooding as:

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

These investigations typically included a review of existing infrastructure and topography, identification of predominant flow paths, site visits and local knowledge gathering.

Through a detailed analysis, the LLFA have identified the types of flooding that occurred at each location during the events of February 2020.

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

Step 4: Recommended Actions

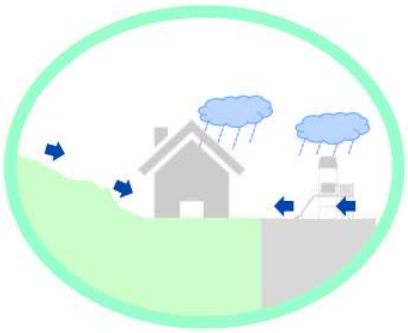
Following the analysis of the affected area, the LLFA have worked in collaboration with other RMAs to identify opportunities and options to mitigate the potential that a similar rainfall event will result in similar outcomes. These have been summarised as 'Recommended Actions' and a lead RMA has been identified to undertake these actions.

Types of Flooding

The following section explores the various types of flooding that may have been experienced during the event in February 2020.

Surface Water Flooding

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



Permeable surfaces, sometimes colloquially known as *'soft surfaces'*, allow water to soak (infiltrate) into the ground. These are typically in the form of gardens, parks, fields, and green spaces,

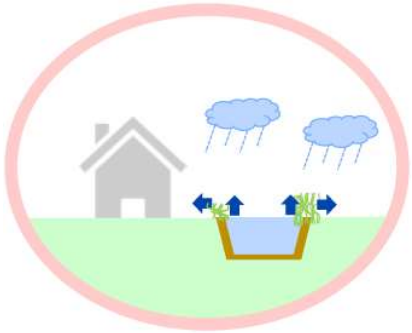
Impermeable surfaces, sometimes colloquially known as *'hard surfaces'*, do not allow any rainfall to soak into the ground and this rainfall will become (surface water) runoff. Runoff is usually very quick. These are typically in the form of highways and roads, roofs, car parks and public squares.

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

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

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

River Flooding



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

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

Main River; and ***Ordinary Watercourse***.

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

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

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

There has been a prolonged period of rainfall whereby permeable surface become saturated and the rate of surface water runoff increases thereby reaching the river faster;

There is heavy rainfall on impermeable surfaces and the provided drainage system conveys water to the river quickly;

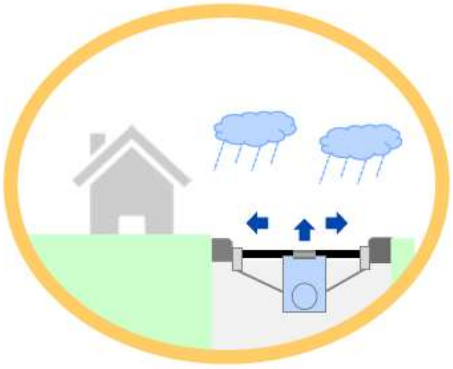
There are high flows within the river which become restricted by structures (e.g. bridges and culverts) which results in water levels upstream rising and spilling from the banks;

Sediment and debris building up in the river channel that reduces the capacity of the river channel causing flows to spill from the banks.

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

Flooding from Sewer Infrastructure

Where rainfall falls on an impermeable surface, it will typically be served by a formal drainage system, most commonly this is a sewer.



There are different types of sewer, including:

Surface Water Sewers, that carry rainfall and surface water away from properties to watercourses;

Foul Water Sewers, that carry wastewater away from properties to be treated; and,

Combined Sewers, that drain both wastewater from properties along with runoff from highways, roofs, car parks and other sources. These systems were typically constructed up to the 1950s and hence are still found in historic areas of cities.

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

There is a blockage, or the sewer itself collapses, which restricts or prevents flow within the sewer network. This causes water to back-up through the network and find its way to the surface, typically through a manhole or associated drainage structure.

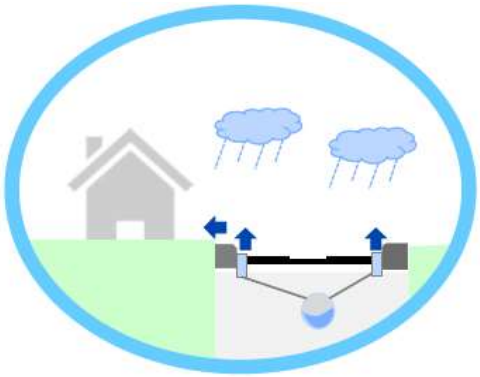
There is a period of heavy and/or prolonged rainfall, which results in significant flows that exceed the capacity of the sewer network. This prevents water from entering the sewer network and may result in surface flooding.

Severn Trent Water, as the sewerage company, is responsible for the operation and maintenance of the public sewers within the Staffordshire area.

Surface water and foul water sewers are currently designed in accordance with Sewers for Adoption (8th Edition, published 2018). This guidance states that sewers should have to capacity to deal with all runoff from a storm with a 3.33% or greater probability of occurring in any given year and not cause any above ground flooding. This guidance is relatively recent having been brought into effect in approximately the last 15 years. In addition, improvements in computer aided design and calculations also ensure designs are in agreement with the existing standards.

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

Flooding from Highway Drainage



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

Where rainfall falls onto the highway, this will enter the highway drainage system or flow within the highway channel until a point where it enters the system or ponds on the surface.

In new development, it is common practice to use highways to contain and convey heavy rainfall events away from properties, however historically this practice has not happened.

Across Staffordshire, properties can be seen at or below the level of the adjacent road. This means that should a carriageway not be able to contain the water flowing within it, flow will overtop the kerbs on the highway and spill over adjacent land into properties.
Flooding from highway infrastructure occurs under a number of circumstances, most commonly occurring when:

There is a blockage or build-up of surface debris in the vicinity of a gully, typically trash, leaves and twigs, which prevents, or restricts, the highway runoff from entering the gullies and subsequent highway infrastructure.

There is a period of heavy and/or prolonged rainfall, whereby the volume of rainfall falling onto the highway overwhelms the highway drainage features and is unable to be captured. The resulting flows are then conveyed or contained within the highway, until such times as the water level overtops the kerbs and flows overland into properties.

The sewer, culvert or watercourse to which the highway drainage is connected is at full capacity and therefore the highway run-off has no-where to drain to.

Staffordshire County Council, in their role as the local highway authority, is responsible for the highway drainage and gullies across East Staffordshire Borough. This work includes maintenance of the highway drainage including roadside gully pots.

Flood Risk Mapping

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

Surface Water Flood Risk

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

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

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

High Risk: Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year or 3.3% chance that the storm will occur in a single year

Medium Risk: Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year

Low Risk: Flooding occurring as a result of rainfall between 1 in 1000 and 1 in 100 chance in any given year or between 0.1% and 1% chance that the storm will occur in a single year

Very Low Risk: Flooding occurring as a result of rainfall with less than 1 in 1000 chance in any given year or less than 0.1% chance that the storm will occur in a single year.

It should be noted that this mapping has been produced at national scale with a number of assumptions and therefore there are some limitations at a local scale and is not appropriate for identifying individual property level flood risk. This mapping is publicly available for use and is available online at:

https://check-for-flooding.service.gov.uk/



Figure 2: Example of Environment Agency updated Flood Map for Surface Water Flooding

River Flood Risk

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

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

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

High Risk: Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year or 3.3% chance that the storm will occur in a single year

Medium Risk: Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year

Low Risk: Flooding occurring as a result of rainfall between 1 in 1000 and 1 in 100 chance in any given year or between 0.1% and 1% chance that the storm will occur in a single year

Very Low Risk: Flooding occurring as a result of rainfall with less than 1 in 1000 chance in any given year or less than 0.1% chance that the storm will occur in a single year.

This modelling is publicly available as the Environment Agency's Flood Risk from Rivers or the Sea map and is available online at:

https://check-for-flooding.service.gov.uk/



Analysis of Flooding Locations

The following sections describe the flooding that occurred on Lichfield Road, a section of the A38 south of the village of Branston, on February 17th 2020. The event has been assessed by reviewing the evidence collected from local resident surveys, and through consultation with the relevant RMAs.

Event Background

Several storms occurred in winter 2019-2020 across the UK and the Midlands. The combined impacts of Storm Ciara and Storm Dennis resulted in exceptionally high rainfall totals across the UK, with associated flooding in several areas.

Storm Dennis (15th-16th February 2020) was the fourth named storm in the 2019/20 season, which arrived one week after Storm Ciara and brought with it heavy and persistent rainfall[3]. In the period prior to Storm Dennis, Staffordshire had exceptionally high rainfall compared to the average (**Figure 4**). Rainfall in December and January was unremarkable. However, rainfall totals in February were exceptional, with February the wettest month in a series from 1862; the England figure was 258% of the long-term average (1981-2010). Crucially, soil moisture deficit from December 2019 through to February 2020 was generally practically zero/remained close to zero in Central England[3] (**Figure 5**). This means in the time running up to Storm Dennis there was generally little to no capacity within soils to drain or infiltrate rainfall. River flows in large rivers were also exceptionally high through February.

On 14th February, Storm Dennis developed off the west coast of Ireland, moving east, and arriving in England early afternoon. By mid-afternoon the front swept into Staffordshire and by late Friday night/early hours of Saturday morning this front had passed east out of Staffordshire. On Saturday 15th February a large front of rainfall developed in the morning and approached Staffordshire quickly, sustaining through to mid-day and continuing to remain over Staffordshire until early afternoon on Sunday 16th February. **Figure 6** shows radar-images of the rainfall across the UK. Through the rest of Sunday, the sustained/persistent rainfall moved over the rest of Europe, leaving scattered rainfall showers over Staffordshire through to Monday. For a more detailed account of Storm Dennis please refer to The Met Office[4] and Centre for Ecology and Hydrology[5].

[3] Met Office – Winter 2019/2020 https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/summaries/uk_monthly_climate_summary_winter_2020.pdf

[4] Met Office – Storm Dennis https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2020/2020_03_storm_dennis.pdf

[5] Centre for Ecology and Hydrology – Briefing note: Severity of the February 2020 floods – preliminary analysis https://nrfa.ceh.ac.uk/sites/default/files/Briefing_Note_V6.pdf

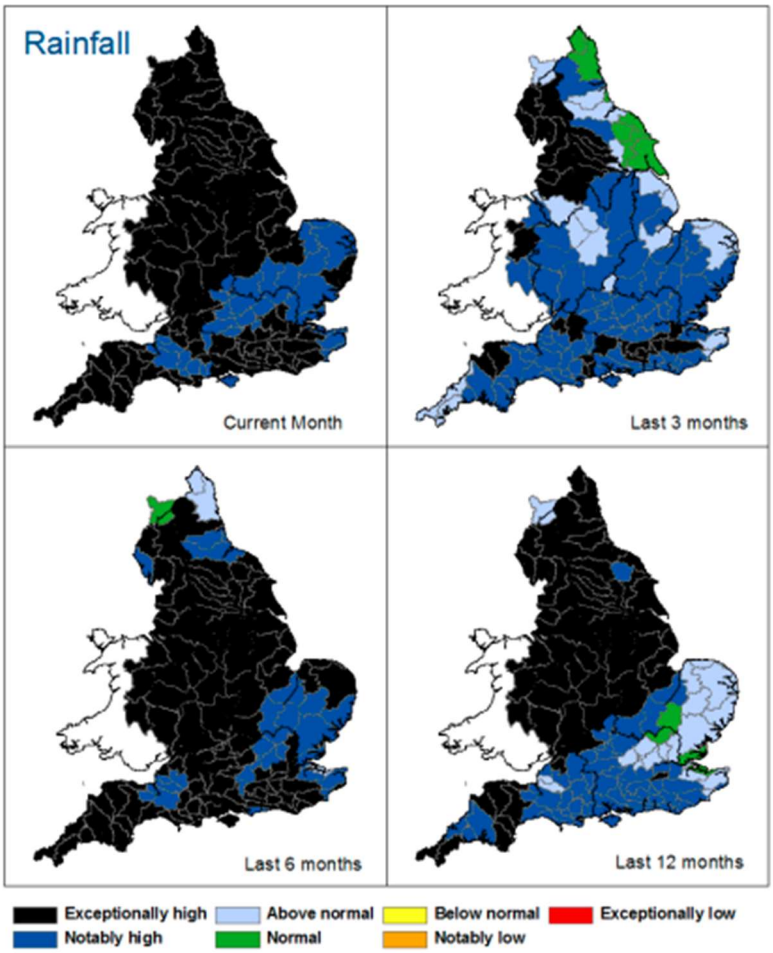


Figure 4: Total Rainfall Across England up to February 29th 2020 (Source: Environment Agency[6])

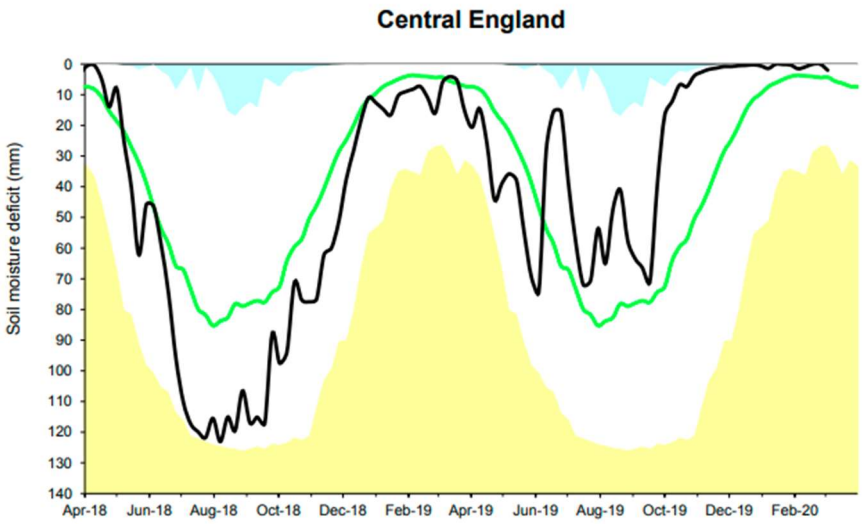


Figure 5: Central England Soil Moisture Deficit (Source: Environment Agency[6])

[6] Environment Agency – Monthly water situation report: England
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/871949/Water_situation_February_2020.pdf

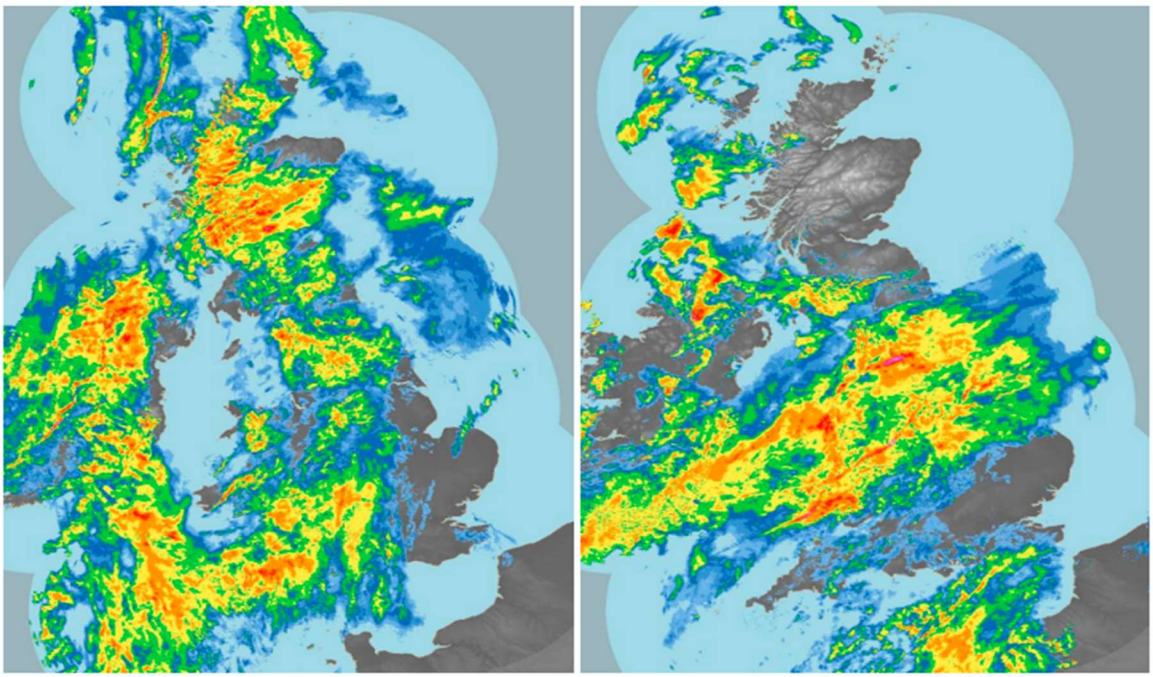


Figure 6: Rain-radar images at 12 UTC 15th and 00 UTC 16th February 2020 show the heavy and persistent rainfall from storm Dennis with the fronts sweeping across the UK (Source: The Met Office[4])

Location Background

Lichfield Road is a section of the A38 highway in Staffordshire that stretches from the Barton Turn Marina, near the village of Barton-under-Needwood, through Branston, to Burton-on-Trent (**Figure 7**). This section of the A38 was improved to a dual carriage standard in February 1964. Along Lichfield Road, there are intermittent stretches of residential properties along slip/service roads parallel to the main carriageway, as well as several industrial businesses and business units. The Branston Water Park is located along the north-west of Lichfield Road, south of Branston village and Branston Junction. The site was originally an open cast gravel pit that disrupted the natural area. The Branston Water Park is now a Local Nature Reserve operated by East Staffordshire Borough Council that includes water-front park walking paths, a visitor centre, and a café. The Trent and Mersey Canal is situated west of the Lichfield Road and Branston Water Park, that flows between the Barton Turn Marina, south of the Lichfield Road highway by Barton-under-Needwood, and Branston Locks, north of Branston Junction. In addition to the area around Branston being largely manufactured by the original gravel pits, the topography of the area is very flat.

Adjacent to the Branston Water Park, on the east side of the Lichfield Road highway, is the St Modwen's (South of Branston) development site that will incorporate 659 new residential properties and 18 ha of employment land for industrial business units. A railway line is situated east along this development that connects Burton-upon-Trent train station with Tamworth and Lichfield Trent Valley train stations. A second, new development area by Branston Locks, named the Branston Lock

Development, will incorporate a further 2,500 new residential properties, 20 ha of land for office and industrial business use, new care facilities, two new schools and a public house.

Local Watercourses:

Several watercourses are located around, or are culverted under, the Lichfield Road. This is primarily due to the proximity of the highway to the River Trent, a designated main river that is the responsibility of the Environment Agency that flows in a north-easternly direction along the east side of the A38. The Trent rises in the Staffordshire Moorlands by Biddulph Moor village, flows through Stoke-on-Trent and Rugeley to be joined by the River Tame at Alrewas, Lichfield, before flowing through Branston and Burton-upon-Trent, and then continues north-east to Nottingham and finally the Humber Estuary. The River Trent catchment, including all tributaries, covers an area of 10,452km^2. Prior to reaching Branston, the River Trent flows through a predominately rural area. In Branston, the Trent flows east of the new St Modwen's development site, that has required low-lying land in the development area to be raised, around Drakelow nature reserve and Branston Golf and Country Club, and discharges in a north-eastern direction towards Burton-upon-Trent. A continuous flood protection scheme along the west bank of the River Trent is present through Burton-upon-Trent and has recently been improved as part of the Burton Flood Risk Management Scheme - phase two. Phase one was completed between 2005 and 2007, and phase two completed in 2021.

Two designated main river watercourses are culverted under the Lichfield Road (**Figure 7**). The first is the Tatenhill Brook that has a catchment area of approximately 15km^2 and flows from Tatenhill, north-west of the Lichfield Road, towards the Trent and Mersey Canal and the Branston Water Park. In this area, the Tatenhill Brook is joined by two ordinary watercourses that discharge from Newbold Quarry in Tatenhill and rural land in Dunstall, east of Lichfield Road. At Tatenhill Locks, the Tatenhill Brook and additional ordinary watercourses are culverted under the Trent and Mersey Canal in a twin-barrel culvert, discharge through a 350m open channel section, and are culverted again under the Lichfield Road highway. Two further ordinary watercourses on the east side of the carriageway discharge north-east into the Tatenhill Brook. From here, the Tatenhill Brook flows south to the railway embankment, discharging around the new St Modwen's (South of Branston) development site, and under the railway in two locations to join the River Trent.

South of the Tatenhill Brook, an unnamed ordinary watercourse discharge south-east and north-east to flow into the River Trent. A second designated main river, the Barton Brook, is culverted under the Lichfield Road further south at the Barton Turns Marina. The Barton Brook originates north-west of Barton-under-Needwood on agricultural land and discharges through the village with enclosure in several culverts. When discharging out of the village, the Barton Brook is culverted under the Trent and Mersey Canal, where it is joined by three ordinary watercourses, the Full Brook, Marina watercourse, and an unnamed watercourse originating in farmland south of Barton-under-Needwood. The Barton Brook is further culverted under the A38 as it becomes the Lichfield Road.

The presence of the Branston Water Park has a significant effect on attenuation for flood response, identified by a FARL (Flood Attenuation by Reservoirs and Lakes) value of 0.901 for the catchment.

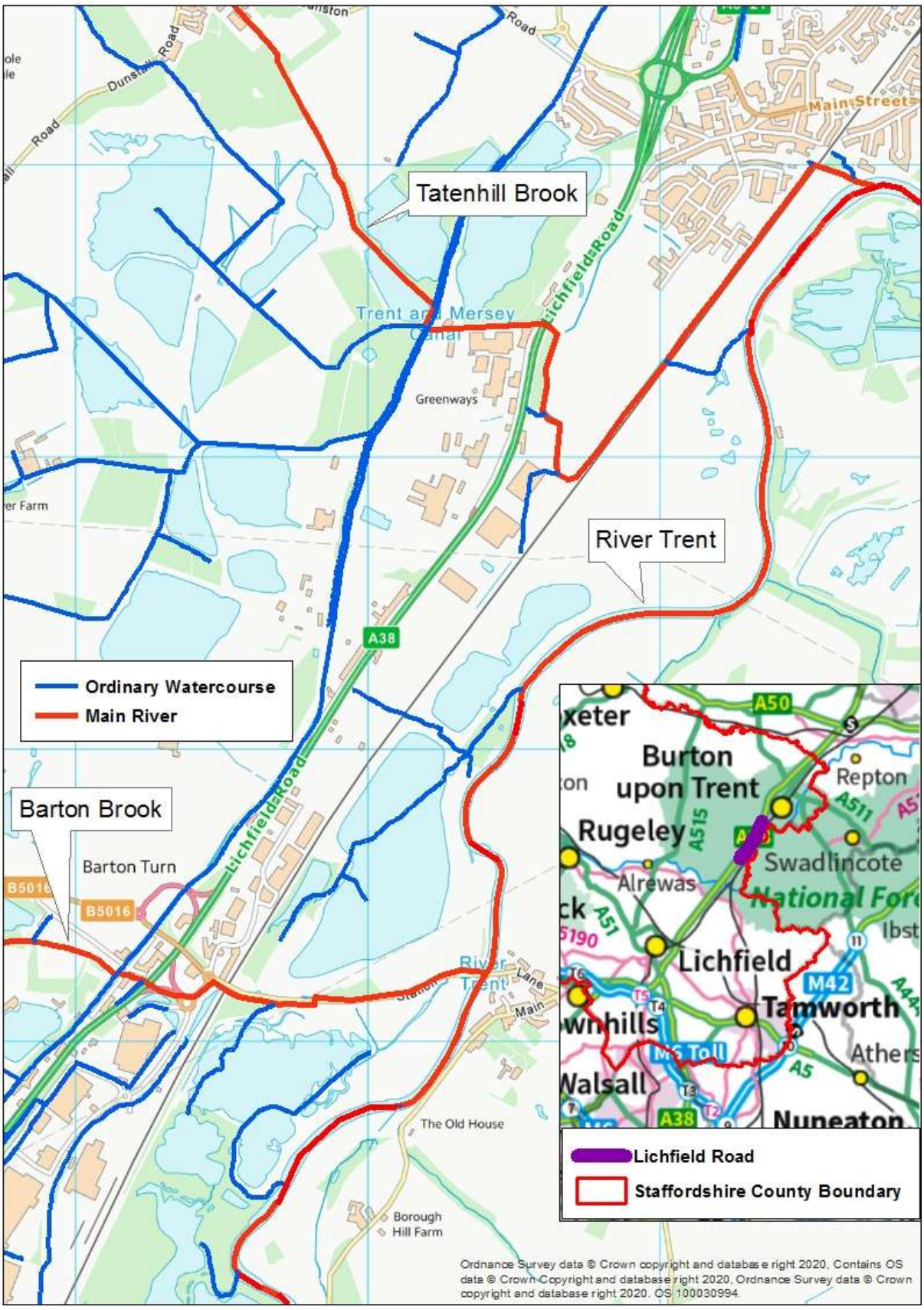


Figure 7: Map showing the location of Lichfield Road and the village of Branston in East Staffordshire and the local watercourses in this area

Public Sewer Network and Highways Drainage Network:

A gravity fed foul sewer system serves the Lichfield Road which is owned and maintained by Severn Trent Water. This runs south under the highway, fed by several foul system manholes, that connects to a pumping station by some industrial units on the east of the highway, south of Branston Water Park and the Tatenhill Brook culvert. A pressurised foul sewer runs north along the eastern edge of the highway and connects to a series of foul manholes in Branston village. An abandoned pressurised sewer is also located under the Lichfield Road highway.

Highway drainage along the Lichfield Road is managed by National Highways (previously Highways England). This discharge system includes several drainage gully assets along each side of the carriageway, the central reservation and slip roads leading onto the Lichfield Road and A38. These connect into pipes that outfall into the surrounding watercourses and discharge into the River Trent. Cleansing of these drainage assets is undertaken on a risk-based contract, not a scheduled maintenance contract. Therefore, cleansing of assets is undertaken when the risk category, assigned by inspections from Asset Incident Watchmen (AIWs) that informs the maintenance and safety programme, indicates it is required. Unless flooding is present during the time of inspection, blocked gullies do not necessarily result in immediate safety maintenance or programmed for immediate removal. While highway drainage is undertaken by National Highways, highway cleaning, sweeping and litter picking along major roads (All Purpose Trunk Roads; APTRs) is the responsibility of the local authority and therefore assumed by East Staffordshire Borough Council (ESBC). For service roads south of Branston that include stretches of residential properties, this maintenance is undertaken on a 6-week service schedule. These duties are undertaken on the main Lichfield Road section of the A38 when coordinated with other cyclical operations as they are not permitted to operate on the carriageway unless the required management is in place.

Historical Flooding of the Lichfield Road

There have been previous incidents of historical flooding along the Lichfield Road and around the Branston Water Park area. The recorded mechanics of these previous flood events are due to high River Trent levels that overtop and flow underneath the railway embankment, through unprotected gaps, into the low-lying land of Tatenhill Brook channel. From here flood water backs up the Tatenhill Brook watercourse and can cause flooding along the Lichfield Road section of the A38 carriageway.

Extensive flooding from high River Trent and Tatenhill Brook levels occurred on the Lichfield Road on November 7th 2000, during which River Trent levels at the Drakelow Park gauge reached the joint highest recorded levels since records began in 1959. This flood incident affected both sides of the highway, including inundation of properties, the Branston Water Park area and land now designated for the St Modwen's development site. Further incidents of highway and property flooding along the Lichfield Road occurred in 2007 and 2012, during which the Lichfield Road was closed on two occasions in 2012 due to flood incidents. Several separate incidents have been linked to flooding from blocked gullies and drains, including autumn 2000, autumn and winter 2004, and summer

2006. Remedial works by National Highways, previously the Highways Agency and Highways England, were carried out after each flood incident.

Environment Agency Flood Maps:

Sections of the Lichfield Road are at risk of flooding from watercourses as well as surface water flooding. **Figure 8** and **Figure 9** below display the Environment Agency Risk of Flooding from Rivers and Sea (flood zone mapping) and Risk of Flooding from Surface Water maps for the Lichfield Road. The flood zone map in Figure 3 shows parts of the Lichfield Road in Flood Zone 2 (FZ2; projected flood risk between 1% and 0.1% Annual Exceedance Probability AEP yearly) between Branston and the Tatenhill Brook culvert, around industrial and residential properties in the middle of the length of the highway, and at the south end of the highway by Barton Turn. Land with 20m of the Lichfield Road is also in Flood Zone 3 (FZ3; greater flood risk than 1% AEP yearly), particularly around the Branston Water Park and River Trent floodplain. There are also some highway sections at risk of surface water flooding, with areas falling within the 1 in 100-year (1% yearly AEP) and 1 in 1000-year (0.1% yearly AEP) Risk of Flooding from Surface Water (RoFSW) outlines.

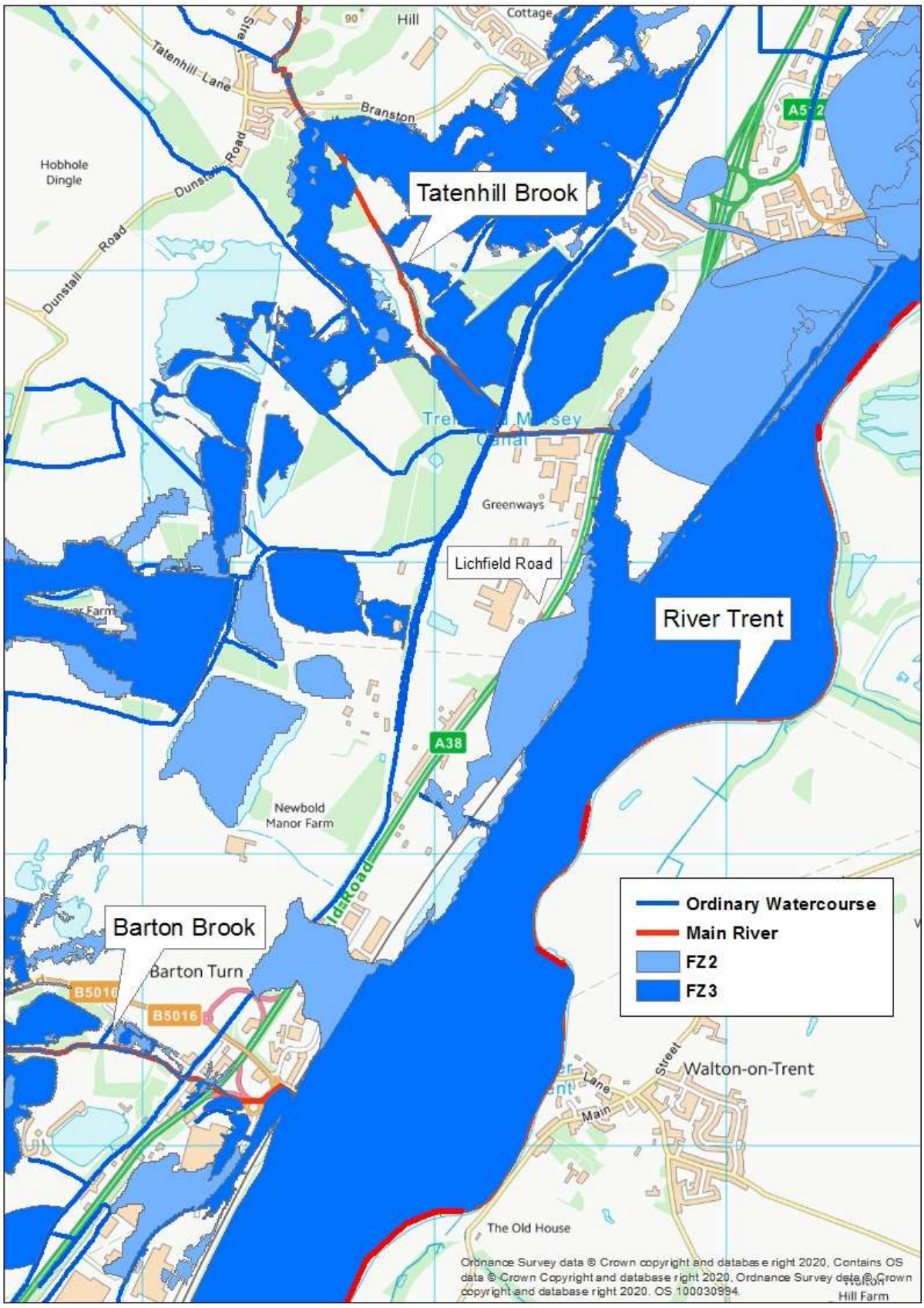


Figure 8: Environment Agency Risk of Flooding from Rivers and Sea (RoFRS) map that shows the outlines of Flood Zone 2 (FZ2) and Flood Zone 3 (FZ3) for the Lichfield Road, A38, Branston

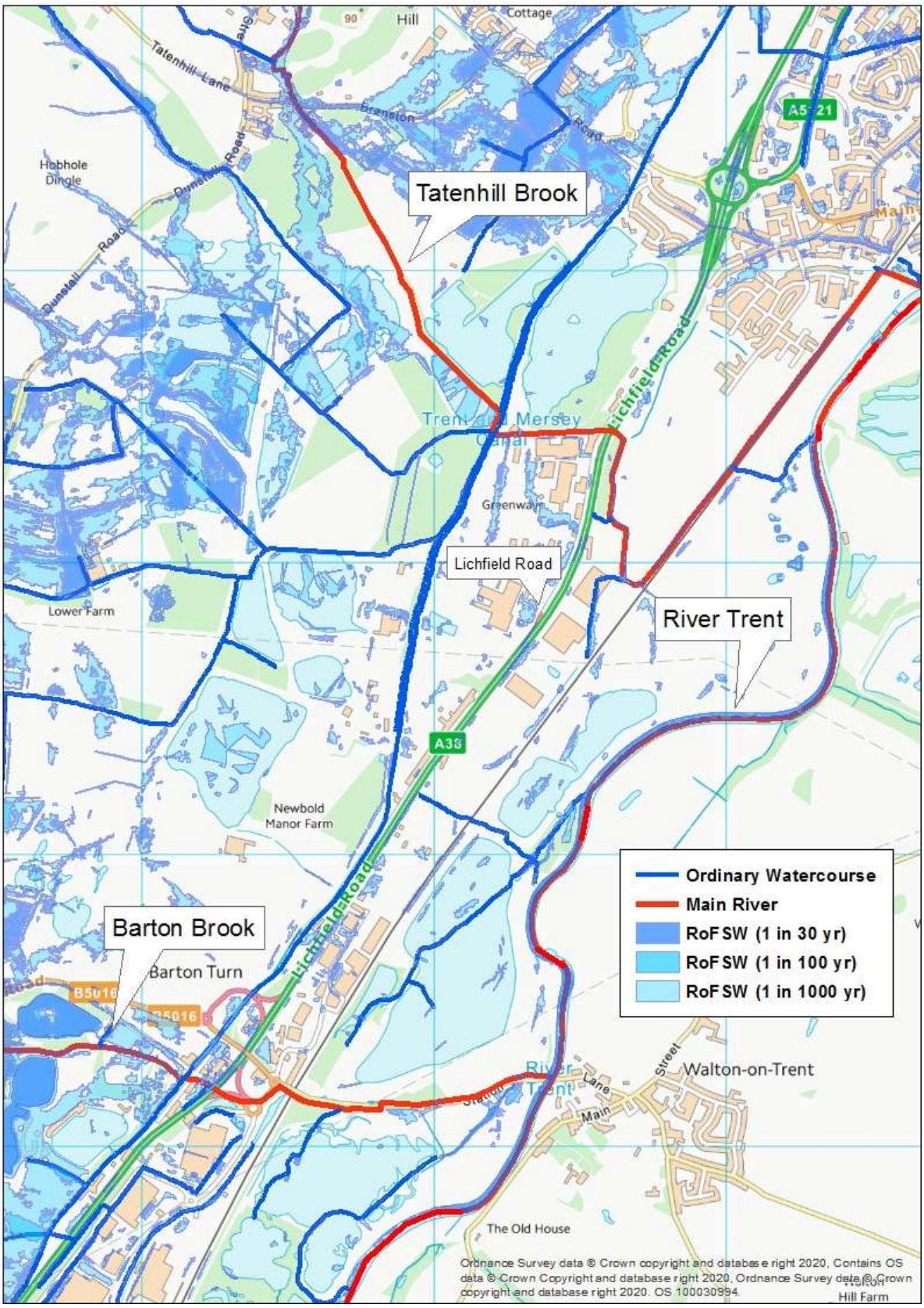


Figure 9: Environment Agency Risk of Flooding from Surface Water (RoFSW) map that shows the outlines for a 1 in 30-year event (% AEP), 1 in 100-year event (1% AEP) and a 1 in 1000-year event (0.1% AEP)

February 2020 Flood Event

On February 17th, multiple properties on Lichfield Road reported internal flood issues. Reports from affected residents describe flood water entering properties on February 17th. Details suggest the source of flooding was river flooding, surface water flooding and overwhelmed highway drainage.

Identified flooding type(s)		
River	Surface Water	Highway Drainage
		

Reports direct to SCC indicate 11 residential properties inundated along the west side of the Lichfield Road were inundated during the incident, but Environment Agency reports indicate 18 residential and 5 business properties were affected in total. The approximate depth of flooding in these properties reached 300mm (11.8 inches). The floodwater is reported to have remained within properties until February 19th and required some residents to leave their properties and remain in temporary accommodation for an excess of three months. Flooding to gardens was also reported. The Lichfield Road section of the A38 was also closed for three days from February 17th to the 19th.

Anecdotal reports suggest flood water began exceeding the capacity of the Tatenhill Brook at the south end of the residential properties by the Branston Water Park, referred to as 'Little Wood' by a local resident. At the same time, water is reported to have flooded land, designated as land for the St Modwen's development site, on the east side of the highway, which proceeded to flow across the highway and through drainage systems on the Lichfield Road to flood properties on the west side of the Lichfield Road. This floodwater entered through the front of properties, and subsequently flooded entire ground floors and rear gardens.

Flood incident Response:

The Lichfield Road is covered by Burton-upon-Trent flood alert and flood warnings for the River Trent. The Lichfield Road section of the A38 was closed by the Police for three days during the flooding and reopened when flood and river levels had receded.

Subsequently to the flooding, the Environment Agency visited the area and spoke to affected residents. National Highways crews assisted with flood incident clean up, cleansing of the drainage system and road sweeping along the Lichfield Road to reopen the carriageway, although this was not a requirement of this RMA. The Environment Agency further held virtual drop-in sessions in December 2020 for residents affected by the Lichfield Road flooding to discuss reducing this risk

with an alleviation scheme that forms part of the phase two Burton Flood Risk Management Scheme, and any further flood issues or concerns.

East Staffordshire Borough Council (ESBC) also collected information from residents that had flooded in order to assist with processing Flooded Property Claims to help fund repairs for damages caused by the February 2020 event. More than 130 applications for grant support from residential and business properties across East Staffordshire were received. By the end of the scheme, the DEFRA Property Flood Resilience grant scheme and ESBC will have provided grants to approximately 86 properties that equals an approximate value of £370,840 across the Borough.

Investigation

Following the flood event, SCC (LLFA) have worked in conjunction with the relevant RMAs to obtain data to help understand what happened during the flooding on the 17th of February 2020.

Flooding on and across the Lichfield Road highway has been an ongoing issue, but the mechanisms of flooding in this area were not previously understood. The flood type has been identified as river and highway, with the catchment area receiving more than average rainfall for February that saturated the catchment prior to the flood incident, and intense precipitation during the Storm Dennis event. Questionnaire responses indicate flooding occurred on February 17th and remained in properties until February 19th, with the Lichfield Road/A38 carriageway also closed during this time.

In response to the February 2020 event, the Environment Agency has further investigated and modelled the mechanisms of the Lichfield Road flood incident and have incorporated the alleviation of this flooding into phase two of the existing Burton-upon-Trent Flood Management Scheme.

Rainfall event:

On the 15th and 16th of February, Storm Dennis generated a severe weather warning over much of the Midlands. The Storm Dennis event has been characterised as a long duration, low to moderate intensity rainfall event that spread over a large catchment and is typical with winter rainfall storm events. **Figure 10** shows the recorded 15-minute rainfall for the Lichfield Road from February 15th to 17th. A total of 33.3mm of rainfall was recorded over the two days, with 29.9mm of this total recorded during a 17-hour period between 20:45 on February 15th until 14:00 on February 16th, 2020. The return period of this event (**Table 1**) has been identified as between a 1-year and 2-year event by HydroMaster software. Although this presents the event as unexceptional, the average rainfall for February (1981-2010 baseline) for the area, recorded by the closest Staffordshire Met Office climate station in Denstone, is 62.1mm. Therefore, more than 50% of the monthly rainfall fell in the Lichfield Road, Branston, within two days making it significant to the area.

This intense rainfall was widespread across the catchment and larger area of Staffordshire (**Figure 11**). Verifying this data, similar rainfall totals for the same time-period were recorded by DEFRA Environment Agency rain gauges within the area. The closest gauge to the Lichfield Road, Byrkley Park gauge, recorded a total of 40.6mm for the two days of February 15th and 16th. Of this total, a significant 31.8mm peak rainfall was recorded between 21:30 on February 15th and 07:00 February 16th. Comparable rainfall values were also recorded at Overseal rain gauge, that recorded 42.4mm of rainfall, and Clay Mills rain gauge, that recorded 43.8mm of rainfall, for February 15th and 16th. This rainfall data for the surrounding area, including the intense period of rainfall recorded at Brykley Park at a similar time to Lichfield Road, shows an excess of 40mm of rainfall fell over the wider area surrounding Lichfield Road prior to the flood event on February 17th, whilst soils were already saturated and river levels remaining high throughout the catchment from Storm Ciara the previous week.

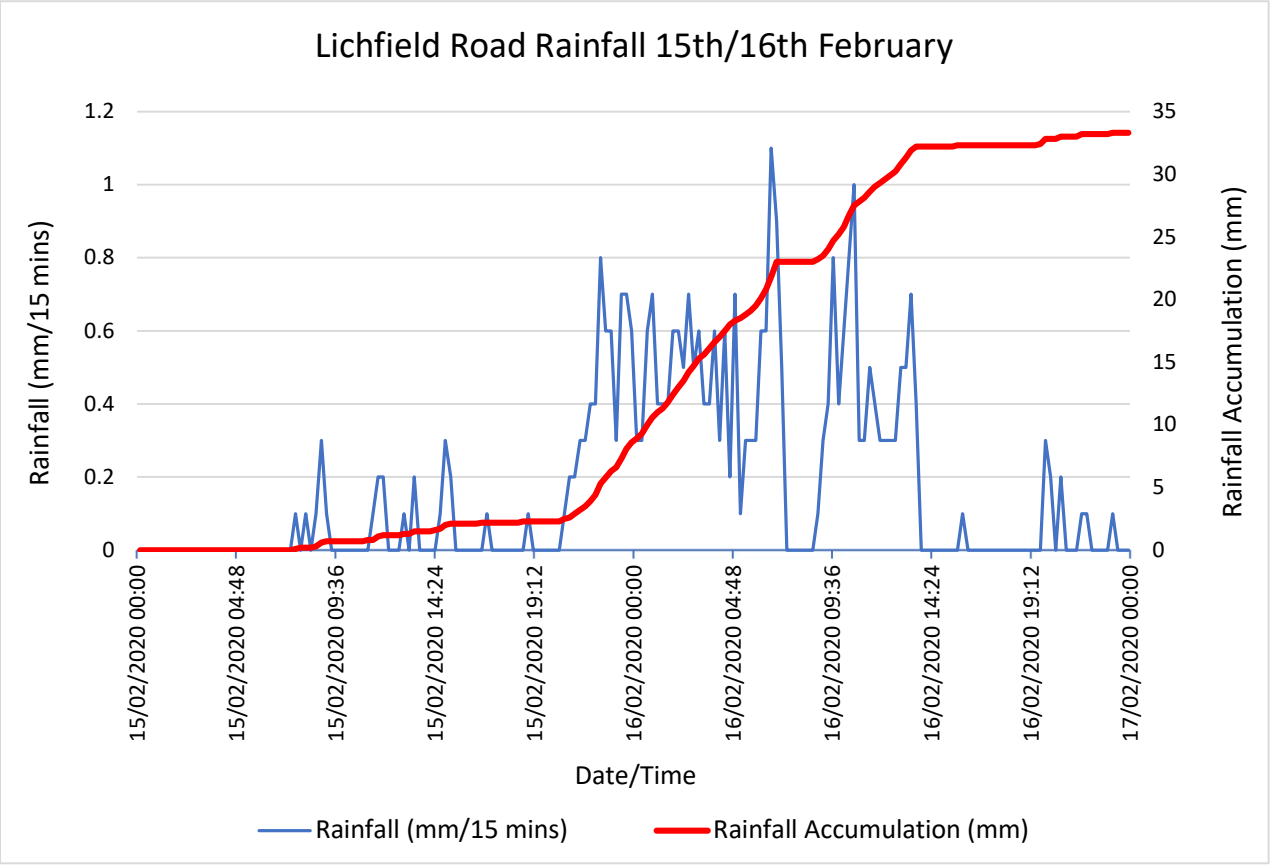


Figure 10: 15-minute rainfall for Lichfield Road, Branston on February 15th and 16th 2020 (Data Source: Hydromaster)

Table 1: Rainfall event return periods for Storm Dennis on February 16th and 17th from HydroMaster data

Event duration	Event occurrence date/time	Total rainfall (mm)	Intensity rainfall (mm)	Event return period
6-hour	15/02/2020 21:55 – 16/02/2020 03:55	12.7mm	2.1mm	< 1 year
12-hour	15/02/2020 22:40 – 16/02/2020 10:40	22mm	1.8mm	> 1 year and < 2 year
24-hour	15/02/2020 13:45 – 16/02/2020 13:45	31.2mm	1.3mm	> 1 year and < 2 year
48-hour	15/02/2020 05:25 – 17/02/2020 05:25	35.2mm	0.7mm	< 1 year

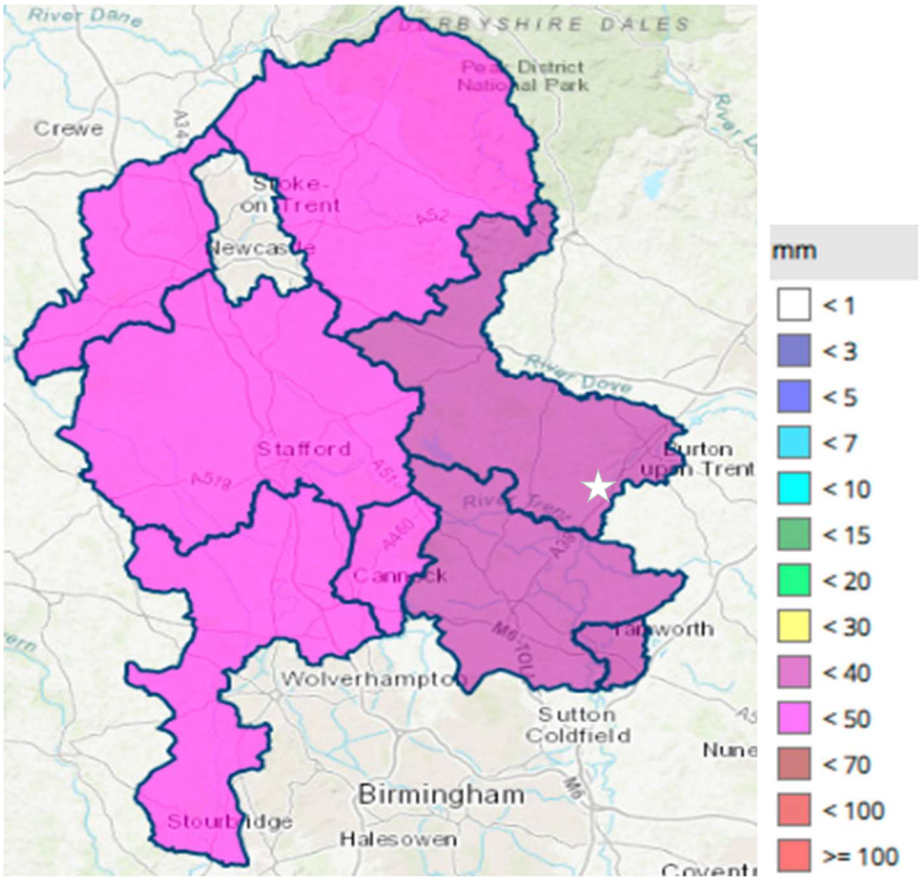


Figure 11: Rainfall totals for districts and boroughs across Staffordshire County with Lichfield Road indicated by a white star (Data Source: HydroMaster)

Watercourses:

The Storm Dennis event and associated rainfall impacted watercourse levels and flows in the surrounding Branston area. The Tatenhill Brook is an ungauged watercourse, but ReFH software has been used to create a hydrograph of observed rainfall and catchment characteristics, as well as modelled hydrographs for design storms of different return periods. The hydrograph shows rainfall from February 13th to 19th 2020, and identifies an intense, earlier but smaller rainfall event on the 13th that had a fast response on Tatenhill Brook levels increasing to >1.6m^3/s. Total flow reduced following this event but remained moderate in channel before the occurrence of Storm Dennis rainfall on the 15th and 16th. Peak rainfall at 10:30 on February 16th resulted in fast responding levels with peak discharge of 3.5m^3/s around 15:00 on February 16th. Comparison of peak flows has enabled the return period of this peak Tatenhill Brook discharge to be calculated as an event with a return period between 1 and 2-years. The resulting hydrograph is available as **Figure 12**.

On February 17th 2020 at 23:00 the River Trent gauge at Drakelow Park, the nearest River Trent gauge to Lichfield Road, Branston, by Branston Golf and Country Club (**Figure 13**), recorded a river level of 3.8m and a discharge of 384.2 m^3/s (**Figure 14**). This is the joint highest recorded level of the River Trent at Drakelow Park gauge station since records started in 1959, coinciding with levels from November 7th 2020 that had a slightly higher flow rate of 385.3 m^3/s but a lower river level of 3.79m. Data available from the National River Flow Archive (NRFA) under an open licence.

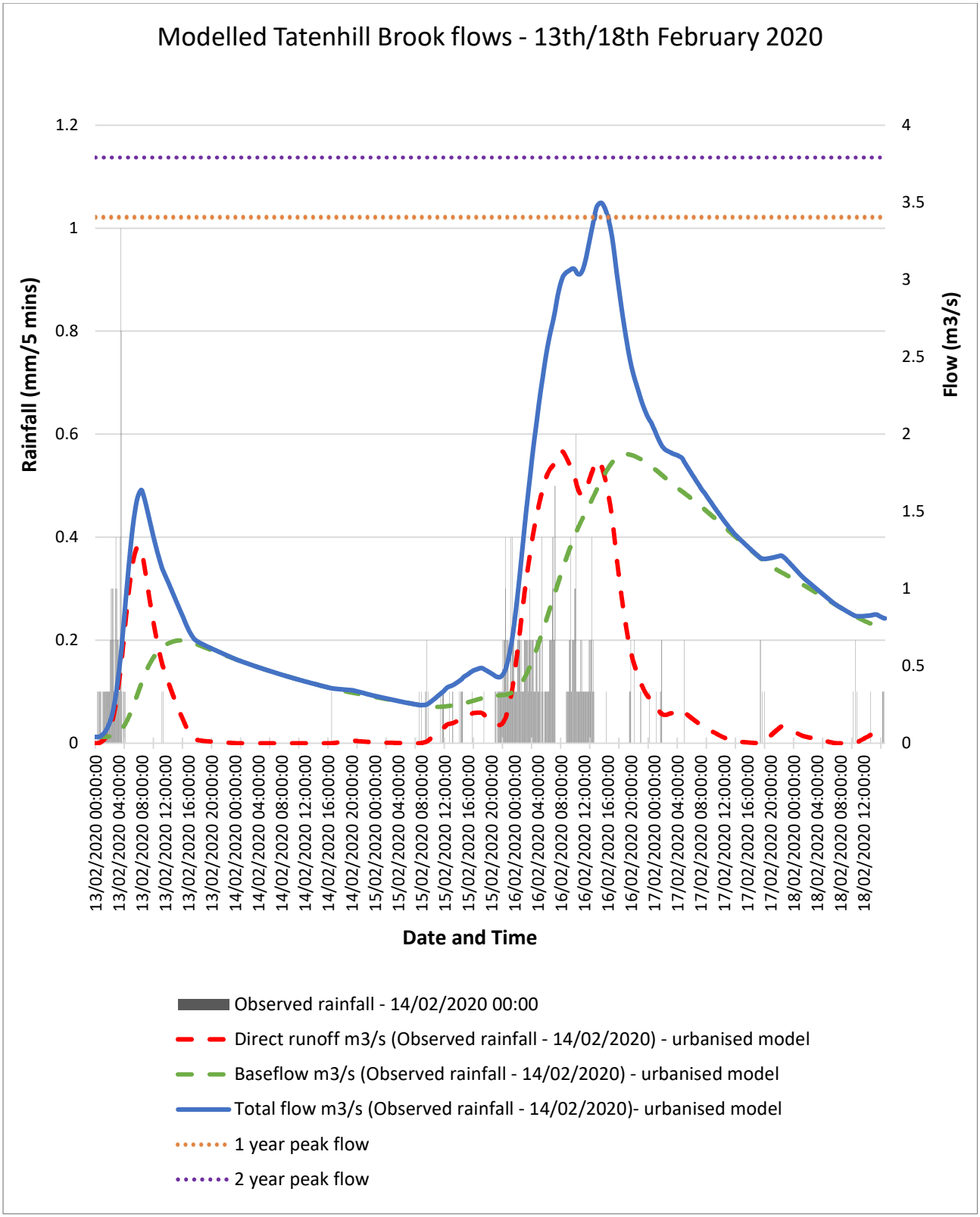


Figure 12: ReFH design flood hydrograph for Tatenhill Brook overtopping event on February 17th following the Storm Dennis rainfall event on 15th/16th. The modelled return period of flows has been calculated as between a 1 and 2-year peak event (Data Source: Hydromaster and ReFH)



Figure 13: Location of River Trent gauge at Drakelow Park in relation to Lichfield Road, section of the A38, Branston (outlined in orange)

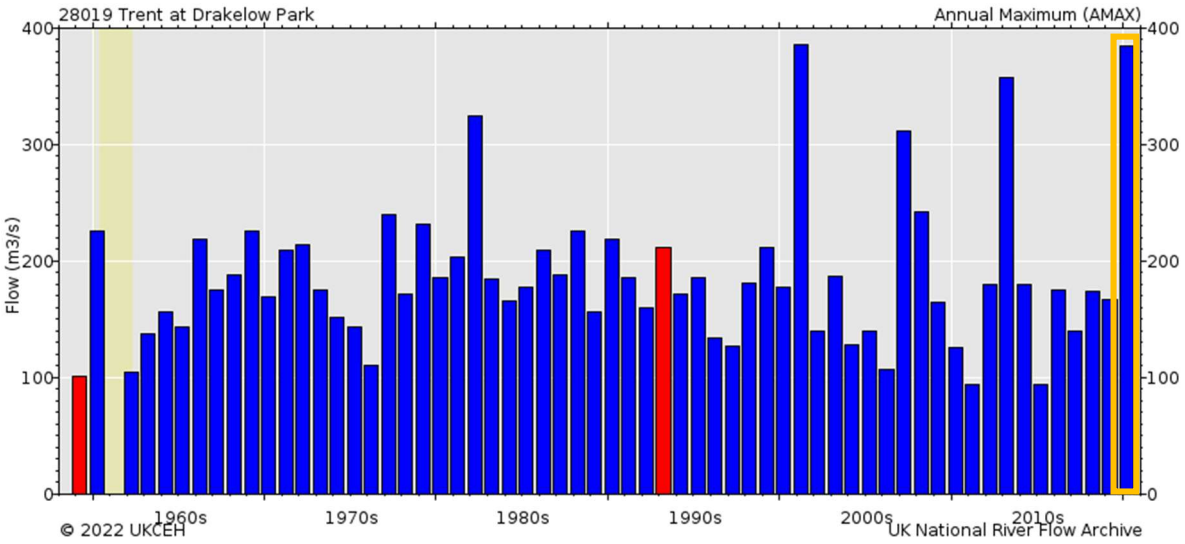


Figure 14: River Trent flow from 1959 to 2020. February 17th 2020 (outlined in orange) has the joint highest recorded flow levels for the River Trent at Drakelow gauge (Data Source: NFRA)

Intense precipitation from Storm Dennis on February 15th and 16th, in addition to earlier Storm Ciara that occurred between February 7th to 10th and a smaller, intense rainfall event on February 13th, resulted in rainfall totals for February above the average for the catchment and surrounding area. Storm Dennis is calculated to have a rainfall return period of between a 1 and 2-year event that had an impact on Tatenhill Brook levels. While the rainfall return period was not exceptional, the joint probability of a storm of this magnitude falling on already severely saturated ground alongside already high River Trent and Tatenhill Brook levels resulted in greater levels of flooding. This includes the combination of a saturated catchment, river and watercourse levels already high, and increased rainfall across Staffordshire County that largely drains into the River Trent. The resulting extremely high, and joint highest recorded River Trent levels on February 17th then reduced the ability of the 1/2-year rainfall event and associated Tatenhill Brook levels to discharge normally into the River Trent. This flow, in combination with high River Trent flows, backed up along the channel to discharge onto, and around, the Lichfield Road highway and properties.

Communication from the Environment Agency on flood mechanisms and hydraulic modelling confirm the main factor causing flooding along the Lichfield Road is high River Trent levels backing up along the Tatenhill Brook and stopping flow discharging into the River Trent as it usually would. **Figure 15** shows this route of flows from the River Trent along the Tatenhill Brook to the Lichfield Road. Overtopped flow from the Tatenhill Brook on the east side of the Lichfield Road highway is subsequently redirected into an identified low spot and across the highway to inundate properties (**Figure 15, number 1**). While this is the first instance of water overflowing from the Tatenhill Brook channel, a second flood route is identified by discharge that remained in channel and continued backing up under the Lichfield Road culvert and towards the Branston Water Park area (**Figure 15, number 2)**. Here, this flow overtops the channel and floods the rear of properties, exacerbating the inundation of properties.

A further route of River Trent flows backing up along the Tatenhill Brook and an unnamed ordinary watercourse (**Figure 15, number 3**) to flood the Lichfield Road around several industrial units and businesses is also identified by the Environment Agency. These flood flows can result in ingress of river flows into the Severn Trent Water foul sewer system, as well as by manholes and drains for sewage systems and highway drainage.

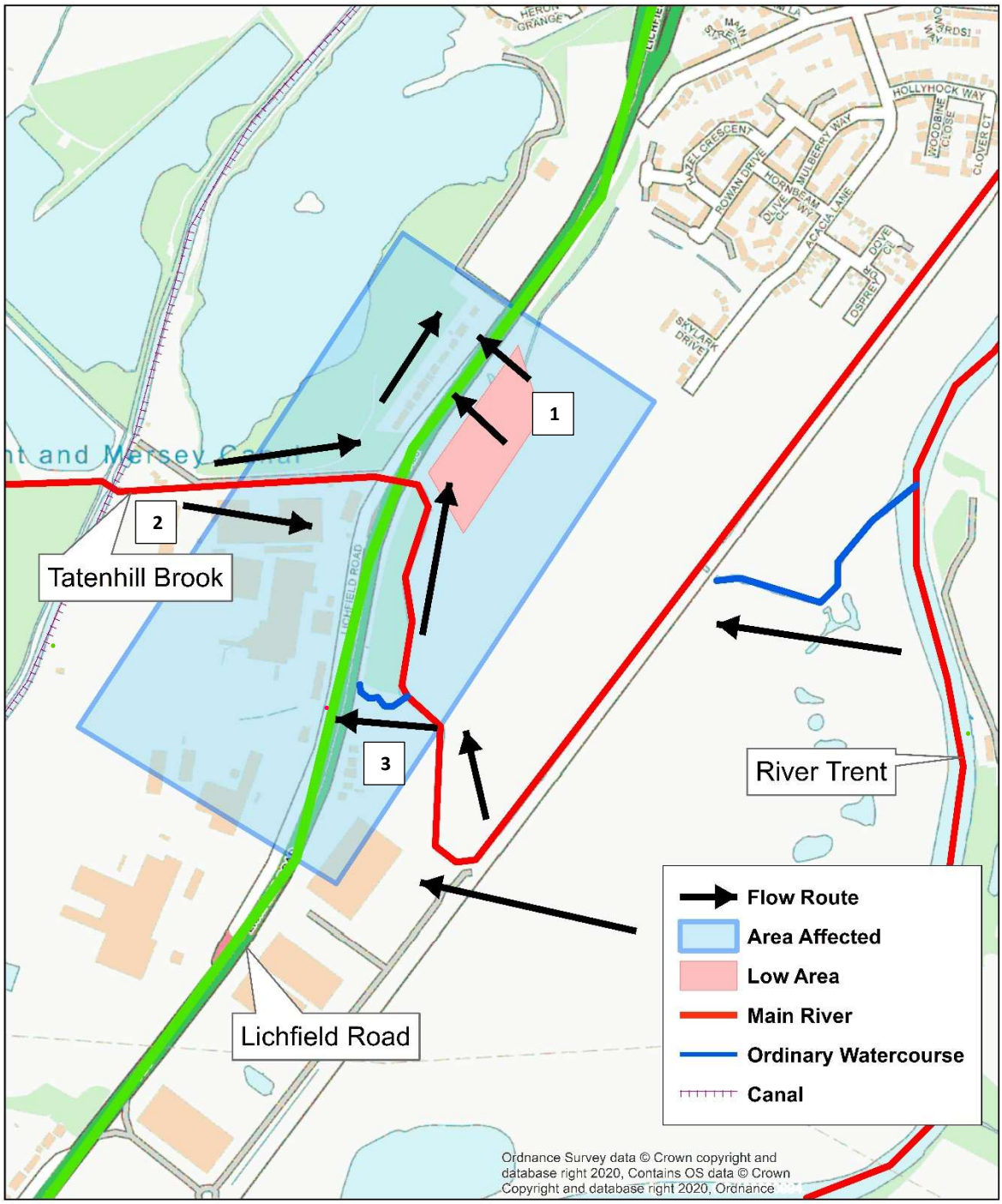


Figure 15: Map of the area on Lichfield Road that was affected by flooding on the 16th and 17th of February 2020 primarily due to Tatenhill Brook flow backing up from high River Trent levels and entering a low area, and some potential overtopping

To reduce this flood risk, an Environment Agency scheme for the Lichfield Road and Branston area, working in partnership with the relevant RMAs, has been incorporated into the improvement works for the Burton Flood Alleviation Scheme. The scheme is designed to hold high River Trent flows in the Tatenhill Brook channel and reduce overtopping in two areas with sheet piling walls (**Figure 15, numbers 1 and 2**), and to stop ordinary watercourse flows discharging onto the highway (**Figure 15,**

number 3). Construction of the scheme began in July 2021 and was completed in June 2022. More information about this scheme is available in the following section.

Anecdotal reports from residents further mentioned potentially increased flood risk from new St Modwen's development site. The Flood Risk Assessment (FRA) for the new development highlighted that during previous flood events from extremely high River Trent levels, flood water may enter the development area through unprotected openings in the railway line embankment as well as by overtopping this. The mechanism identified in the FRA are the same as those identified for the main cause of flooding during this event, with River Trent flows backing up along the Tatenhill Brook and into a low spot between the development site and the Lichfield Road. The new development is therefore not thought to have increased any flood risks to the Lichfield Road or surrounding areas. The St Modwen's development site has increased low-lying ground levels and increased the protection along the railway embankment to reduce flood risk to the site in future.

Highway Drainage and Sewer Network:

Anecdotal reports from residents suggest flood water came up through drains on the west side of the Lichfield Road. Highway drainage assets and pipes along the A38 carriageway outfall and drain into surrounding watercourses, including the Tatenhill Brook around the affected area. Thus, high river flows, such as those during this event, can result in surcharging of these highway drainage systems on the Lichfield Road carriageway and in front of driveways. Surcharging of this highway drainage resulted in rising watercourse flows onto the carriageway that in turn reduced the capacity for surface water flows to drain away from the Lichfield Road. Working in collaboration with National Highways, part of the Environment Agency scheme includes the implementation of non-return values on these drainage assets to stop surcharging onto the carriageway from ingress of river discharge. This will reduce the impact to properties, residents, and the travelling public during extreme exceedance events as less water will flow onto the carriageway when surrounding rivers and watercourses rise. More information about this scheme is available in the following section. The implementation of non-return valves as part of the Environment Agency scheme will not result in any scheduled maintenance changes and will remain a risk-based maintenance contract.

It has been noted that the area around the Lichfield Road is prone to a lot of silt and detritus that can block highway gullies and exacerbate flooding when not cleared. Although this is an already recognised problem, flooding issues on the highway during the Storm Dennis event were primarily due to high flows from the surrounding watercourses surcharging within the highway drainage system that resulted in river flows on the carriageway, which has previously been detailed above. Reports of blocked gullies have also been investigated as part of this report, with East Staffordshire Borough Council (ESBC) confirming the residential slip road is cleaned on a 6-week schedule and opportunities to sweep the main A38 carriageway are identified with National Highways (NH). Improved communication between NH and ESBC and a clarification of roles has resulted from this investigation for future works to alleviate silt build up in highway drainage.

Anecdotal reports from residents suggest that the Severn Trent Water pumping station along Lichfield Road, south of the affected area, was out of action during the event that may have resulted in drainage systems surcharging and inundating properties. Exhibiting the flood mechanisms modelled by the Environment Agency, River Trent levels back up along the Tatenhill Brook and unnamed watercourse to discharge across the Lichfield Road (**Figure 13, number 3**). These flows pooled on the Lichfield Road carriageway and inundated the pumping station and surrounding industrial units. Comments from Severn Trent Water confirm the pumping station was overwhelmed and could not cope with the ingress of river flows. However, the pumping station remained actively working and was not disconnected during the flood incident. Any potential sewer flooding in the area during this event is likely to have been caused by the sewer system surcharging from manholes after being overwhelmed by river flows, as well as pooling flood flows on the Lichfield Road reducing the ability for sewage flows to drain along the highway to the pumping station.

Subsequently to the February 2020 flood incident, Severn Trent Water has undertaken flood proofing of the pumping station with telemetry on the pumping station covers. Severn Trent Water is also working in collaboration with the Environment Agency to implement non-return valves on sewage system assets to reduce the ability of surcharging flows to flood the carriageway and drainage system. More information about this scheme is available in the following section.

Conclusion

The flooding incident that occurred on the Lichfield Road section of the A38, Branston, on February 17th was the result of an exceedance event, with flooding from designated main rivers as well as overwhelmed highway drainage. An intense period of rainfall leading up to the event resulted in high river levels in the surrounding main rivers and watercourses. Whilst evidence from ReFH hydrographs identify a smaller magnitude of peak flows, between a 1 and 2-year return period, that would be expected for an event of this magnitude and resulting impacts, the factor of intense rainfall across the catchment draining largely into the River Trent is predominately the driving factor of flood issues. High River Trent levels backed up along the Tatenhill Brook, that discharges into the River Trent after discharging through a culvert under the Lichfield Road. These flows overtopped the Tatenhill Brook channel in two places, west of the highway into a low spot that discharged across the highway and east of the highway around the Branston Water Park to inundate the carriageway, residential and business properties. River Trent levels also backed up along an unnamed ordinary watercourse that joins the Tatenhill Brook west of the Lichfield Road highway, and resulted in further flooding of the carriageway, a Severn Trent Water pumping station and further business properties. River flows further surcharged through highway drainage infrastructure and sewer systems, to rise on and across the carriageway that subsequently reduced the ability for surface water flows and sewerage to follow the ordinary routes of discharge from the area. While addition reports of blocked highway drainage and issues with sewer system pumping were reported to potentially have exacerbated the flooding, all issues are aligned with an ingress of river flows in these systems caused by high levels in the River Trent.

Branston A38 Alleviation Scheme

In 2020 the Environment Agency completed phase two of a scheme to improve the flood protection standards surrounding Burton-upon-Trent to reduce the flood risk from the River Trent and protect homes. Phase one that was completed in 2007. However, the flood incident in February 2020 along the Lichfield Road highlighted additional concerns of flood risks to the A38 and potential flooding to a further 300 properties in this area and within Branston. After initial investigations, a solution to reduce these flood risks along the Lichfield Road section of the A38 was incorporated into phase two of the Burton Flood Alleviation Scheme.

The 2020 flooding clearly highlighted the mechanisms of the flooding situation on Lichfield Road, that resulted in an initial investigation to develop a solution in line with the Burton-upon-Trent scheme. Hydraulic modelling of the incident identified that 300 properties, including the 18 that flooded during the February 2020 flood incident, along the Lichfield Road and in Branston could be at risk of flooding during a 1 in 200-year (0.5% Annual Exceedance Probability AEP) event. The scheme looks to contain flood flows from the River Trent and Tatenhill Brook within the Tatenhill Brook channel and stop surcharging of drainage assets from the ingress of these river flows to reduce the flood risk to Lichfield Road highway, properties, and businesses. This will incorporate measures in three areas (**Figure 15, numbers 1, 2 and 3**) that include sheet piled flood protection walls, non-return valves on Severn Trent Water and National Highways drainage systems to reduce surcharging, and a control structure on an unnamed watercourse. **Figures 16**, **17** and **18** below show each area of the scheme during the construction phase. This will reduce backed up flows from the River Trent exiting the Tatenhill Brook and ordinary watercourse around the Branston Water Park area west of the carriageway, into the low spot on the east of the carriageway, and further south of the Lichfield Road.

Construction for this phase of the scheme began in July 2021, with the area around the Tatenhill Brook low spot and the majority of sheet piled flood protection walls completed by winter 2021-2022. The whole scheme was completed in June 2022.



Figure 16: Construction of the scheme in area one, the low spot on the east of the Lichfield Road highway (image source and rights belong to the Environment Agency)



Figure 17: Construction of the scheme in area two, alongside the Tatenhill Brook (image source and rights belong to the Environment Agency)



Figure 18: Construction of the scheme in area three, alongside the east of the Lichfield Road/A38 (image source and rights belong to the Environment Agency)

Recommended Actions

As part of the flood investigation into the February 2020 flood incident, recommended actions to continue to alleviate flooding on the Lichfield Road for the relevant RMAs have been provided in **Table 2**.

Table 2: Recommended actions to address flood issues on the Lichfield Road for relevant RMAs

	Risk to address	Recommended Action	Responsibility
1	River flooding from the Tatenhill Brook	The Environment Agency's A38 flood alleviation scheme to reduce flood risks to the affected location on the Lichfield Road should continue to progress in partnership with the relevant RMAs. Information from the Environment Agency confirms the scheme was completed in June 2022.	Environment Agency (EA) supported by various RMAs
2	Maintenance of highway drainage infrastructure along the Lichfield Road	Part of the A38 Flood Alleviation scheme includes the implementation of non-return valves on highway drains. Risk-based contract for maintenance should be continued with inspections of assets undertaken regularly. Any future surface water flooding that occurs due to precipitation not discharging off the carriageway from high Tatenhill Brook levels is not expected to be as severe as combined surface water and river flood incidents, but should continue to be observed, with appropriate management undertaken if necessary.	National Highways (NH)
3	Highway maintenance of cleansing and sweeping	Communication and coordination between Highways England and East Staffordshire Borough Council (ESBC) should be improved and continue in relation to highway cleansing and sweeping to remove silt and detritus that can block drainage assets. Results of this Section 19 reports confirms RMAs are aware of roles and requirements.	National Highways (NH) and East Staffordshire Borough Council (ESBC)
4	Any potential issues with pumping station	Continue reviews and maintenance of the pumping station and flood proofing of the pumping station by Severn Trent Water to reduce any future potential problems that may occur.	Severn Trent Water (STW)
5	Impact of future development on flood risk along the Lichfield Road section of the A38	Future flood risk challenges from increased development on the Lichfield Road and Branston village should be discussed with East Staffordshire Borough Council (ESBC) planners and Councillors to ensure appropriate consideration of future flood	East Staffordshire Borough Council (ESBC) and Staffordshire County Council (SCC)

		risks have been considered. ESBC as Local Planning Authority (LPA) will consult with Staffordshire County Council as Lead Local Flood Authority (LLFA) on land drainage and flooding issues.	
6	Property Flood Resilience (PFR)	Investigate opportunities of providing potential PFR to property owners to identify if these could be appropriate or required alongside the A38 flood alleviation scheme.	Staffordshire County Council (SCC); Environment Agency (EA)
7	Communication of flood risks to residents	Residents should be made aware of their risk to flooding and provided with updates resulting from changes to the Environment Agency Flood Zone maps upon completion of the A38 scheme.	Environment Agency (EA)

Risk Management Authorities and Other Parties

In addition to the recommended actions, a Risk Management Authority (RMA) or alternative party has been identified to undertake these actions.
While some actions require collaboration and partnership, the RMA or alternative party identified will co-ordinate all parties to ensure that the action is completed in a timely manner.

A summary of each of the RMAs, with regard to their role in flood risk management, is provided below:

Environment Agency
https://www.gov.uk/government/organisations/environment-agency

The Environment Agency has a strategic overview of all sources of flooding and hold responsibility for flood risk management activities on Main Rivers. The Environment Agency are the lead RMA on the A38/Lichfield Road scheme, part of the Burton-upon-Trent Flood Risk Management scheme that reduces flood risk from the River Trent and Tatenhill Brook designated rivers.

Staffordshire County Council (LLFA)
https://www.staffordshire.gov.uk/environment/Flood-Risk-Management/Home.aspx

LLFAs are county councils or unitary authorities which are required to prepare and maintain a strategy for local flood risk management in their areas, investigate significant local flooding incidents and publish the results of such investigations and play a lead role in emergency planning and recovery after a flood event.

Severn Trent Water
https://www.stwater.co.uk/my-supply/pipes-and-drains/help-with-pipes/sewer-flooding/

As a water and sewerage company, Severn Trent Water manage the risk of flooding to water supply and sewerage facilities and the risk to others from the failure of their infrastructure. They ensure their systems have the appropriate level of resilience to flooding, and maintain essential services during emergencies, maintain and manage their water supply and sewerage systems to manage the impact and reduce the risk of flooding and pollution to the environment and they provide advice to LLFAs on how water and sewerage company assets impact on local flood risk.

National Highways (previously Highways England)
https://www.gov.uk/government/organisations/highways-england

National Highways is the highway authority with lead responsibility for maintaining and managing trunk roads and motorways, including highway drainage and drainage assets.

East Staffordshire Borough Council (ESBC)
https://www.eaststaffsbc.gov.uk

As the Local Planning Authority, ESBC are responsible for determining planning applications within the catchment in accordance with local and national policies. ESBC are also responsible for street cleansing and sweeping the Lichfield Road section, and slip road, of the A38.

Riparian Owners
https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities

A riparian owner is any party or individual who has a watercourse within or adjacent to any boundary of their property. They are responsible for maintaining the riverbed and banks within their section of the watercourse to preventing obstruction to the water flow and mitigate flood risk.

Conclusions

Several storms occurred in 2020 across the Midlands region that impacted many areas. In February 2020, a long duration, low-to-moderate intensity event, named Storm Dennis, led to severe weather warnings across much of Wales and the Midlands. As a result, a significant number of associated flooding incidents to properties and highways were recorded across Staffordshire, and reported to SCC, as well as nationwide. This includes the flooding incident that occurred on Lichfield Road, a section of the A38 south of the Staffordshire village on Branston.

Reports indicate that 18 residential and 5 business properties were internally flooded along Lichfield Road on February 17th 2020. Flooding on the Lichfield Road carriageway also resulted in this section of the A38 being closed for three days, affecting residents and the travelling public.

The main types of flooding have been identified as flooding from rivers and flooding from highway drainage infrastructure becoming overwhelmed. The dominant flooding mechanism has been identified as flows backing up from the River Trent along the Tatenhill Brook. Evidence from ReFH hydrographs identify the magnitude of peak flows in the Tatenhill Brook as between a 1 and 2-year return period. However, the levels in the River Trent were recorded at 3.8m on February 17th, the joint highest since records began. This results from an accumulation of intense rainfall across the catchment during the Storm Dennis event on February 15th and 16th draining into the River Trent. These flows backed up along the Tatenhill Brook channel that overtopped both sides of the carriageway, filling a low-lying area on the east side of the Lichfield Road, and discharged onto and across the highway to impact properties.

These flood mechanisms had not previously been fully understood. However, the February 2020 incident and resulting hydraulic modelling of the Tatenhill Brook have clearly identified the cause and routes of flood flows to the highway, residential properties, and surrounding businesses. In response to the February 2020 event, the Environment Agency has incorporated these flood mechanisms to the Lichfield Road into phase two of the existing Burton-upon-Trent Flood Management Scheme to alleviate this risk. This work incorporates works undertaken in partnership with the relevant RMAs, particularly with Severn Trent Water and National Highways implementing non-return valves. This work was completed in June 2022.

Staffordshire County Council (SCC) in its role as LLFA will continue to work with the Environment Agency and other identified RMAs to try to reduce flood risk to properties and infrastructure, as well as assisting the local community to ensure that it is resilient and prepared for flood events, should they occur in future.