Staffordshire County Council

2020 Flood Events:

Flood and Water Management Act

Section 19 - Investigation

The District of South Staffordshire

Staffordshire County Council

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.

Table of Contents

Executive Summary

When made aware of flooding, Staffordshire County Council, in its role as Lead Local Flood Authority, has a duty to investigate, if certain criteria or thresholds are met, to determine the causes of the flooding and determine appropriate actions that may be undertaken by the relevant Risk Management Authority.

A number of storms occurred in 2020 across the Midlands region which impacted many areas, including the District of South Staffordshire. Storm Dennis in February was a long duration event, causing widespread flooding nationwide. The June and August storms which occurred were typical of summer storms in the UK, being short, intense and highly localised in nature.

As a result of these storms, a significant number of flooding incidents were reported to Staffordshire County Council.

Immediately following the events, Staffordshire County Council with the assistance of South Staffordshire District Council and Severn Trent Water distributed flood questionnaires to all residents within, or in close proximity to, areas where flooding was reported.

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

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

Introduction

A number of storms occurred in the South Staffordshire District area in 2020, with the most significant storms occurring on 16th February, 16th June and 16th and 17th August 2020.

These storms caused widespread flooding to highways and properties across Staffordshire and as a result, Staffordshire County Council has undertaken investigations in the areas where flooding occurred.

This report will also aim at providing a broad overview of the causes of the flooding in February, June and August 2020 and identifies the next steps, if any, to be taken.

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.

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, in Appendix D 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.

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

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

- Stage 1: Initial assessment
- Stage 2: S19 Investigation
- Stage 3: S19 Report and publish

It follows that there will be requirements for coordination and cooperation between Risk Management Authorities at each stage and, where required, following the outcome of a S19 Investigation. This will be undertaken via day to day officer communication, and through the LLFA's governance process for flood risk management.

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
Human Health Flooding of 15 people, but no less than 5 properties
Economic Activity Flooding of 2 businesses
Critical Services Flooding 1 critical service or the marooning of one critical service, or
Road and Rail The flooding of a motorway or strategic road where it is closed for over 2 hours
Environment - Harmful consequence to 1 nationally or internationally designated site or nationally or internationally recognised heritage site

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.

February 2020 – Storm Dennis - General Meteorological Synopsis[3]

From Met Office reports-

Storm Dennis was the fourth named storm of the 2019/2020 season. The storm arrived one week after another severe named storm- Ciara. It is reported that Dennis brought heavy and persistent rain across much of the UK; indeed a Red Warning was issued for some parts. There was major and widespread flooding.

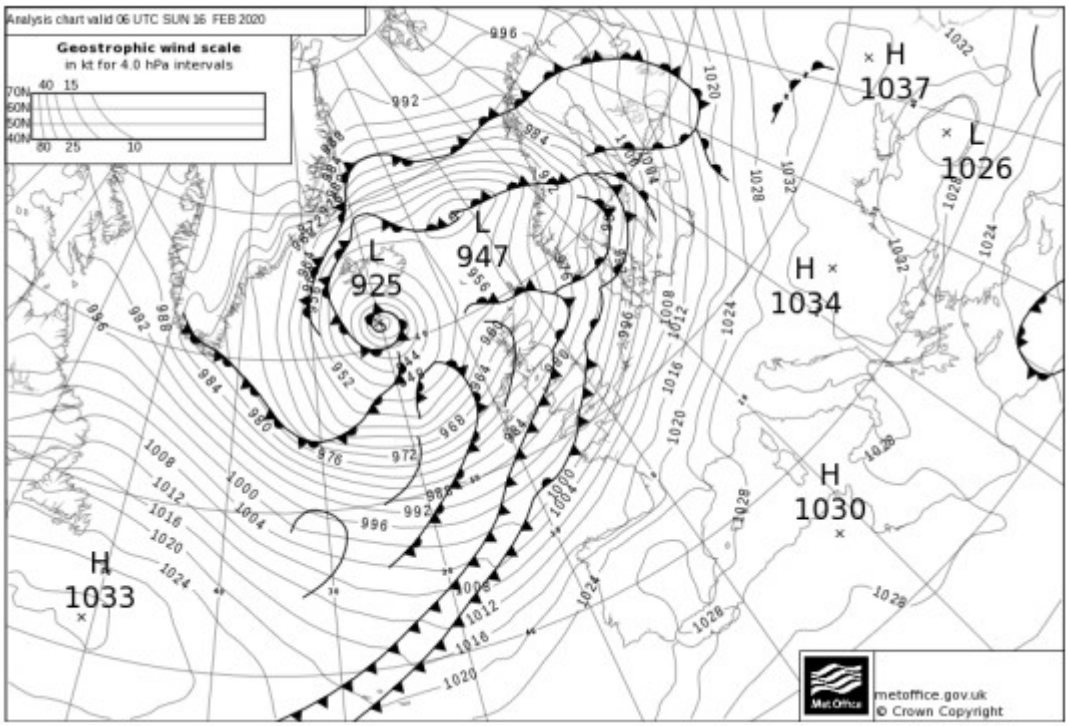


Figure 1 Met Office analysis chart at 0600 UTC 16/02/2020 -indicating a large area of low pressure dominating the north Atlantic. Strong winds and rain-bearing fronts swept across the UK –© Crown Copyright[3].

As a result of Storm Dennis in February 2020, more specifically the storms that occurred over the weekend of 15th and 16th February 2020, widespread flooding occurred across Staffordshire. Numerous incidents of flooding were reported, ranging from waterlogged gardens, impassable roads and water inundating highways. Numerous watercourses breaching their banks, resulting in internal property flooding.

3. Kendon, M (20120 'Met Office- Storm Dennis. *Met Office National Climate Information Centre,* Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2020/2020_03_storm_dennis.pdf (metoffice.gov.uk) (Accessed: 27 May 2022).

From analysis, the Storm Dennis flood event on the 15th and 16th February was characterised as long duration, rainfall, spread over large catchments; typical with winter rainfall storm events. Some rain gauges recorded a very highly significant total rainfall

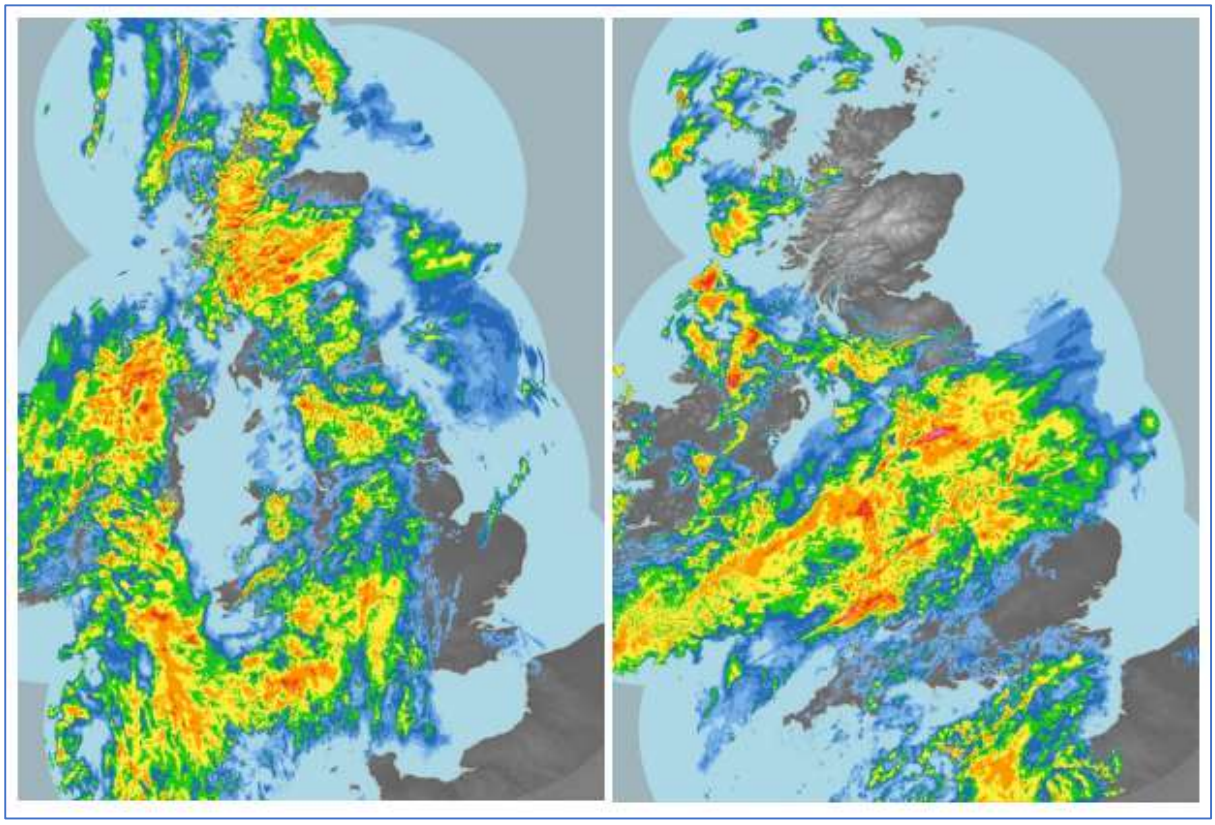


Figure 2: Rain-radar image panel indicates persistence of heavy rainfall at 1200 UTC on 15/02/2020 and 0000 UTC on 16/02/2020- indicating heavy rain and persistent rainfall from Storm Dennis. Strong fronts swept across the UK © Crown Copyright[3].

3. Kendon, M (20120 'Met Office- Storm Dennis. *Met Office National Climate Information Centre,* Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2020/2020_03_storm_dennis.pdf (metoffice.gov.uk) (Accessed: 27 May 2022).

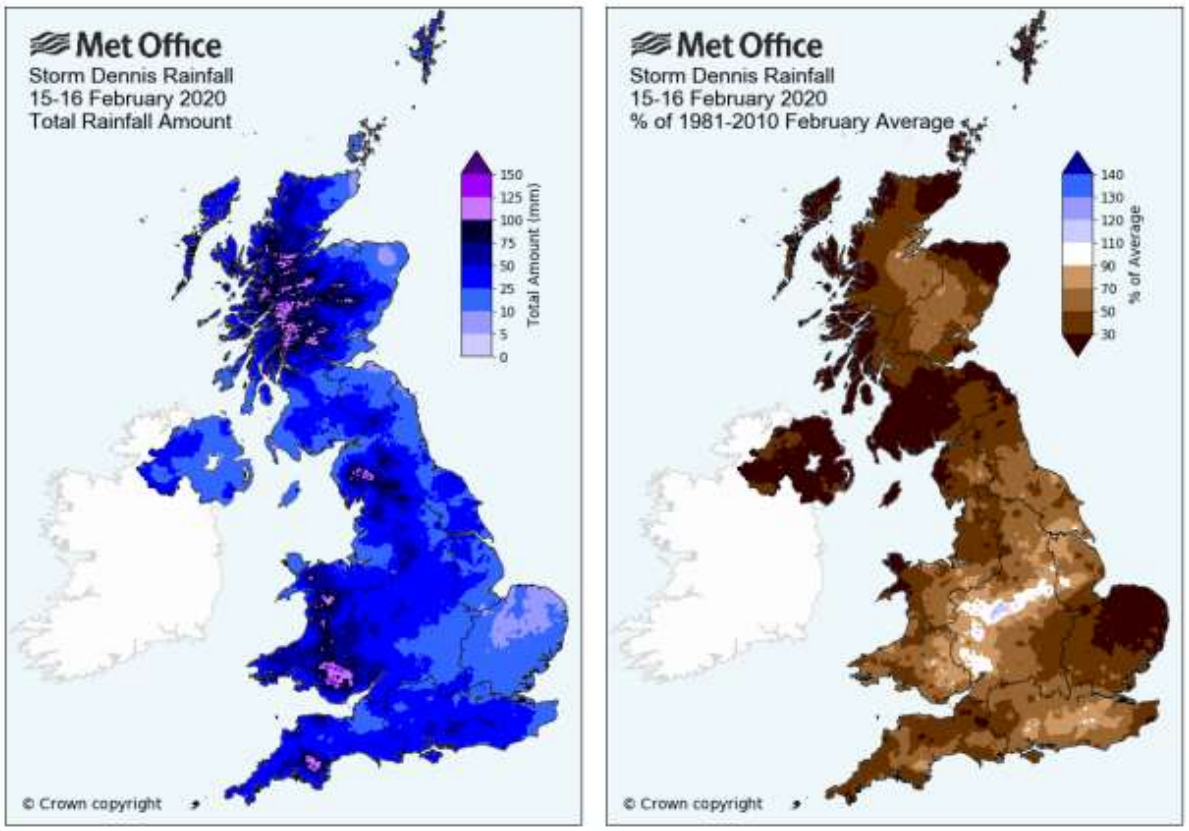


Figure 3- Total of rain falling in UK over 9 day period 8-16/02/2020. Most of the UK received a whole February month average over the 9-day period. The West Midlands received up to 150% this monthly average value © Crown Copyright[3].

DEFRA Environment Agency rain gauges on at Wombourne and Penkridge, both located in the District of South Staffordshire, recorded daily (24hr) total rainfall as 16.6mm and 15.4mm respectively, during the day of 15th February, and 32.8mm and 31.2mm respectively on 16th February.

3. Kendon, M (20120 'Met Office- Storm Dennis. *Met Office National Climate Information Centre,* Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2020/2020_03_storm_dennis.pdf (metoffice.gov.uk) (Accessed: 27 May 2022).

June 2020

As a result of the storms in June 2020, more specifically the storms that occurred around the 16th June 2020 widespread flooding occurred across Staffordshire. Numerous incidents of flooding were reported, ranging from waterlogged gardens, impassable roads and water outflowing from highway gullies to watercourses breaching banks, manholes and sewers surcharging and internal property flooding.

From analysis, the events recorded on the 16th June were of high intensity and highly localised which is consistent with storms typically experienced in summertime. Some rain gauges recorded a significant total rainfall depth whilst other gauges recorded very little further supporting the above assertion.

DEFRA Environment Agency rain gauges at Wombourne and Penkridge, both located in the District of South Staffordshire, recorded daily (24hr) total rainfall as 1.2mm and 0.2 mm respectively on 15th June 2020, and 37.2mm and 21.6mm respectively on the 16th June.

August 2020

As a result of the storms in August 2020, more specifically the storms that occurred around the 16th and 17th August; widespread flooding occurred across Staffordshire. Numerous incidents of flooding were reported, ranging from waterlogged gardens, impassable roads and water outflowing from highway gullies to watercourses breaching banks, manholes and sewers surcharging and internal property flooding.

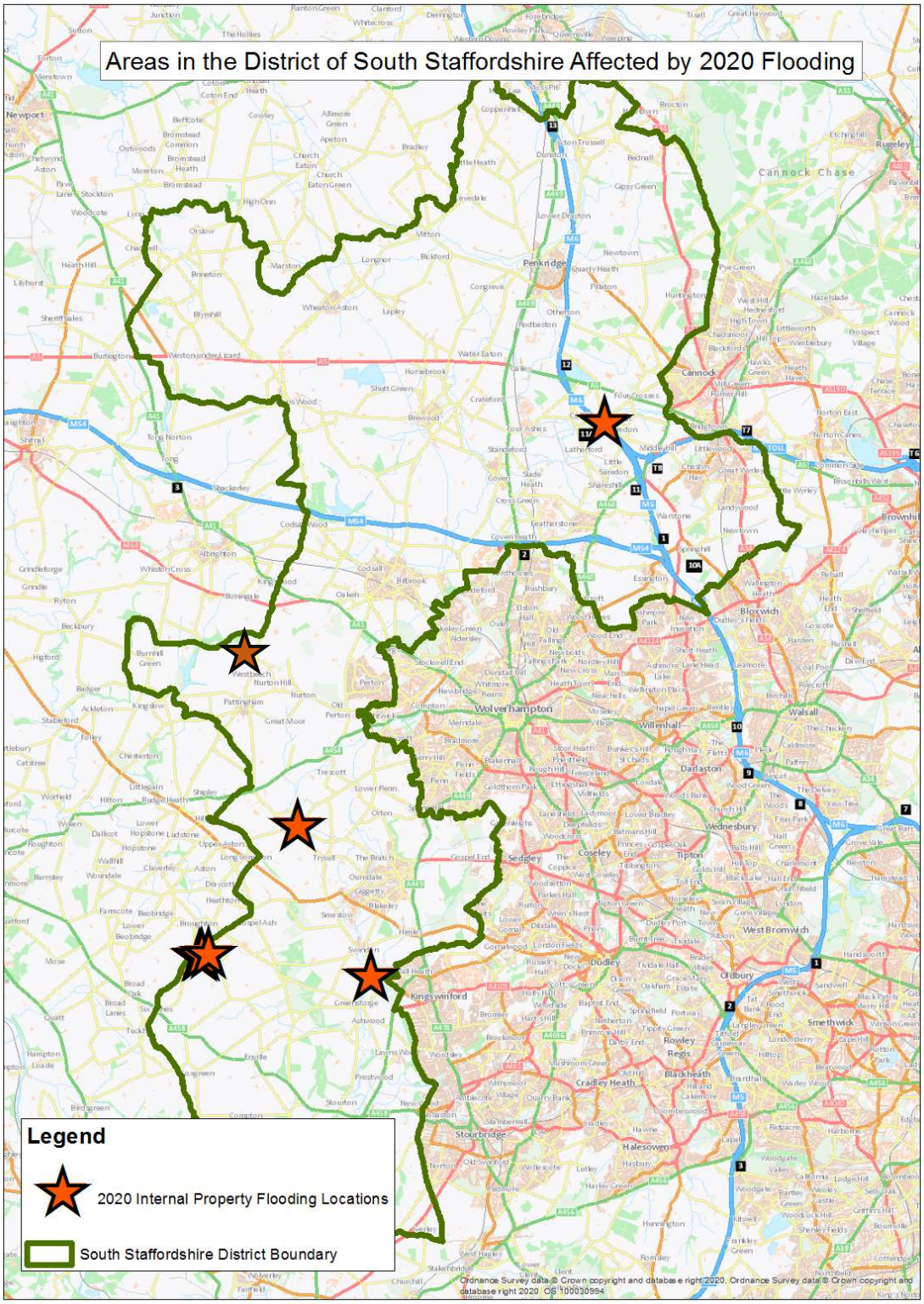
From analysis, the events recorded on the 16th and 17th August were of high intensity and highly localised which is consistent with storms typically experienced in summer. Some rain gauges recorded a significant total rainfall depth whilst other gauges recorded very little further supporting the above assertion.

DEFRA Environment Agency rain gauges at Wombourne and Penkridge recorded daily (24hr) total rainfall as 7.2mm and 3.6mm respectively on the day of 16th June, and 2.6 and 1.4mm respectively on 17th August.

The main areas affected by the June and August 2020 storms are shown below in Figure 1-1.

Areas affected by flooding in 2020 within South Staffordshire District

Figure 1-1



Investigation into Flooded areas

Following the events of February, June and August in 2020, SCC in its role as LLFA, has undertaken the steps as outlined below:

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 events, 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

Through the use of call records, flooding investigation questionnaires and site visits, the LLFA identified the locations where flooding occurred and distributed 'Flood Surveys' to all property owners and residents directly affected by flooding and those within the surrounding area.

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 where a minimum of one property 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 2020.

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

Step 4: Recommended Actions

Following the analysis of the affected areas, 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.

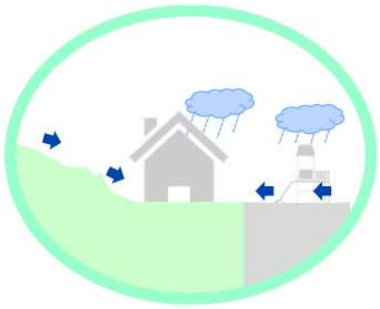
The following section of this report provides a summary of the findings from the works undertaken to date with regard to the affected areas.

Types of Flooding

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



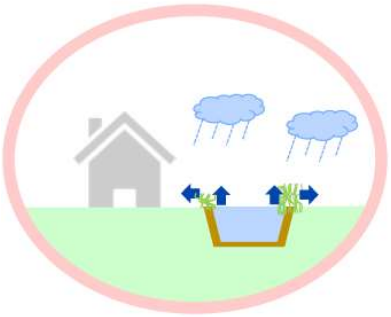
Soft surfaces, known as *permeable surfaces*, allow water to soak (infiltrate) into the ground. These are typically in the form of gardens, parks, fields and green spaces,

Hard surfaces, known as *impermeable surfaces*, do not allow any rainfall to soak into the ground and this rainfall will become (surface water) runoff. Runoff is usually very quick too. 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;

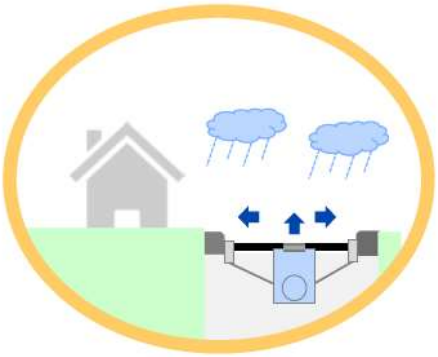
There has been a prolonged period of rainfall whereby permeable surface become saturated and the rate of surface water runoff increases thereby reaching the river faster;

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 and 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 carry rainfall and surface water away from properties to watercourses;

Foul Water Sewer, carries wastewater away from properties to be treated; and,

Combined Sewer, 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 occurring when:

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

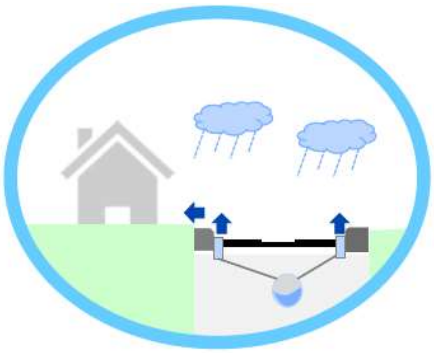
There is a period of heavy and/or prolonged rainfall, which results in significant flows that exceed the capacity of the sewer network. This prevents water from entering the sewer network and may result in surface flooding.

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 (6th Edition, published 2006). This guidance states that sewers should have to capacity to deal with all runoff from a storm with a 3.33% 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 the last 10 to 15 years. In addition, improvements in computer aided design and calculations also ensure designs are in agreement with the existing standards.

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 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 Cannock Chase District. 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

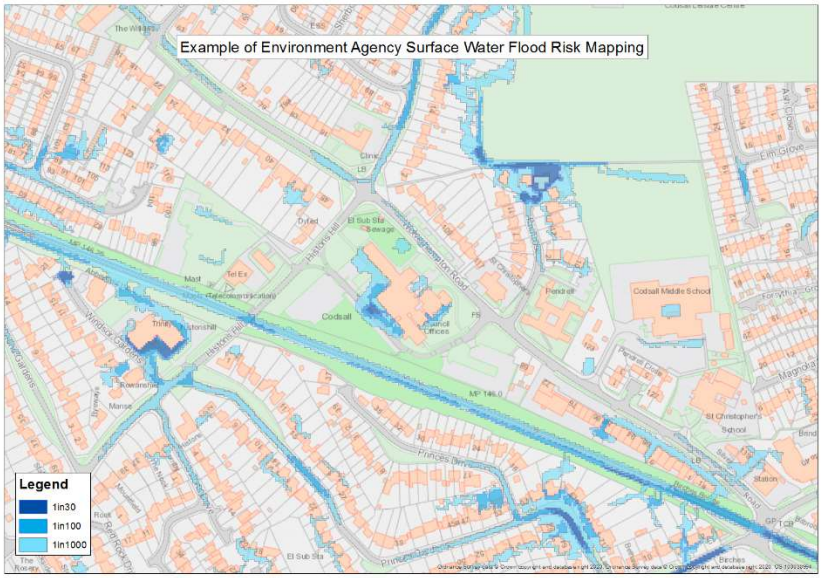
Medium Risk : Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year

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.

https://flood-warning-information.service.gov.uk/long-term-flood-risk/postcode



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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.

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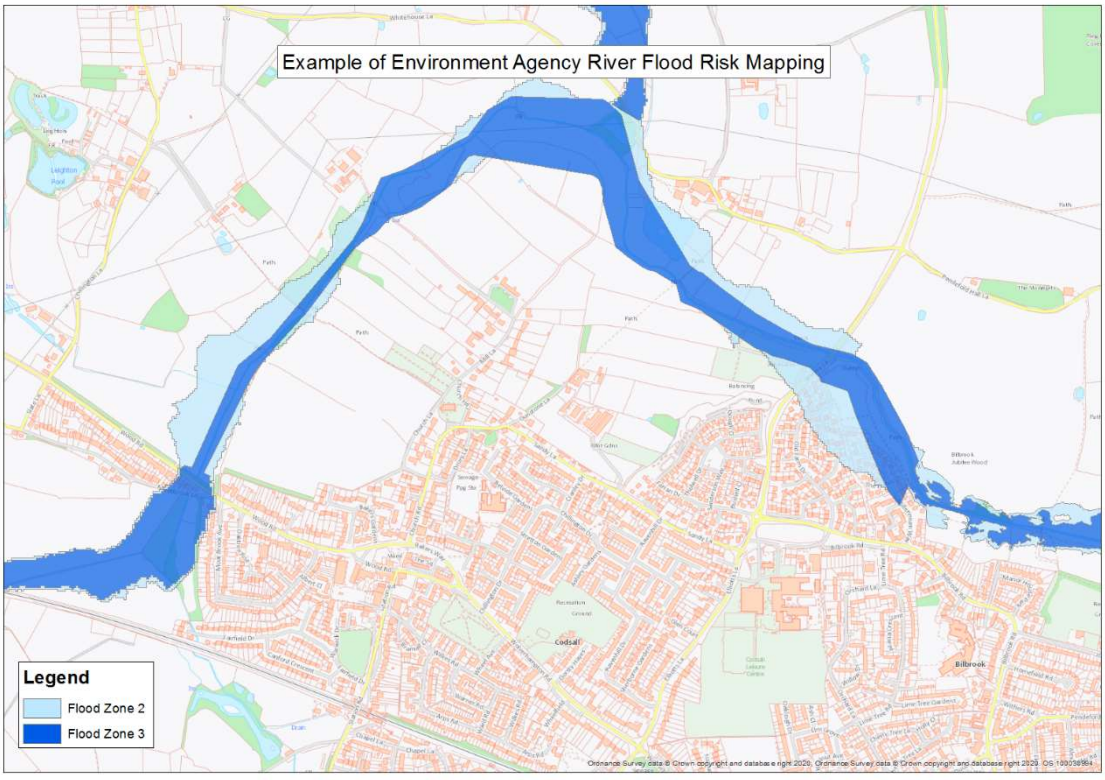
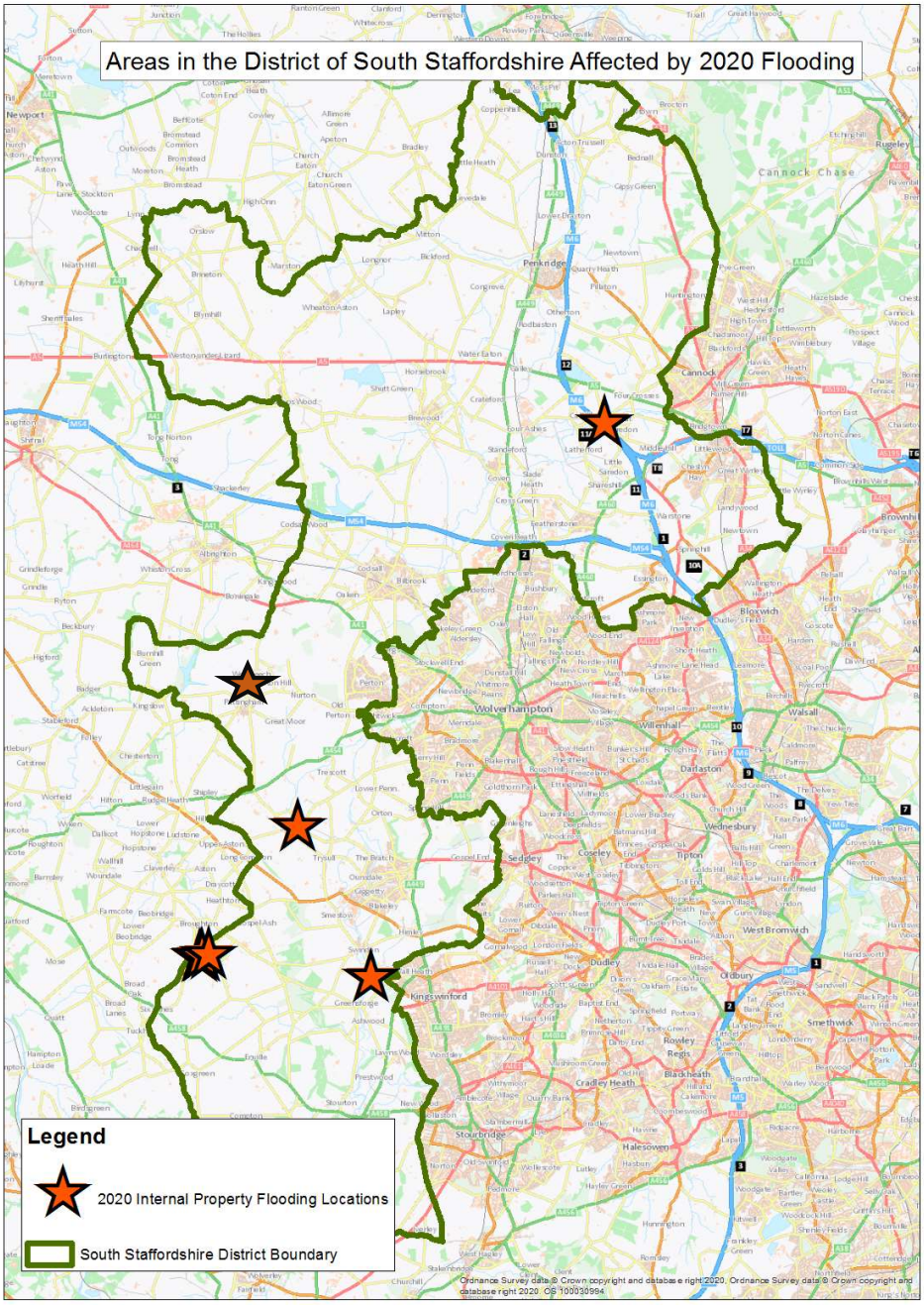


Analysis of Flooding Locations



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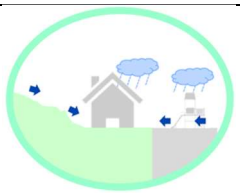
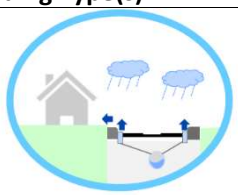
Event	Locations	Estimated Return Period (years)
February 2020	Moor Lane, Pattingham	3-10 (Rainfall)
February 2020	Malthouses, Great Saredon	2-5 (Watercourse)
February 2020	Six Ashes, Bobbington	2-5 (Watercourse)
February 2020	Church Lane, Bobbington	11 (Rainfall)
February 2020	Hinksford Caravan Park	30-50 (Main River)
February 2020	The Beeches, Ebstree Road, Seisdon.	5-10 (Watercourse)

Moor Lane, Pattingham, WS6 7DN

Identified Flooding Type(s)	
	

History of flooding in location

N/A

Event Background

On the 16th February 2020, properties in the vicinity of Moor Lane, Pattingham reported internal flooding, together with flooding to surrounding roads, driveways and gardens, both on Moor Lane and the Elms Paddock. It was reported that the flooding came from the agricultural land to the north of Moor Lane, as well as surface water runoff down Moor Lane itself and the field to the south of Moor Lane. Drainage along the north-western boundary of New Peace field (the extension of Letchmere Lane) reportedly conveyed flows south westwards also. Drainage infrastructure on Moor Lane reportedly was overwhelmed. Water flowing from the fields to the North of Moor Lane also reached properties in the opposite side of the road, via gardens and also the highway.

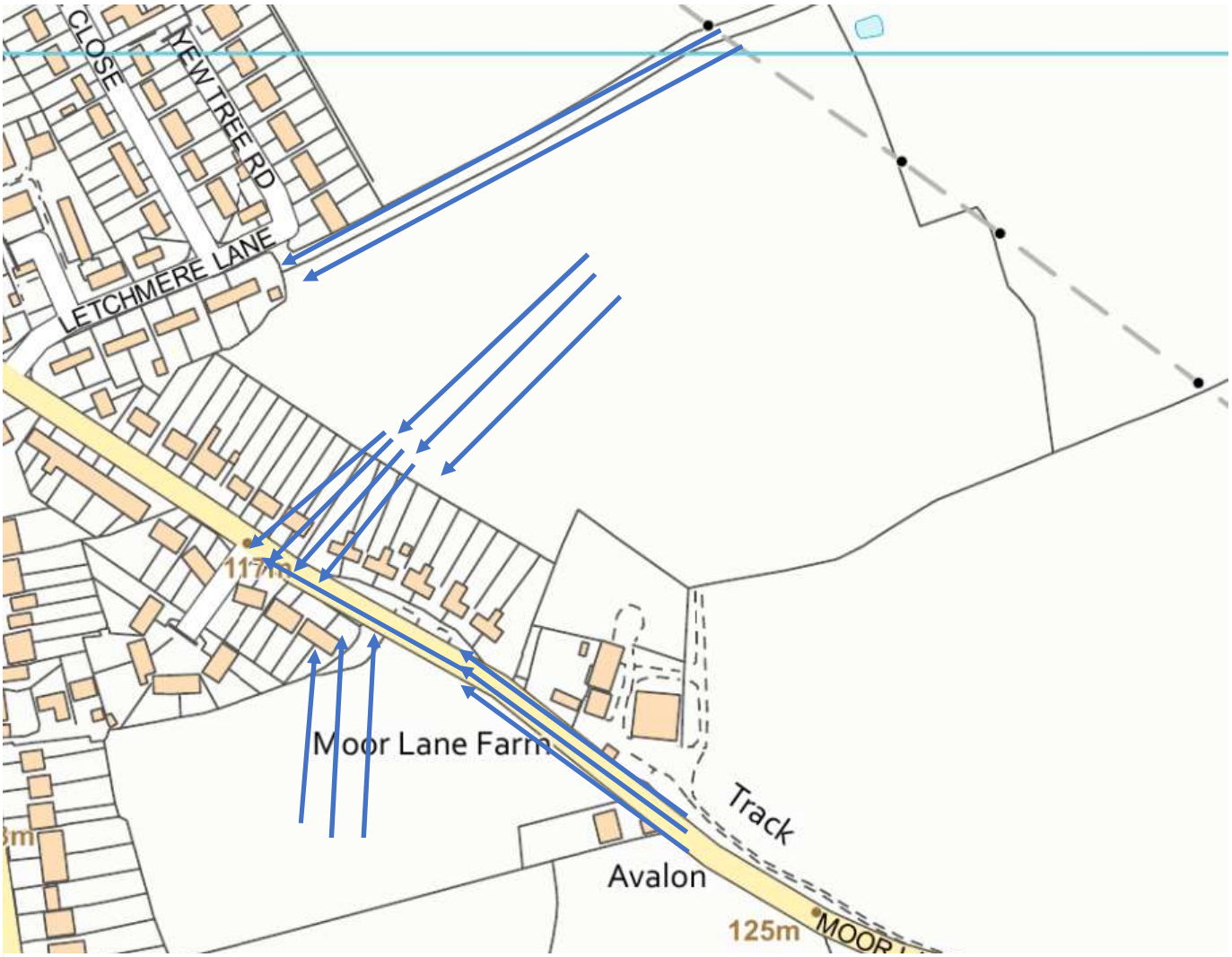


Figure 4: Flow Directions (blue arrows).

Investigation

Following these reports residents have been engaged- by the sending of questionnaires- immediately following the event. Also, an initial investigative site visit by a SCC Flood Risk Officer was carried out on 4th June 2021 – where discussions with residents were had and the County Councillor was in attendance. New Peace Field was surveyed along with a walk around the area concerned. The owner of the surrounding land has been engaged in discussion and positive work has been undertaken in the form of a temporary ditch and hay bale barrier to assist with holding back flood flows in the future.

Staffordshire County Council (Highways) have been engaged to ensure highway gully drainage assets are fully functional as well as to understand the available capacity of the system and network in the village.

Further information needs to be gathered to ensure a full understanding of the extent of flooding in the locality. Further questionnaires will be disseminated.

Conclusion

Storm Dennis was an extreme rainfall event, where a very high amount water fell on already saturated land over an extended period. There were three contributing surface water flow path directions contributing to the flooding on Moor Lane during Storm Dennis. Water flowed off surrounding fields and along the lane itself. This resulted in multiple properties flooding internally, as well as inundating surrounding roads and gardens.

Recommended Actions

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

Recommended Actions	**Identified Party / RMA**
More evidence to be sought regarding flooding to properties for which we do not have data.	SCC (LLFA and Councillor)
Highway Gullies to be put on regular maintenance rota.	Highways (SCC)
Highway drainage system to be surveyed and cleared.	LLFA (SSC) /Highways (SCC)
Engagement with surrounding landowners to discuss options for mitigation.	LLFA (SCC) / Landowners
Follow up eligibility for grant funding for relevant properties.	SSDC / LLFA (SCC)

Malthouses, Great Saredon, WV10 7LP

Identified Flooding Type(s)	
	
	

Rainfall and Hydrological Analysis.

The flooding at this location originated from the watercourse (Saredon Brook). From hydrological flow analysis- (see Appendix A), the peak flow in this event has been estimated at 13.32 m3/s. This equates to a return period of the flow on the brook of between 1 in 5 and 1 in 10 years. This equates to between a 10% and a 20 % chance of occurring in any year.

History of Flooding in Location

N/A

Event Background

On the 16th February 2020 one property in Great Saredon reported internal flooding, together with flooding to surrounding roads, driveways and gardens.

It is reported that water flows down Saredon Lane, bypassing drainage, through an access gate and into rear gardens of the properties. Four Crosses Lane is also said to flood in three places, not allowing vehicles to pass. The highway floods extensively in this location with water being unable to return to the Saredon Brook.

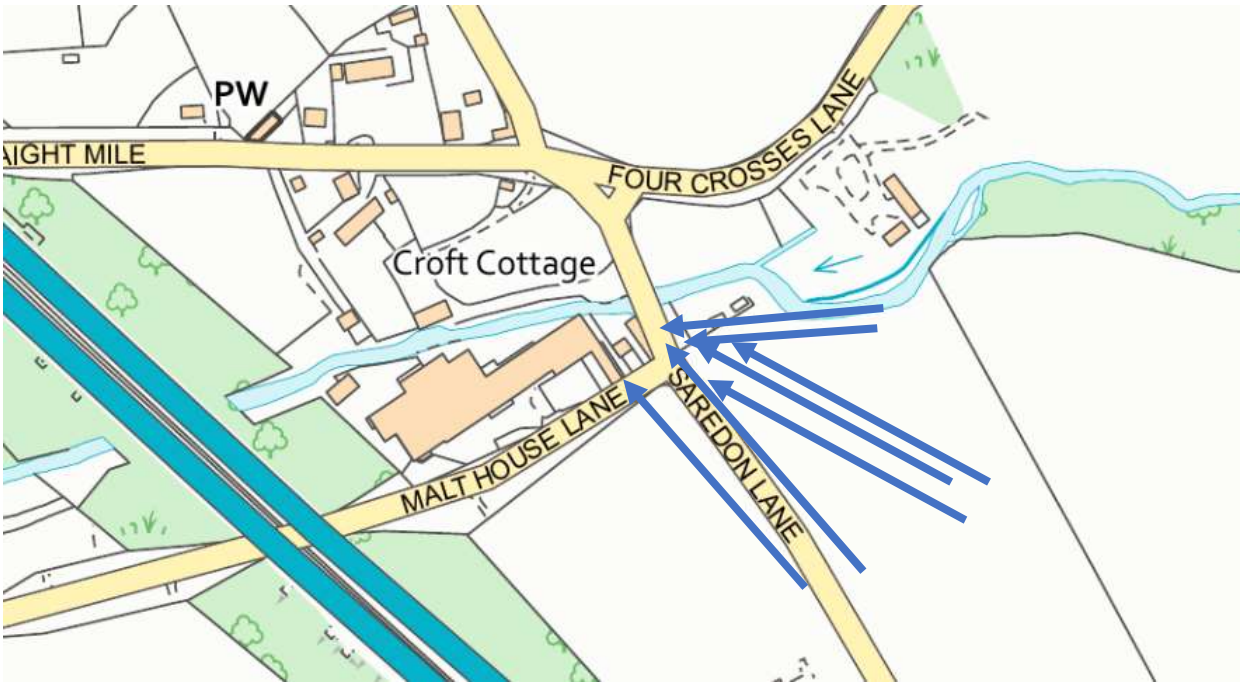


Figure 5- Surface water flow routes (blue arrows)

Investigation

The flooding in this location has been identified as being a combination of surface water runoff from surrounding land, highway runoff from Saredon Lane and water being unable to return to the Saredon Brook (Main River).

A site visit on 4th June 2021 by a Flood Risk Management Officer from Staffordshire County Council was undertaken where discussions were had with residents and a local business. Information gathered pointed towards multiple sources and factors leading to the flooding issues on this occasion.

During the storm event, the prevailing topography directed rainwater towards the bridge mapped above in figure 2 (Saredon Lane). Water reportedly pooled outside of the properties and the highway was barely passable. It was also reported that water was hindered from re-entering the Saredon Brook due to debris in neighbouring drainage ditches.

Whilst a number drainage infrastructure assets are identified at this location, the capacity of these features appears to be limited and potentially inhibited.

Conclusion

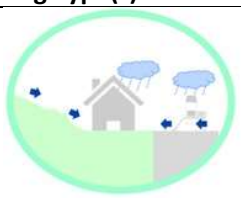
Following the storms, Staffordshire County Council as Lead Local Flood Authority visited the location on 4/06/2021. Flooding is reported as being from a number of sources, namely surface water runoff, highway runoff and main river flooding.

Recommended Actions

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

Recommended Actions	**Identified Party / RMA**
Affected properties to be offered individual property level flood resilience	SCC (LLFA)
Staffordshire County Council Highways to ensure gullies are maintained and kept clear. Important to ensure existing gully infrastructure is regularly maintained. To consider installing additional gullies in highway.	Highways (SCC)
Environment Agency to be informed to ensure Saredon Brook is maintained appropriately.	SCC (LLFA) / EA
To engage with local landowners to ensure surface water is allowed to flow freely on its natural course.	SCC (LLFA) / Landowner

The Beeches, Ebstree Road, Seisdon

Identified Flooding Type(s)	
	
	

Rainfall and Hydrological Analysis

The flooding at this location originated from the watercourse (Smestow Brook). From hydrological flow analysis- (see Appendix A), the peak flow in this event has been estimated at 10.60 m3/s. This equates to a return period of the flow on the brook of between 1 in 5 and 1 in 10 years. This equates to between a 10% and a 20 % chance of occurring in any year.

History of flooding in location

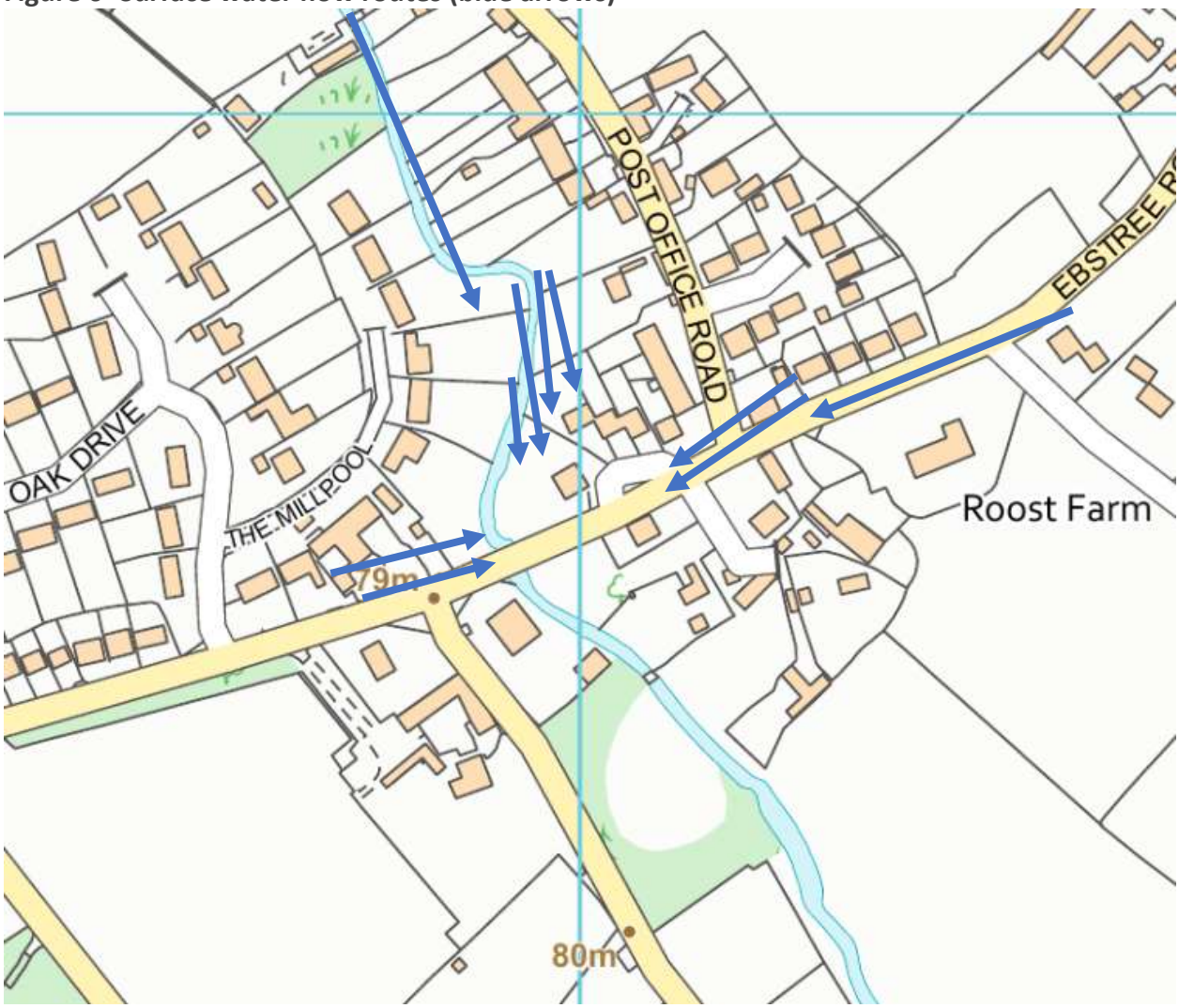
N/A

Event Background

On 16th February 2020 properties at The Beeches, Ebstree Road, Seisdon reported flooding, some internal. Together with flooding to surrounding roads, driveways, and gardens.

Water levels rose rapidly over the duration of the Storm event, especially overnight. Residents awoke to catastrophic flooding.

Figure 6- Surface water flow routes (blue arrows)



Investigation

The source of the flooding in this location primarily originated from the Smestow Brook (Main River), which overtopped its banks and inundated surrounding land and property. Surface Water also flowed down Ebstree Road, bypassing drainage infrastructure- therefore exacerbating the flooding issue.

Flood Risk Management Officers from Staffordshire County Council (LLFA) have visited the location on multiple occasions to assess the site. The first site visit allowed the Principal Officer to ensure local assets were functioning as designed.

The County Councillor for the area has also engaged with Officers and residents. Staffordshire County Council Highways have also attended the location to ensure the highway drainage assets (gullies), are functioning suitably, and that they are to be put on a regular maintenance rota.

A resident who was affected particularly severely has installed property level measures such as flood walls, gates and a rain garden. These were accessed via grant allocation funding from South Staffordshire District Council. An upgraded drain has also been installed at the entrance to The Beeches.

Conclusion

The flooding in this location has been determined to be from Main River (fluvial), Surface Water Runoff, as well as runoff from the highway. Therefore, a multi-agency approach is required in this location. Staffordshire County Council Highways has been contacted to ensure that the gully infrastructure is free and functioning correctly. The Environment Agency will be contacted to recommend that the location assessed appropriately.

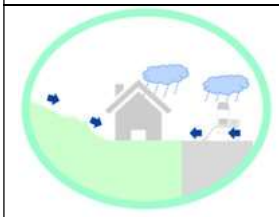
Recommended Actions

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

Recommended Actions	**Identified Party / RMA**
LLFA (SCC) to contact and liaise with EA to understand catchment dynamics and possible mitigation.	SCC (LLFA) / EA
SCC (Highways) to ensure gully drainage infrastructure is maintained and functioning correctly.	SCC (Highways)
SCC to work with residents and local elected members to ensure disseminate information.	SCC (LLFA)

Six Ashes Road, Bobbington

The flooding at this location originated from the watercourse. From hydrological flow analysis- (see Appendix A), the peak flow in this event has been estimated at 0.64 m3/s. This equates to a return period of the flow on the brook of between 1 in 2 and 1 in 5 years. This equates to between a 20% and a 50 % chance of occurring in any year.

Identified Flooding Type(s)	
	
	

History of flooding in location

N/A

Event Background

On 16th February 2020 multiple properties in the Six Ashes Road area of Bobbington reported internal flooding, together with flooding to surrounding highways and gardens.

Surface water was reported to have flowed down Six Ashes road after sustained heavy rainfall. The drainage infrastructure in the vicinity has been identified as being unable to cope with the volume of water in this event. A small watercourse to the rear of the properties on Six Ashes Road, was identified as breaching its banks. A blocked culvert inlet has been noted as a potential factor here.

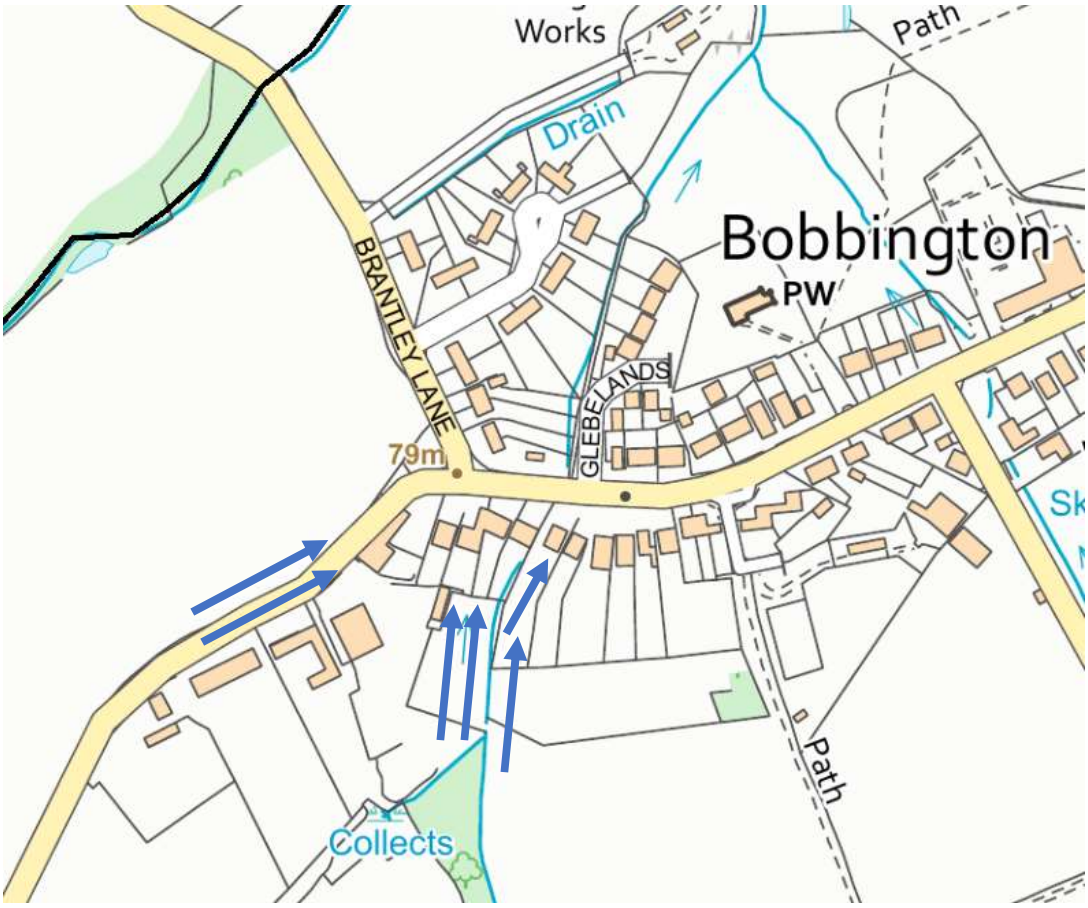


Figure 7- Surface water flow routes- (blue arrows)

Investigation

Flood Risk Officers have visited the location. Several residents have been consulted. On attending the location, an obstruction in a private garden was identified as a possible constriction on flow on the watercourse. In extreme flow events, this may have reduced the capacity of the culvert therefore restricting flows that are able to be conveyed.

On investigating the upstream catchment and surrounding agricultural land, natural flood management and channel geomorphological interventions were identified as possible interventions to slow catchment flows and provide resilience.

Conclusion

The flooding in this area has been identified to be surface water flooding. Over the course of the storm event, the prevailing topography directed rainwater towards properties, via an ordinary watercourse.

Recommended Action

It is recommended that the identified obstruction is to be removed or modified in a way to maximise potential channel and culvert capacity. It is also suggested that a new, fit for purpose, upgraded debris screen is to be installed, to minimise the chance of debris causing future blockages.

Recommended Actions	**Identified Party / RMA**
Private landowner to remove obstruction from over watercourse	Landowner
Review of potential Trash Screen for Culvert	Landowner / Possible FDGIA
Possible installation of Natural Flood Management measures further upstream in the catchment	Landowner / FDGIA

Church Lane, Bobbington

History of flooding in location

N/A

Event Background

On 16th February 2021, a property on Church Lane, Bobbington reported internal flooding, together with flooding to surrounding highways and gardens.

The property was flooded following extreme rainfall from Storm Dennis- an exceedance event. Surface water flowed down Church Lane, along with runoff from the surrounding fields. A brook next to the property became full and overtopped its banks.

Figure 8- Surface water flow routes- (blue arrows)

Investigation

Flood Risk Officers have visited the location. Several residents have been consulted. It has been identified that Storm Dennis was an extreme exceedance event resulting in abnormally high surface water flows and runoff volumes. Water has been reported as running off neighbouring fields, onto Church Lane itself. A historic road culvert and other drainage infrastructure has been noted as being at least partially blocked. The downstream drainage system has also been identified as having potential blockages and capacity issues.

Conclusion

The flooding in this area has been identified to be surface water flooding. Over the course of the storm event, the prevailing topography directed rainwater towards properties.

Recommended Action

SCC LLFA will investigate the possibility of resilience interventions – such as Natural Flood Risk Management, and increasing ditch and culvert capacity, both upstream and downstream of the affected properties

Recommended Actions	**Identified Party / RMA**
SCC LLFA to identify potential resilience interventions including ditch and culvert clearing as well as Natural Flood Risk Management	SCC LLFA
SCC LLFA to liaise with neighbouring landowners to explore land use change options.	SCC (LLFA) / Landowners

Hinksford Caravan Park

The flooding at this location originated from the Main River (Smestow Brook). From hydrological flow analysis- (see Appendix A), the peak flow in this event has been estimated at 21.58 m3/s. This equates to a return period of the flow on the brook of between 1 in 30 and 1 in 50 years. This equates to between a 2% and a 3.33 % chance of occurring in any year.

History of flooding in location

N/A

Event Background

On 16th February 2020 internal property flooding at Hinksford Caravan Park was reported to a depth of around a metre.

Figure 9- Surface water flow routes- (blue arrows)

Investigation

The location has been visited. Numerous residents have been consulted. Questionnaires have been handed out to residents and information regarding the flooding during Storm Dennis is being gathered. Following investigation and talking with residents, the reported cause of the flooding was an obstructed bridge downstream on the Smestow Brook.

Conclusion

The flooding in this area has been identified to be from the Smestow Brook breaching its banks. Over the course of the event, flow in the watercourse downstream of the mobile home park was obstructed causing water to back up and inundated the park.

Recommended Action

It is recommended that as the primary cause of flooding in this location is the Smestow Brook, which is Main River, the Environment Agency are consulted and possible resilience measures downstream on the brook, at the bridge adjacent to the Navigation Inn are considered. Blockages at this bridge have been repeatedly reported as a major aggravating flood risk factor.

Recommended Actions	**Identified Party / RMA**
NFM, channel / floodplain improvements downstream	EA
Flood warning system to be considered for the park.	EA/LLFA/SSDC

ACTIONS

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

Sewer Infrastructure:

Assess the condition and capacity of the sewer network –

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

An assessment of the sewer network, ensuring that the existing infrastructure is capable of draining the catchment effectively

Investigation and survey of existing assets, for example using CCTV and in-person inspections, to ensure blockages and flow restrictions (e.g. silt accumulation) are removed

Feasibility assessment and optioneering of means to increase capacity of sewer network

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

Hydraulic modelling and performance analysis.

Highway Drainage:

Assess the condition and capacity of the highway drainage network
Review of maintenance schedule of highway assets (e.g. gullies)
The above recommended actions may incorporate multiple tasks which may include:

Review of the location and condition of existing highway drainage assets, to ensure flows are not impeded and that sufficient gullies are in place to collect flows.

Assessment of the capacity of the local highway drainage network to explore opportunities to increase capacity

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

Rivers and Watercourses:

Assess the condition and capacity of the watercourse

Review of maintenance regime for the watercourse

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

Site visits and surveys to identify current condition of rivers, watercourses and assets, including culverts, outfalls and structures

Rehabilitation works including sediment removal, debris removal, clearance of vegetation and restoration of channels where required

Exploration of opportunities to enhance flow capacity of channels and storage capacity of adjacent floodplains

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

Property Level Resilience:

Explore the potential for flood mitigation
The above recommended action may incorporate multiple tasks which may include:

Site visits and surveys to identify potential flood resilience/mitigation

Exploration of property level resilience products and vendors to establish if potential resilience measures may be appropriate

Investigation into previously installed or existing property level resilience measures to assess the effectiveness of the installed measures

Explore community and catchment wide solutions including, property flood walls and gates, flood defence walls/banks, flood storage areas.

Hydraulic Modelling:

Construct a hydraulic model
The above recommended action may incorporate multiple tasks which may include:

Construction of computation models to replicate how watercourses and/or sewers behave when subjected to a significant storm to enhance understanding of flooding mechanisms and properties which are most vulnerable

Feasibility assessment and optioneering of potential measures that may mitigate flood risk. These measures may be strategic or local scale.

RISK MANAGEMENT AUTHORITIES AND OTHER PARTIES

In addition to the recommended actions, a 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:

Staffordshire County Council (LLFA)
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.

Staffordshire County Council (Highways)
Highways authorities have the lead responsibility for providing and managing highway drainage.

Cannock Chase District Council (Leisure Services)
Leisure Services, otherwise known as Parks and Recreation Services, are responsible for the maintenance of public open space. In particular, if this public open space contains or is bound by a watercourse (or feature) Leisure Services hold responsibility for the maintenance and management of this watercourse.

Cannock Chase Housing (Housing)
Housing authorities are county councils or unitary authorities who are required to provide essential housing for the area, and maintain property level drainage systems. In some cases if the properties back onto a watercourse or are constructed above a culverted watercourse, Housing will hold responsibility for the maintenance and management of this feature.

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.

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.

Highways England
https://www.gov.uk/government/organisations/highways-england
Highways England is the highway authority with lead responsibility for maintaining and managing trunk roads and motorways, including drainage.

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

Following the storm events during 2020, incidents of flooding were reported which included internal property flooding, external flooding to gardens and flooding to highways and other areas.

Four types of flooding have been identified as causes for the instances of reported flooding. These include surface water flooding, flooding from rivers, flooding from sewer infrastructure and flooding from highway drainage.

In many locations, surface water runoff was channelled by highways ultimately ponding in low point in the road. Across the reported areas, it was noted the affected properties were usually at or below the level of the adjacent highway.

Therefore, surface water runoff ponded within the low points of the highway and when the highway could not contain any more surface water, it would spill from the highway into properties.
The surface water flooding was then further exacerbated by the other three types of flooding. In some areas, the flow in watercourses exceeded the available capacity, particularly where watercourses entered a culvert. This resulted in a constriction of flows, causing water to back up, overtopping the riverbanks and spilling from the river channel.

In some areas, the capacity of the Severn Trent Water sewer infrastructure was overwhelmed causing water to be issued out of the sewer manholes and highway gullies. This has been further exacerbated due to highway gullies being unable to adequately capture the surface water runoff, particularly on steep catchments where the intensity of the rainfall, and volume of runoff, was such that it flowed over or around a gully pot.

For each of the areas, a set of actions have been proposed. The actions that have been proposed are related to the identified cause of the flooding, the severity of the flooding and identified constraints.

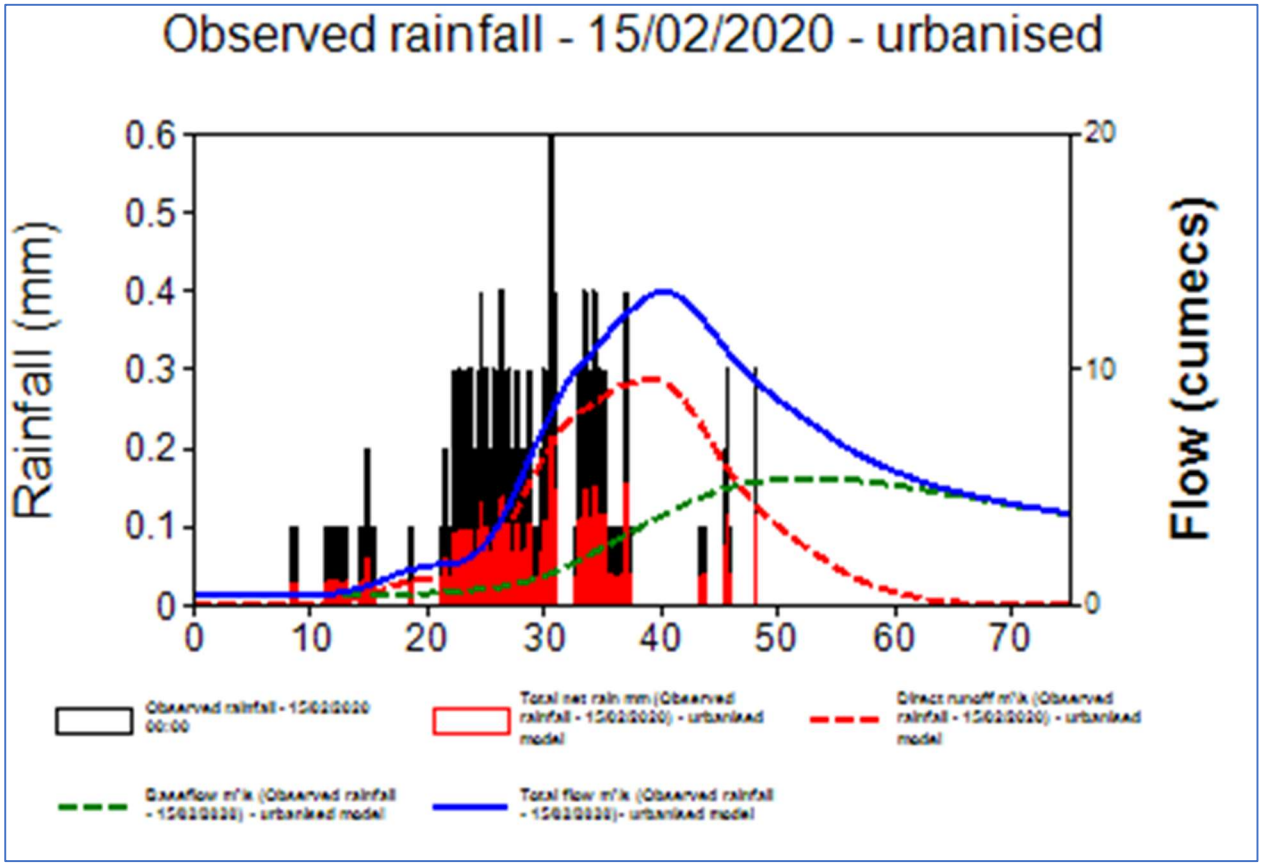
Staffordshire County Council, in their role as Lead Local Flood Authority, are continuing to work in partnership with all other relevant Risk Management Authorities; such as the Environment Agency, Severn Trent Water and SCC (Highways).

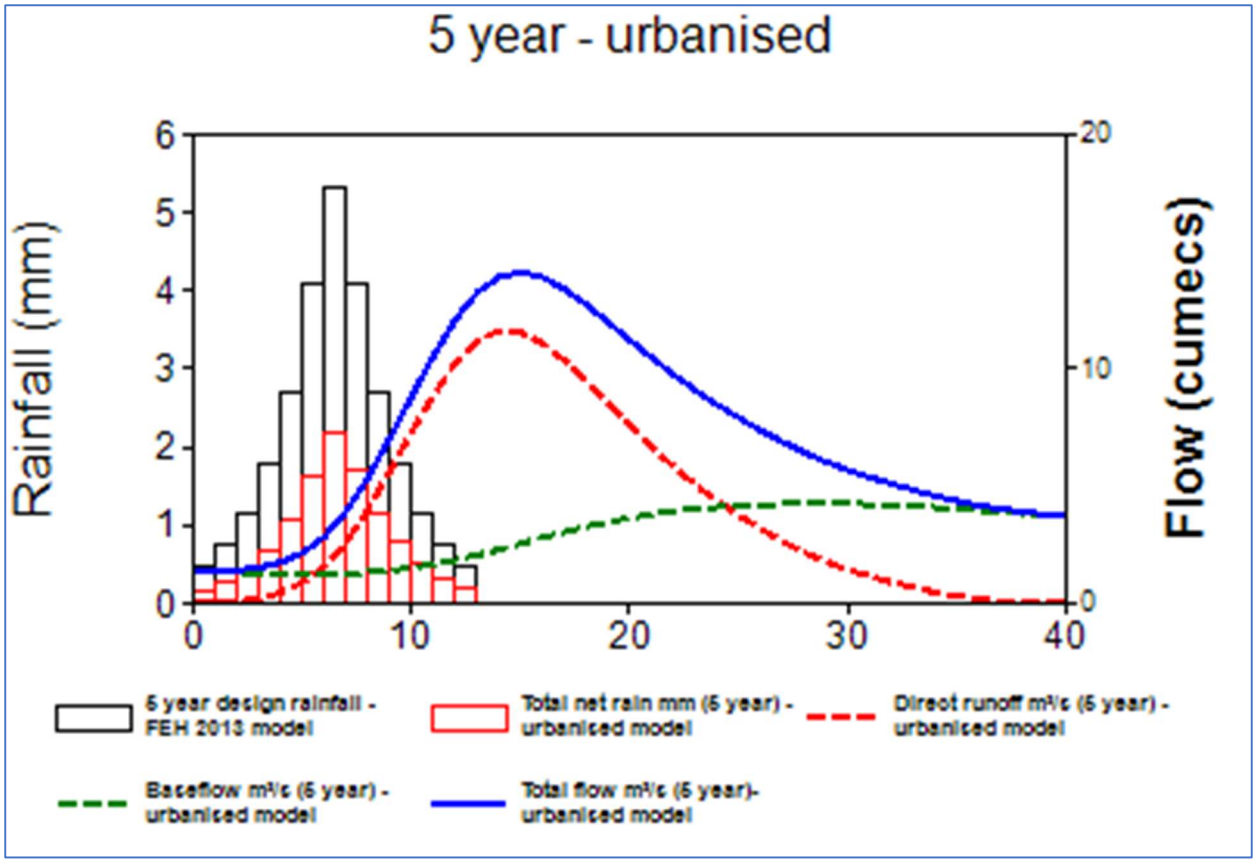
APPENDIX A: HYDROLOGICAL & RAINFALL ANALYSIS

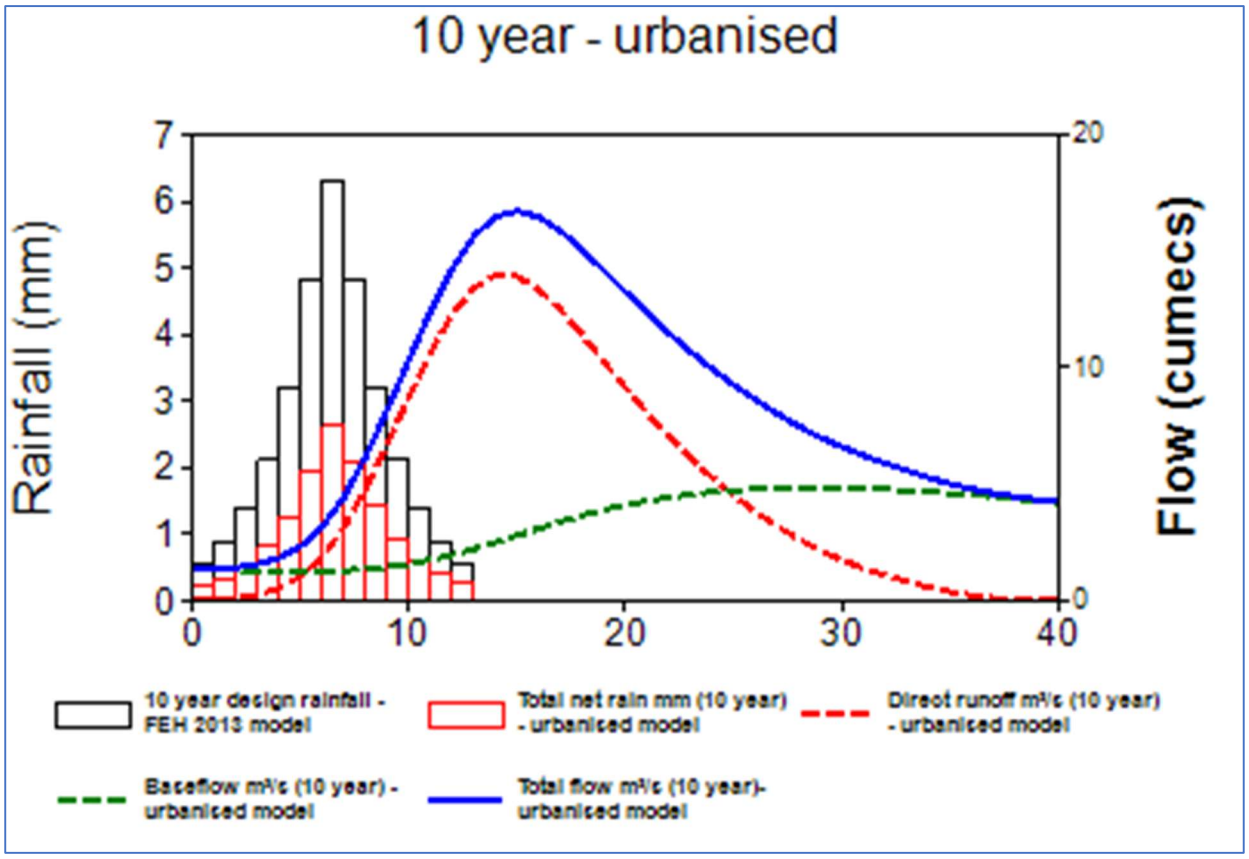
Malthouses – Great Saredon

In performing a hydrological analysis utilising Flood Estimation Handbook (FEH) Webservice catchment data and rainfall data sourced through Hydromaster software, the return period for the storm Dennis on this particular watercourse (the Saredon Brook), can be estimated. An analysis was performed utilising the Revitalised Flood Hydrograph method in ReFH2 hydrological modelling software.

The observed flow event at this location had a peak rate of 13.32 m3/s. The 'design' 1 in 5 year return period peak flow (that which has a probability of occurring of 20 % in any year), is estimated at 14.13 m3/s The 1 in 10 year 'design flow' is estimated as approximately 16.73 m3/s. Therefore, we can have a degree of confidence that the actual return period of this flow event on the Shropshire Brook in Storm Dennis is between 1 in 5 years and 1 in 10 years and therefore a significant flow event so had between a 10 % and 20% probability of occurring in that (or any), year.



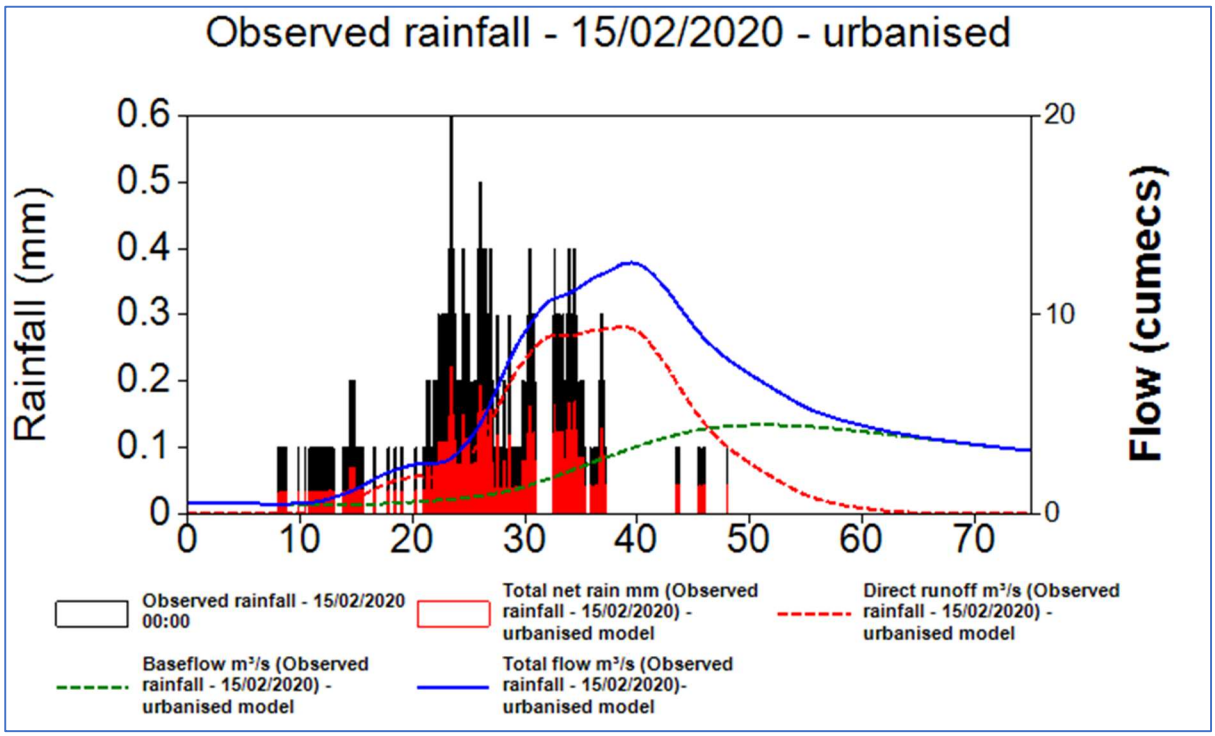

5 year - urbanised
Rainfall (mm)
Flow (cumecs)
0
1
2
3
4
5
6
0
10
20
30
40
0
10
20
5 year design rainfall - FEH 2013 model
Total net rain mm (5 year) - urbanised model
Direct runoff m³/s (5 year) - urbanised model
Baseflow m³/s (5 year) - urbanised model
Total flow m³/s (5 year)- urbanised model


10 year - urbanised
Rainfall (mm)
Flow (cumecs)
0
1
2
3
4
5
6
7
0
10
20
30
40
0
10
20
10 year design rainfall - FEH 2013 model
Total net rain mm (10 year) - urbanised model
Direct runoff m³/s (10 year) - urbanised model
Baseflow m³/s (10 year) - urbanised model
Total flow m³/s (10 year)- urbanised model

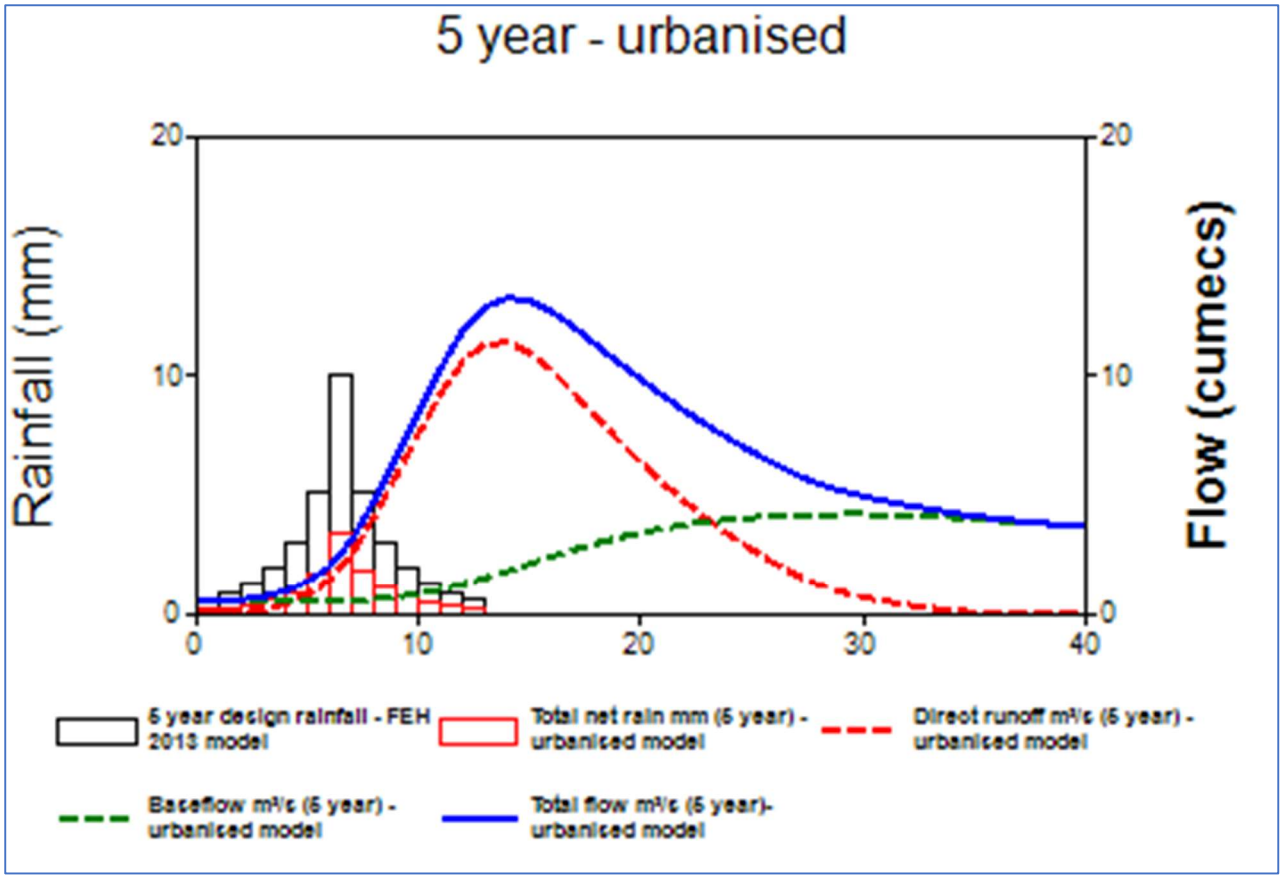
The Beeches, Ebstree Road, Seisdon

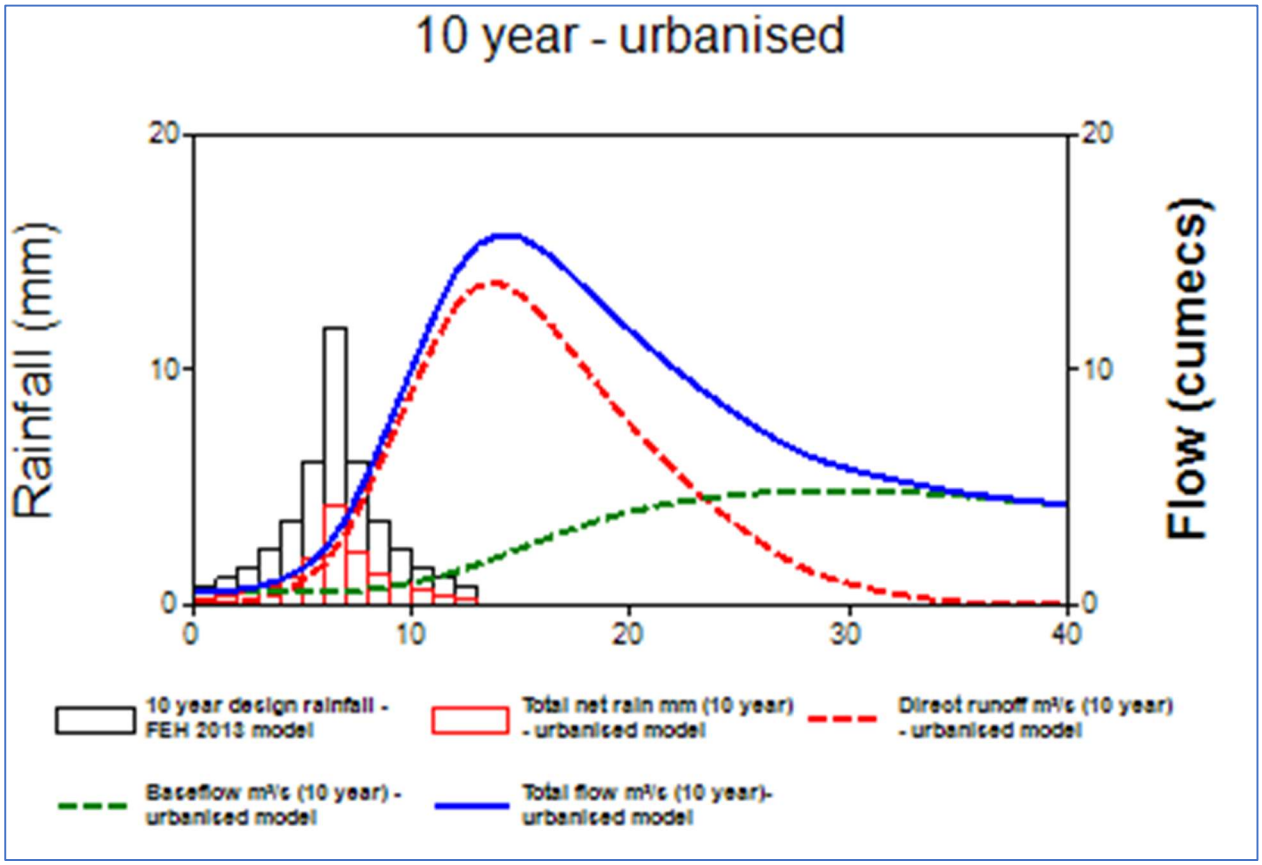
In performing a hydrological analysis utilising Flood Estimation Handbook (FEH) Webservice catchment data and rainfall data sourced through Hydromaster software, the return period for the storm Dennis on this particular watercourse (the Smestow Brook), can be estimated. An analysis was performed utilising the Revitalised Flood Hydrograph method in ReFH2 hydrological modelling software.

The observed flow event at this location had a peak rate of 10.60 m3/s. The 'design' 1 in 5 year return period peak flow (that which has a probability of occurring of 20 % in any year), is estimated at 9.61 m3/s The 1 in 10 year 'design flow' is estimated as approximately 11.44 m3/s. Therefore, we can have a degree of confidence that the actual return period of this flow event on the Shropshire Brook in Storm Dennis is between 1 in 5 years and 1 in 10 years and therefore a significant flow event so had between a 10 % and 20% probability of occurring in that (or any), year.



Staffordshire County Council

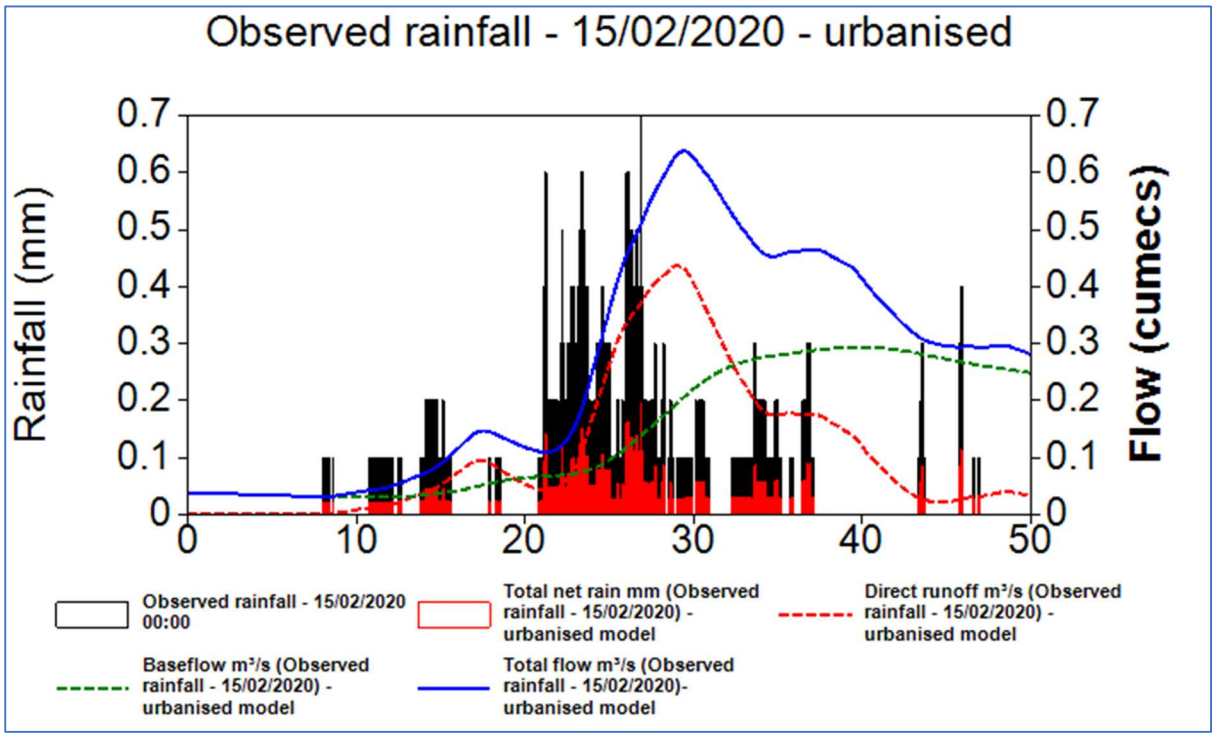

5 year - urbanised
Rainfall (mm)
Flow (cumecs)
20
10
0
0
10
20
30
40
5 year design rainfall - FEH 2013 model
Total net rain mm (5 year) - urbanised model
Direct runoff m³/s (5 year) - urbanised model
Baseflow m³/s (5 year) - urbanised model
Total flow m³/s (5 year)- urbanised model


10 year - urbanised
Rainfall (mm)
Flow (cumecs)
20
10
0
0
10
20
30
40
10 year design rainfall - FEH 2013 model
Total net rain mm (10 year) - urbanised model
Direct runoff m³/s (10 year) - urbanised model
Baseflow m³/s (10 year) - urbanised model
Total flow m³/s (10 year)- urbanised model

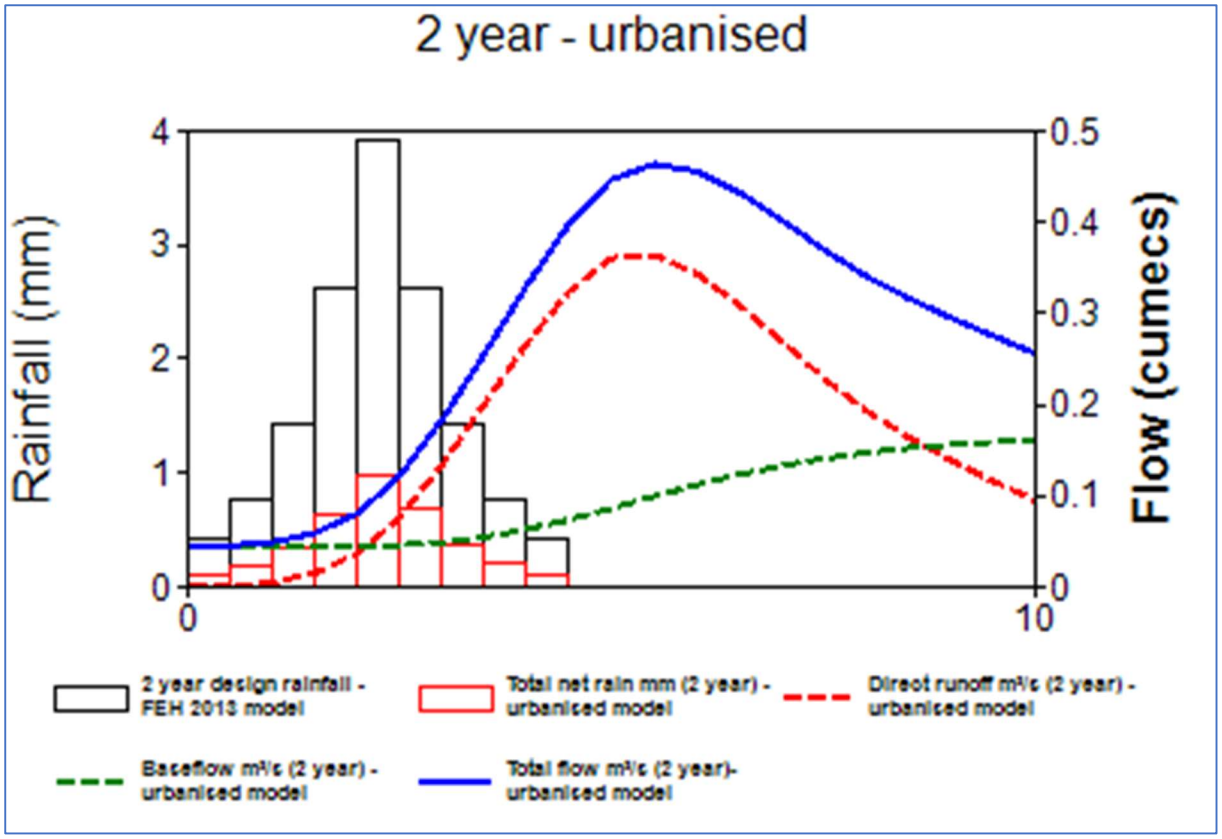
Six Ashes Road, Bobbington

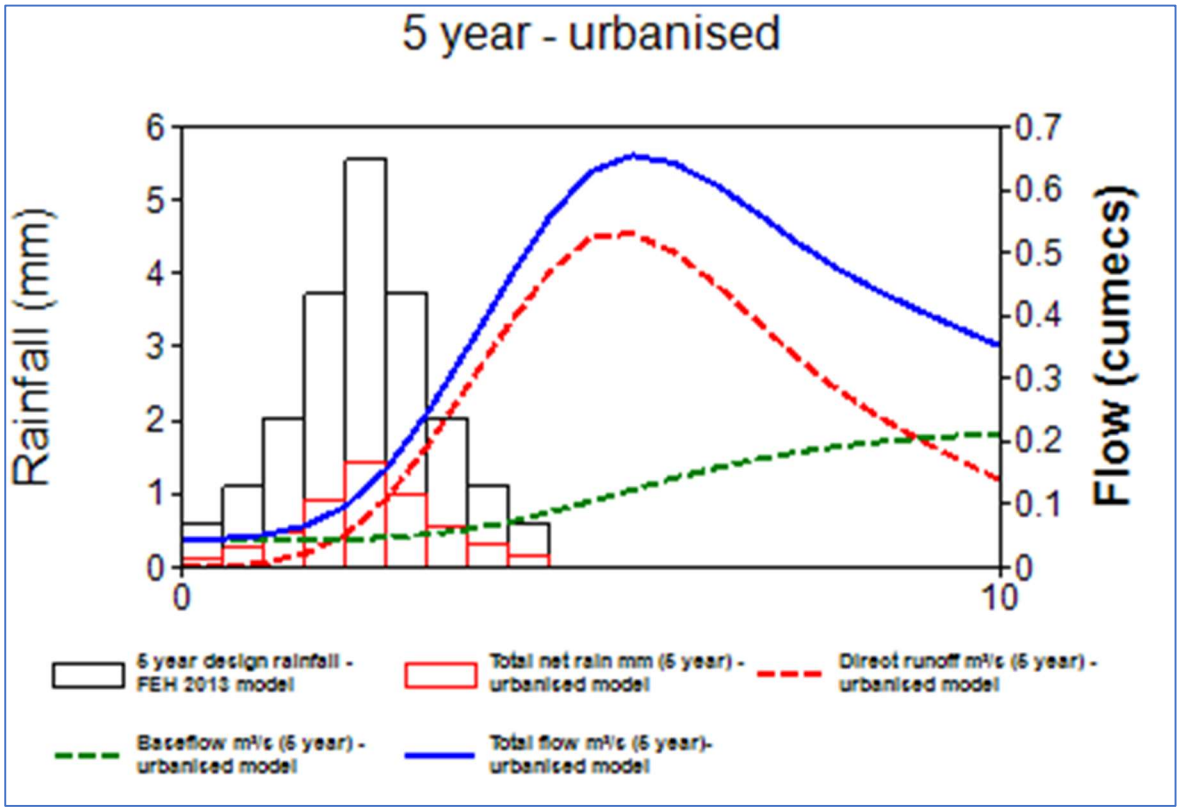
In performing a hydrological analysis utilising Flood Estimation Handbook (FEH) Webservice catchment data and rainfall data sourced through Hydromaster software, the return period for the storm Dennis on this particular watercourse can be estimated. An analysis was performed utilising the Revitalised Flood Hydrograph method in ReFH2 hydrological modelling software.

The observed flow event at this location had a peak rate of 0.64 m3/s. The 'design' 1 in 2 year return period peak flow (that which has a probability of occurring of 50 % in any year), is estimated at 0.46 m3/s The 1 in 5 year 'design flow' is estimated as approximately 0.65 m3/s. Therefore, we can have a degree of confidence that the actual return period of this flow event on the watercourse in Storm Dennis is between 1 in 2 years and 1 in 5 years and therefore a significant flow event so had between a 20 % and 50% probability of occurring in that (or any), year.



Staffordshire County Council

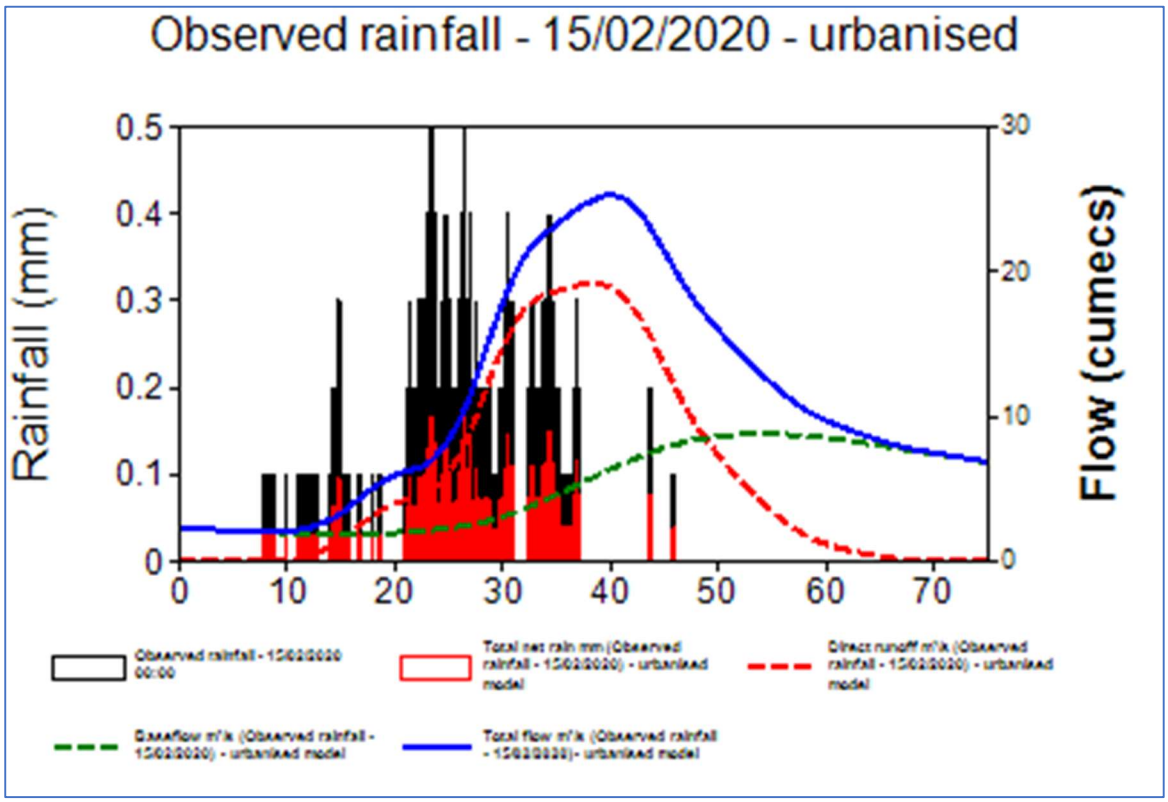

2 year - urbanised
Rainfall (mm)
Flow (cumecs)
0
1
2
3
4
0
0.1
0.2
0.3
0.4
0.5
0
10
2 year design rainfall - FEH 2013 model
Total net rain mm (2 year) - urbanised model
Direct runoff m³/s (2 year) - urbanised model
Baseflow m³/s (2 year) - urbanised model
Total flow m³/s (2 year)- urbanised model

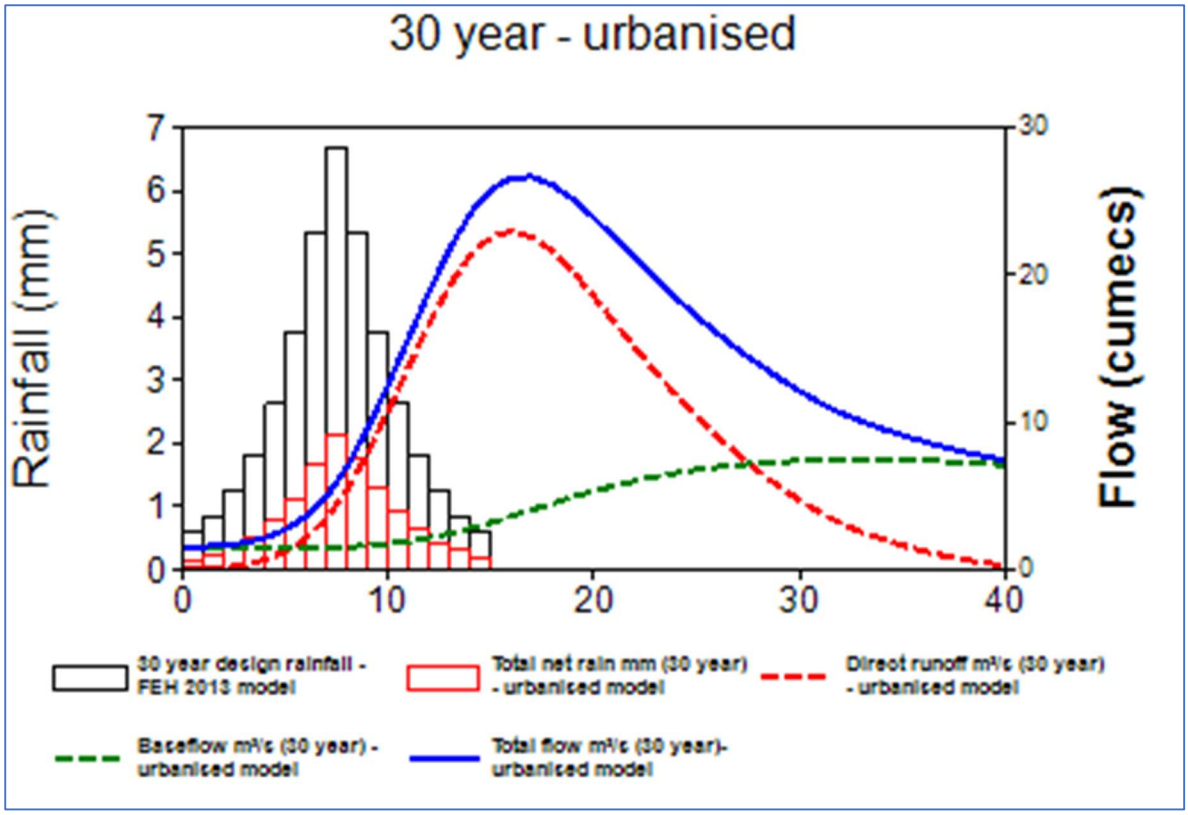

5 year - urbanised
Rainfall (mm)
Flow (cumecs)
0
1
2
3
4
5
6
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
10
5 year design rainfall - FEH 2013 model
Total net rain mm (5 year) - urbanised model
Direct runoff m³/s (5 year) - urbanised model
Baseflow m³/s (5 year) - urbanised model
Total flow m³/s (5 year)- urbanised model

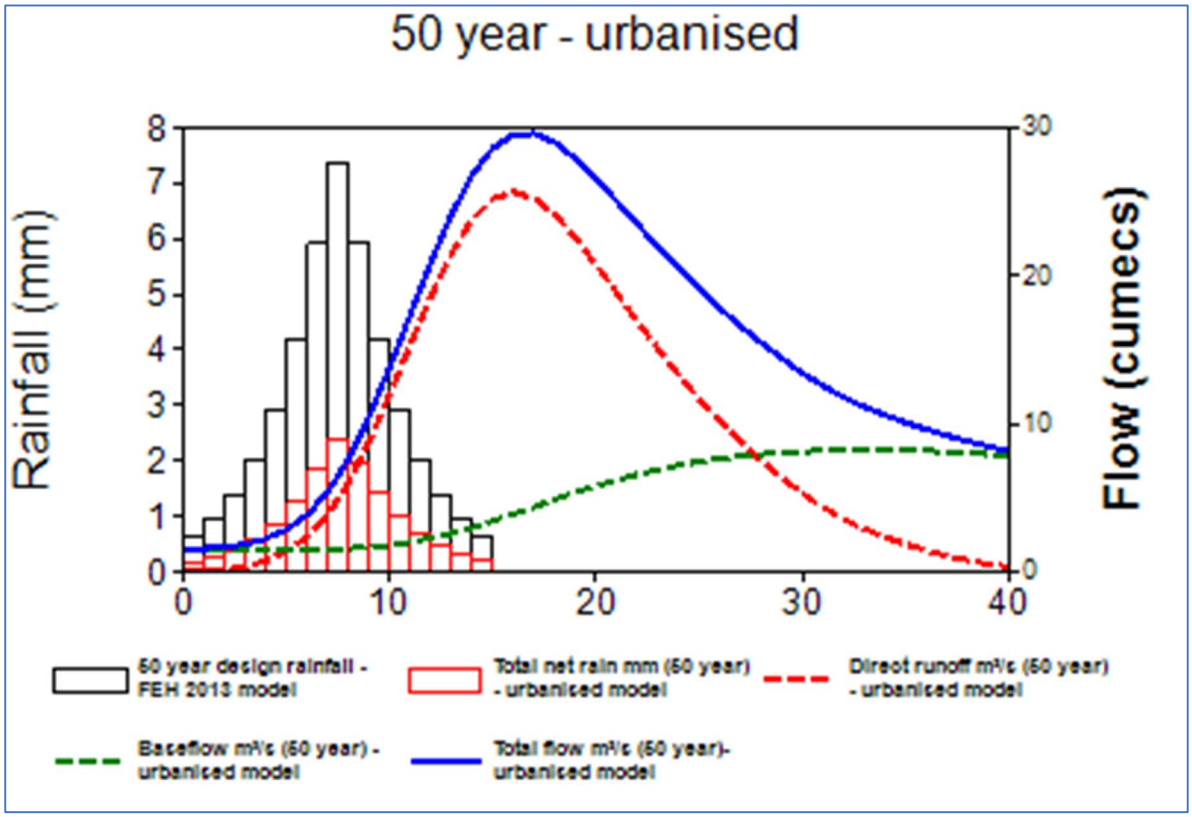
Hinksford Caravan Park

In performing a hydrological analysis utilising Flood Estimation Handbook (FEH) Webservice catchment data and rainfall data sourced through Hydromaster software, the return period for the storm Dennis on this particular watercourse (the Smestow Brook), can be estimated. An analysis was performed utilising the Revitalised Flood Hydrograph method in ReFH2 hydrological modelling software.

The observed flow event at this location had a peak rate of 21.58 m3/s. The 'design' 1 in 30 year return period peak flow (that which has a probability of occurring of 3.33 % in any year), is estimated at 20.36 m3/s The 1 in 50 year 'design flow' is estimated as approximately 22.70 m3/s. Therefore, we can have a degree of confidence that the actual return period of this flow event on the watercourse in Storm Dennis is between 1 in 30 years and 1 in 50 years and therefore a significant flow event so had between a 2 % and 3.33% probability of occurring in that (or any), year.




30 year - urbanised
Rainfall (mm)
Flow (cumecs)
0
1
2
3
4
5
6
7
0
10
20
30
40
30 year design rainfall - FEH 2013 model
Total net rain mm (30 year) - urbanised model
Direct runoff m³/s (30 year) - urbanised model
Baseflow m³/s (30 year) - urbanised model
Total flow m³/s (30 year)- urbanised model


50 year - urbanised
Rainfall (mm)
Flow (cumecs)
0
1
2
3
4
5
6
7
8
0
10
20
30
40
50 year design rainfall - FEH 2013 model
Total net rain mm (50 year) - urbanised model
Direct runoff m³/s (50 year) - urbanised model
Baseflow m³/s (50 year) - urbanised model
Total flow m³/s (50 year)- urbanised model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