Produced for:
Herefordshire Council

# Severe Weather Impact Assessment for Herefordshire 2008-2022


Author:
Sustainability West Midlands

Version:
Final

Date:
September 2023

sustainability west midlands

Herefordshire Council

# Report information

**Title:** Severe Weather Impact Assessment for Herefordshire 2008 – 2022

**Version:** Final, September 2023

**Customer:** Herefordshire Council

Project Manager: Alan Carr (SWM)

Report Author: Morgan Roberts (SWM)

**Project Contributors:** Anna Bright (SWM), Ailsa Gibson (SWM Associate), Julie Pope (SWM), Lucie Mueller (SWM), Mary Burton (Herefordshire Council), numerous stakeholders and consultees who contributed to the research

**Quality assured by:** Anna Bright (SWM)

**Disclaimer:** This report represents the independent advice commissioned by Sustainability West Midlands and partners and not necessarily that of the funders.



## About Sustainability West Midlands

Sustainability West Midlands (SWM) was established in 2002 as an independent, not-for-profit company and is the sustainability adviser for the leaders of the West Midlands.

Our vision is that the West Midlands is leading in contributing to the national target of net zero greenhouse gas emissions by 2050 whilst addressing health inequality and driving inclusive growth. We monitor the West Midlands Sustainability 2030 Roadmap which acts as a framework that all organisations based or operating in the region can use to help them make changes to their activities in the knowledge that they will contribute to wider regional ambition.

SWM's support our members and other local stakeholders in the public, private and third sectors to implement these changes by enabling them to demonstrate innovation and leadership and provide opportunities to collaborate and celebrate success.

www.swm.org.uk
Registered company No.04390508

# Contents

# 1 Introduction

SWM has been commissioned by Herefordshire Council to carry out the following:

- An analysis of how severe weather has impacted on the county over the last 15 years, who has been affected and how events have been dealt with (this document and accompanying Excel database).
- An analysis of how the climate is likely to change in Herefordshire up to the end of this century.
- The development of a climate change risk register that sets out the key climate related risks the county is likely to face.
- The production of a climate change adaptation plan, aimed at providing a series of actions that should be considered for implementation by decision makers in Herefordshire, to ensure that the county's natural environment, people, infrastructure, buildings and businesses are prepared for the impacts of climate change. This is the primary output, informed by the previous analyses listed above.

The core objective is to ensure that Herefordshire can better manage, prepare for and respond to severe weather events and the increasing likelihood and intensity of these in future.

## 1.1 Purpose of this document

The purpose of this study is to assess the impacts of severe weather on organisations based in or operating throughout Herefordshire, on the services of Herefordshire Council and the people, infrastructure, businesses and natural environment within the county in the last 15 years. This will help to contextualise and support the creation of an adaptation plan for Herefordshire. By undertaking an analysis of how the county has been affected by severe weather in the past, we can begin to paint a picture of how it may be affected in future, in light of a changing climate.

The Impact Assessment has involved undertaking a desk-based study to identify severe weather events in Herefordshire that have taken place between 2008 and 2022 inclusive, and to develop this into a database capturing the impacts and to allow for the monitoring and recording of future events. This database is available as a separate spreadsheet on request.

This report provides:

- Key statistics about Herefordshire for background purposes
- Detailed findings of the Impact Assessment
- The methodology used and a glossary of terms as appendices

# 2 Key Herefordshire Statistics

The population of Herefordshire in 2021 was 187,100 and the county has a very low population growth of just 2% compared to both the national average (6.6%) and to neighbouring areas (Worcestershire 5.3%, Shropshire 5.7%). The population is also ageing, with 24.1% of people aged 65 years and over according to the most recent census.

The industries that employ the largest numbers of people are 'health' (12,000), 'manufacturing' (11,000) and 'retail' (9,000). 'Agriculture, forestry and fishing' accounts for 5,000 employees but around 11,000 employments (whereby 'employments' refers to workers who may not necessarily have a contract of work with a particular organisation), reflecting the higher number of individual workers in this sector.

Figure 1 shows the average weather conditions in Shobdon, near Hereford, experienced between 2005 and 2015. This is based on Met Office weather station data and reflects a summary of the sorts of conditions expected across the county as a whole. In summary, winters are mild and wet and summers are warm and wet, although the rurality of the county must be taken into account when considering aspects such as minimum temperatures, which can be significantly lower in winter than in urban centres.

**Figure 1:** Average weather conditions in Herefordshire between 2005 and 2015

| Month | Average Maximum Temperature (°C) | Average Minimum Temperature (°C) | Average Overall Temperature (°C) | Average Rainfall (mm) | Average Wind Speed (mph) |
|---|---|---|---|---|---|
| January | 7 | 1 | 4 | 78.3 | 8 |
| February | 8 | 1 | 4 | 54.2 | 8 |
| March | 10 | 1 | 6 | 49.5 | 8 |
| April | 14 | 3 | 9 | 38.4 | 7 |
| May | 16 | 6 | 11 | 64.2 | 7 |
| June | 20 | 8 | 14 | 63.0 | 6 |
| July | 22 | 10 | 16 | 66.5 | 6 |
| August | 20 | 10 | 15 | 61.4 | 7 |
| September | 19 | 8 | 13 | 38.8 | 6 |
| October | 15 | 6 | 10 | 66.7 | 6 |
| November | 11 | 3 | 7 | 82.2 | 7 |
| December | 8 | 1 | 4 | 87.6 | 8 |

# 3 Summary Methodology

We have set out in Appendix 1 the detailed methodology used to create the Impact Assessment and its concurrent findings detailed in the next section. Set out below is a brief summary of the process undertaken.

- Excel was used to develop the database into which we captured the severe weather events that have taken place since 2008. This included columns allowing the input of the date of the event, type of weather event and its consequence/impact, the weather conditions, specific location in which it occurred, responses identified, and a 'significance score' providing a summary of how impactful each event was.

- Desk-based research was carried out to uncover severe weather events that were documented in the Impact Assessment database. This included relevant policy documents, numerous digital media publications, social media and use of search engines.

- Through interviews with Council staff and external stakeholders, we were able to gain further insight into the impact severe weather had on services and the people of Herefordshire.

- We accessed data sources, such as weather station data, grants received after flood events, the number of fires responded to by the Fire Service etc., to supplement the media trawl and stakeholder accounts of the identified severe weather events.

- Each event was then scored on its 'significance' based on the likelihood of it occurring in any given year, and the impact it appeared to have based on the evidence given. This gives an indication of which events were 'worse' than others.

- All 41 weather events that were found were then inputted into the Excel database, which can now be continuously updated with any new events that take place post-2022, such as the September 2023 unseasonable heatwave.

**Photo:** The Old Bridge, Hereford © Herefordshire Council

# 4 Severe Weather Impacts in Herefordshire

This section provides a detailed analysis of the key trends, causes, impacts and responses that have occurred in relation to severe weather in Herefordshire in the past 15 years. Full details of each event is given in the accompanying Excel database.

## 4.1 An overview of the findings of the Impact Assessment

**Key Points**

- Only events classified as 'significant' or 'highly significant' have been analysed in detail in this report.
- Flooding is the most common event type, followed by cold-weather related events.
- Herefordshire generally copes well with flooding, with responses from the Council and emergency services preventing major casualties and arranging well-coordinated responses.
- However, large numbers of homes and businesses are damaged in floods, and roads are almost always severely impacted. One of the Council's primary contractors, Balfour Beatty, highlighted a spend of £10.7m on dealing with severe weather in recent years on just their areas of responsibility. Anecdotal evidence shows the emergency services often struggle when severe weather results in large numbers of incidents across the County at the same time.
- Adaptation measures to mitigate flood risk in these areas would reduce the level of emergency response required and help protect the public and Herefordshire's infrastructure as flooding events become more frequent and widespread, as indicated in the technical report that sits alongside this document and details future climate projections.
- Despite heat-related events being less common compared to others such as flooding, the aforementioned technical report shows that these will become more frequent and more severe, requiring Herefordshire Council and external partners as referenced in this document to pay careful attention to the county's most vulnerable groups and their overall preparedness for heat-related events.

Forty-one severe weather events were identified in total between and including 2008 and 2022. The results indicate a general upward trend in the number of severe weather events over the 15 year period. However, there are many possibilities for this correlation, such as an increase in media reporting or an availability of more recent media publications, and so any conclusions on the likelihood of an increase in the number of severe weather events over time due to climate change should be drawn from the Technical Report.

The severe weather events identified can be categorised into five main types of event (see the glossary in Appendix 2 for full definitions):

- Flooding
- High winds
- Snow, ice and/or extreme cold

- Heatwave, drought and/or water scarcity
- Fires

The statistics analysed in this section from here onwards, unless otherwise stated, consider only the 26 events that have been classed as 'significant' or 'highly significant', which are the most insightful events to analyse when evaluating Herefordshire's preparedness for severe weather.

The remaining 15 lower severity events are less likely to be comprehensive, as these are documented less often by the media. This may mean that the research may not have uncovered all severe weather events that have occurred in the last 15 years with similar severities/impacts to the 15 less significant ones documented.

## 4.2 Types of weather events experienced

### Key Points

- The results indicate that flooding and other cold weather-related events are more common than hot weather-related events, suggesting that preparing for these should be the **immediate priority** within Herefordshire.
- Herefordshire Council **carry out significant work** on flood management, prevention and emergency response. However, considering the projected increase in the frequency of flooding events and the potential for flooding in areas previously unaffected, it is **essential this work continues** and considers all areas at risk now and in the future.
- It is worth considering events associated with hot weather as when these do occur, although less common they result in a greater impact, in part due to a **lack of preparedness for dealing with heatwaves** and drought.

The findings from the media trawl indicate that flooding events are the most common to have occurred in Herefordshire, followed by snow/ice and cold spells and high winds (see Figures 2 and 3). This trend is supported by the climate data and descriptions such as the Met Office climate overviews and anecdotal evidence from the stakeholder engagement activities undertaken as part of this project.

Preparing for cold weather events appears to be the immediate priority within Herefordshire, alongside generally good responses to flooding events. However, this does not necessarily mean that due consideration for hot weather events should not take place with regards to future planning as the accompanying Technical Report demonstrates.

The Council is aware of issues with water scarcity, especially with regards to the impact on agriculture, and emergency response systems are in place for supporting farmers when groundwater reserves are low. However, health impacts of heatwaves and prolonged periods of higher temperatures do not appear to be as prepared for within the Council's emergency planning procedures, and adapting to these types of events will be pivotal in preventing negative impacts on public health.

**Figure 2:** Frequency of each type of severe weather event between 2008 and 2022, grouped by the considered level of significance.

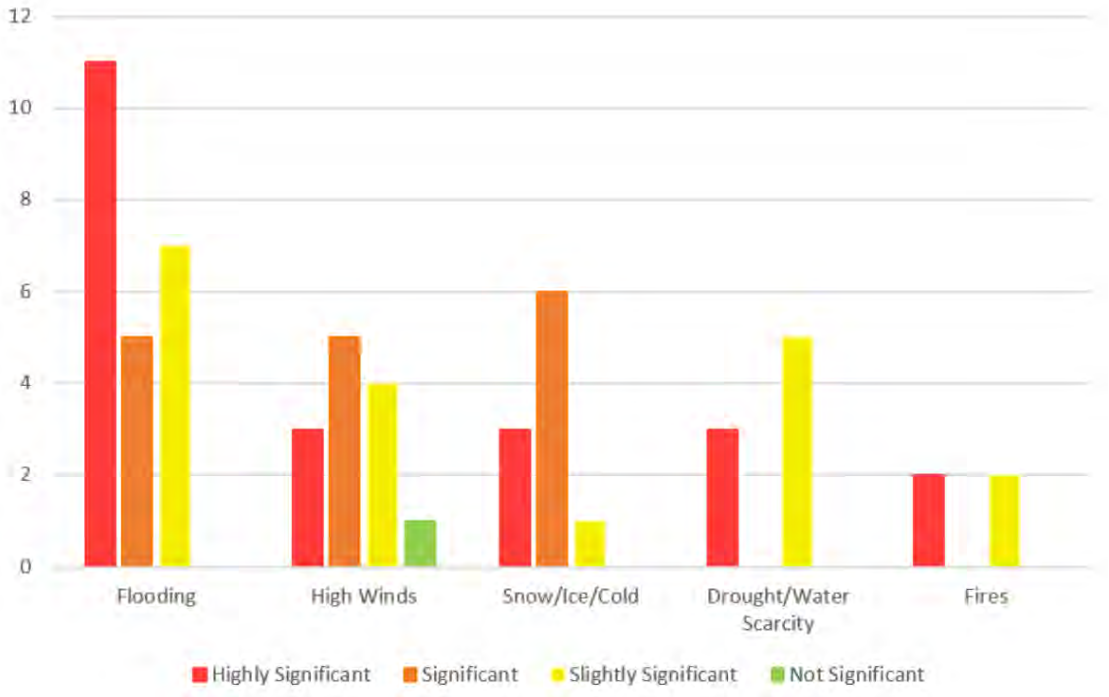
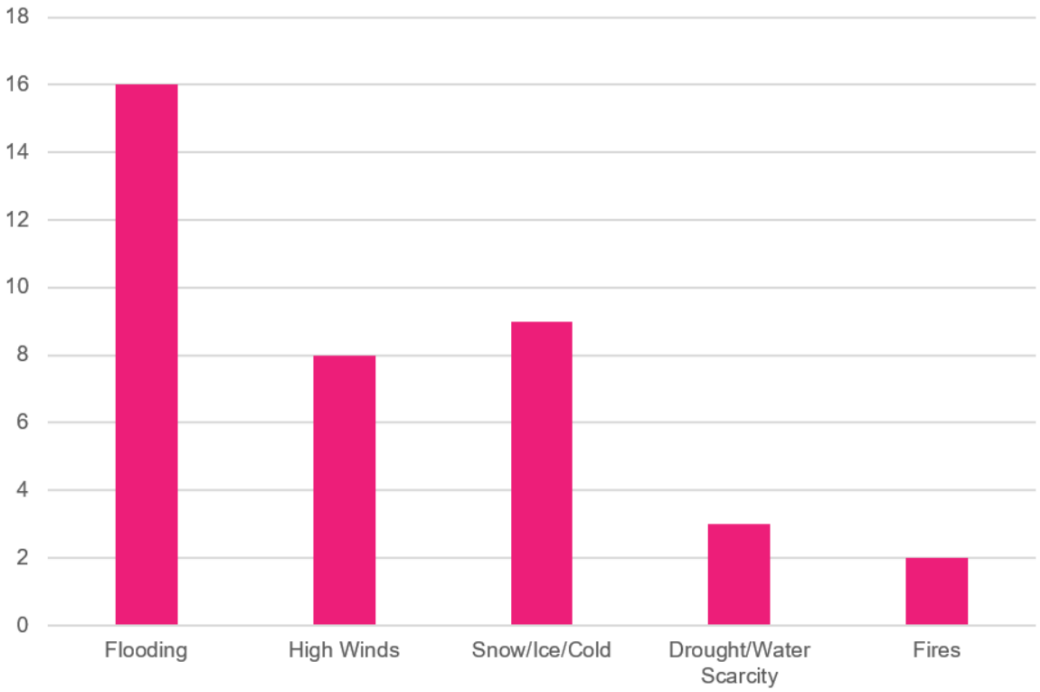



**Figure 3:** Frequency of each type of severe weather event between 2008 and 2022, only including events considered 'significant' or 'highly significant'.



# 4.3 Detailed analysis of impacts

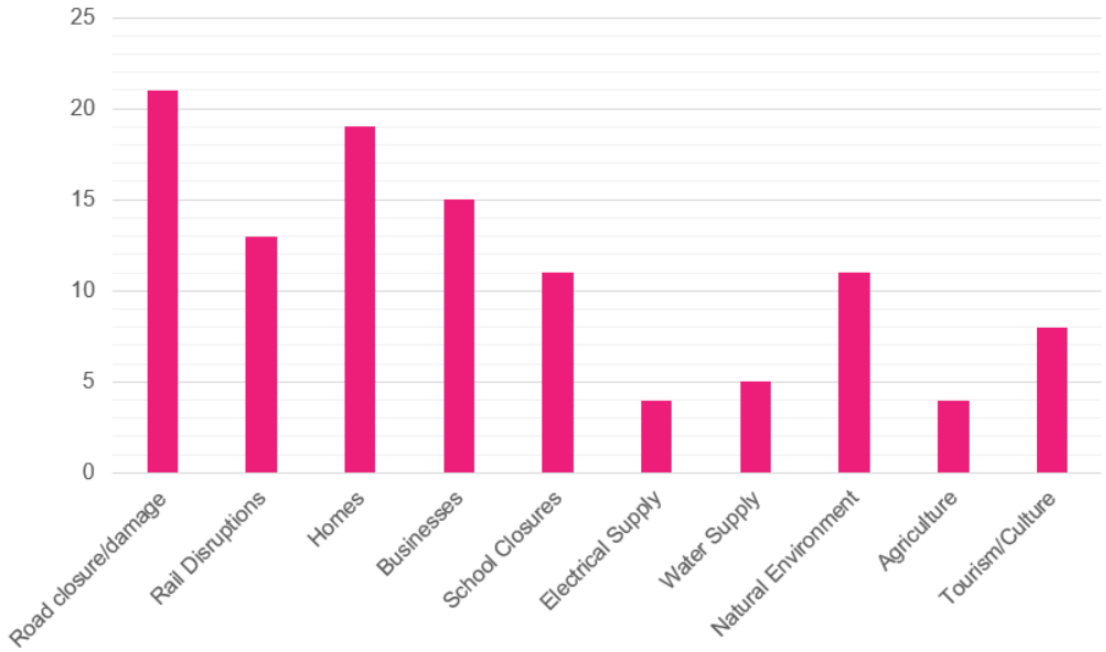
This section provides a detailed analysis of how Herefordshire has been impacted by the 41 severe weather events documented in the past 15 years, including the sectors and assets affected, how well prepared the county is to respond, and where key vulnerabilities appear to be.

## 4.3.1 Impacts on sectors and assets

### Key Points

- The results indicate the sectors most commonly impacted by severe weather in Herefordshire are transport (particularly roads), homes and businesses. Schools and the natural environment are also regularly significantly impacted by severe weather.
- Anecdotal evidence also shows that agriculture is also significantly impacted by severe weather in Herefordshire.

**Figure 4:** The number of documented occasions specific sectors and assets have been impacted by significant weather events in the past 15 years, according to the Impact Assessment research




The long list of impacts from each event were categorised into sectors and assets to identify any emerging patterns or to ascertain whether there is evidence suggesting impacts befall certain sectors or assets more than others. The results displayed in Figure 4 above imply the sectors and assets most commonly impacted are transport (particularly roads), homes and businesses. Schools and the natural environment are also regularly significantly impacted by severe weather.

It is well understood through engagement with local stakeholders that severe weather is also having a major impact on agriculture in Herefordshire, particularly significant due to the rural nature of the county and agriculture's role in the local economy. However, there were limited data available on this and impacts on agriculture are not reported as extensively in the media. Therefore, the trends shown in Figure 4 can only go so far in indicating which areas of Herefordshire are most vulnerable.

A more detailed look at the types of impacts felt by each sector or asset can help us better evaluate how prepared Herefordshire is for dealing with severe weather events, who the most vulnerable sectors are, and how they may be supported in the future. The next section will therefore first discuss the overall ability of Herefordshire Council and the emergency services to respond to severe weather events to prevent serious damage to infrastructure or health. We have then reviewed which sectors and assets are impacted and how, and the degree of severity. . Many of these impacts will indicate not so much how effective the Council and emergency services responses are, but more so how vulnerable these sectors are to severe weather generally.

## 4.3.2 Preparedness and response

### Key Points

- The most significant impacts on Herefordshire Council as a consequence of severe weather currently appear to be around the financial costs of supporting homes, businesses and communities after flooding events, and the level of coordination required in an emergency response to any event, but particularly cold weather-related ones.
- Herefordshire Council responds well to severe weather. There will always be a need for an effective coordinated response to emergencies, with helplines, gritters and snowploughs, etc. However, the impacts on public health and wellbeing, as well as the large financial costs involved in supporting recovery for businesses and homes, could be reduced if climate adaptation measures were in place to lessen the impact of these events in the first instance.
- Emergency services work extremely hard to protect the people and infrastructure of Herefordshire, in collaboration and through established partnerships with other responders. However, they are vulnerable to severe weather events due to the sheer volume of responses that are required at once.

It should be noted that Herefordshire Council has two key statutory responsibilities that are associated with severe weather response. These include:

- **Flood risk management and response** for all sources of flooding other than reservoirs and main rivers (which are the responsibility of the Environment Agency), and public sewerage systems (which are the responsibility of Welsh Water or Severn Trent Water).
- Responsibilities for **public health** and **supporting emergency services** and commitments to **health and wellbeing of communities** as detailed in the County Plan mean they should also be considering how they prepare for and react to heat-related events, especially as these increase in occurrence and severity.

This section of the report discusses how these responsibilities have been 'evaluated' in the last 15 years due to severe weather, and how the Council and its partners have responded to severe weather impacts in general.

### Financial costs through grants administered

The total costs incurred to Herefordshire Council due to severe weather cannot be accurately estimated for the past 15 years, but the cost of Flood Recovery Grants received from central Government after flooding events has been documented (see Figure 5). This shows that the Council has spent nearly **£1.5 million between 2008 and 2022** in supporting homes, businesses and communities after flooding events.

**Figure 5:** Estimate of Flood Recovery Grants given to households and businesses by Herefordshire Council following severe flooding events between 2008 and 2022

| Date | Homes | Business | Total cost to the Council |
|---|---|---|---|
| **12 February 2014** | 18 household grants (£66,098) | 17 Business Support Grants (£19,001) | £85,099 |
| **01 December 2015** | £500 flood recovery grant administered to five households | One business which received £2,000 | £4,500 |
| **26 February 2018** | £1.3 million of cold weather payments from central Government | £97,000 to fix village hall roof | £97,000 |
| **27 October 2019** | 87 Community Recovery Grants (87 * £500 = £43,500) | 11 Business Recovery Grants (11 * up to £2,500 = £24,600) | £68,100 |
| **15 February 2020** | 545 Community Recovery Grants (545 * £500 = £272,500). Flooded properties awarded a council tax discount, totalling £212,636 | 207 Business Recovery Grants (207 * up to £2,500 = £479,747). Three months of business rate relief (a small minority received support for longer), totalling £204,707 | £1,169,590 |
| | | **Total estimated costs** | **£1,424,289** |

## Coordination of response

The results of the Impact Assessment demonstrate the **high level of coordination** required by the Council in an emergency response to any event, but particularly those that were cold weather-related.

**Figure 6:** The range of actions carried out by Herefordshire Council during severe weather events

| Weather Event | Actions taken by the Council |
|---|---|
| **Flooding** | • There is a phone line set up (01432 261800) that people can use to report flooding and seek advice; calls are taken by Balfour Beatty (see below)<br>• Reporting of road closures and local flood warnings on Council website<br>• Being a part of the Local Resilience Forum, coordinating responses with external partners (police, fire etc.)<br>• Flood recovery grants for households and businesses (see Figure 5)<br>• Supporting rest centres |
| **Snow/Ice** | Reporting of road closures, school closures and disruptions to services such as bin collections on the Council website |
| **Heatwaves** | Issue advice on dealing with extreme heat |
| **Cold-weather events (flooding and snow/ice)** | Coordinating Balfour Beatty response (see below) |
| **Any type of weather event (flooding, storms, snow/ice, heatwaves)** | • Emergency Information Line for advice on responding to an ongoing severe weather event<br>• Issue 'do not travel' recommendations and warnings when required |

## Balfour Beatty Living Places

The Council's public realm contract for providing services including highways, public rights of way, parks and open spaces, street cleaning and street lighting was awarded in 2013 to Balfour Beatty under the guise of Balfour Beatty Living Places (BBLP). As such, BBLP maintain a record of costs and schemes carried out since the start of their contract that have accrued as a result of the impact of severe weather events. Figure 7 summarises these costs, with the total cost accrued since 2013 as a result of severe weather impacts being over £10 million, with the vast majority of this as a result of flood and storm damage.

**Figure 7:** Cost implications of severe weather impacts according to BBLP data

| Date/ nature of weather event | Cost implications | Nature of cost |
|---|---|---|
| **2014: Severe flooding** | £3.28 million | Bellwin claims |
| **2014: Follow on impacts from above flooding** | £1.57 million | Bellwin claims |
| **2017/18: Snow** | £602,842 | Maintenance |
| **2020: Storm Dennis** | £4.29 million | Bellwin claims and repair works |
| **2020/21: Storm Dennis and Bella** | £1.01 million | Repairs/ initial response |
| **2022: Storm Eunice** | £37,235 | Initial response |
| **TOTAL** | **£10.79 million** | |

In addition to the direct cost implications on BBLP, their duties are often impacted by the weather in other ways, such as:

**Road clearing (trees):** Part of Balfour Beatty's service involves street and public space management which, during high winds and storms, often includes responding to emergency calls and general reports about fallen trees. These can sometimes be urgent due to roads being blocked or cars and properties being damaged. There have been at least five major incidents since 2008 that required an emergency response from Balfour Beatty, the most significant of which was in February 2022 during storms Eunice, Dudley and Franklin, where the service received 1,000 calls and attended 208 emergency jobs related to fallen trees and debris, infrastructure and roads in just a few days.

**Gritting:** The Council coordinates the gritting of roads when there is potential for ice or when it has already formed, and Balfour Beatty carry out the gritting. There have been at least four occasions where major gritting has been necessary, and a strategic choice of which roads to grit has been required due to either a shortage of rock salt or an unprecedented amount of gritting needed.

**Figure 8:** Examples of scenarios where a high level of response was required by BBLP to grit roads between 2008 and 2022.

| Date | Response |
|---|---|
| **02 February 2009** | Not enough salt for the scale of response needed, and only major routes were gritted |
| **23 December 2009** | 18 gritters needed. Bins of salt provided for smaller roads |
| **25 November 2010** | Thousands of tonnes over six weeks. Only major routes were gritted to conserve salt stocks |
| **26 February 2018** | Over 1,000 miles of roads were gritted |

## Other Council service disruption

There have been multiple occasions where other Council services have been disrupted during severe weather, including suspension of bin collections or bus services during heavy snow and facilities such as libraries and recycling centres closing. The Impact Assessment database provides full details of all 41 events documented.

## Hereford & Worcester Fire and Rescue Service response and impacts

The main responsibilities of the Fire Service are:

- Fighting and preventing fires
- Rescuing people from flooded properties
- Rescuing people from vehicles stranded in floodwater
- Bringing services to homes blocked in by snow
- Pumping water out of houses and public spaces such as road tunnels
- Responding to road traffic accidents
- Preventing fires when flooding impacts the electrics in homes and businesses

It should be emphasised that it is often difficult to determine to what extent the weather causes or exacerbates the likelihood of any given fire occurring. If conditions are tinder dry, then the likelihood of a fire starting and spreading more quickly is greater due to the conditions, but also because more people may be outdoors and (e.g.) having barbecues. Similarly, not all floods are caused by heavy rain. Data from the Fire Service does not always make it clear what the cause of each incident they responded to was. However, below we have looked at these data to identify as clearly as possible the trends between severe weather occurrences and Fire Service responses.

Whilst the Fire and Rescue Service responds to more outdoor fires (Figure 9) than floods (Figure 10) overall, it is important to consider the significance of both. Severe weather, both heatwaves and/or droughts and abnormally heavy rain, can cause a large number of incidents (either fires or floods) to occur all at the same time, stretching the Fire & Rescue Service thinly across multiple events.

**Figure 9:** Number of outdoor fires responded to by Hereford & Worcester Fire and Rescue Service per year since 2009. Differentiated on the bottom line are grassland fires, which may be more likely to have been caused by severe weather (extreme heat or drought) conditions.

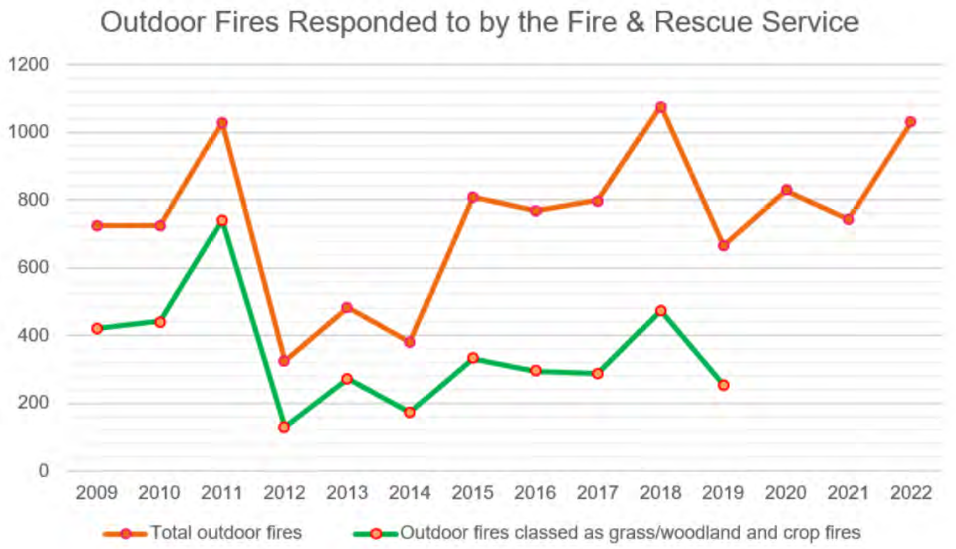
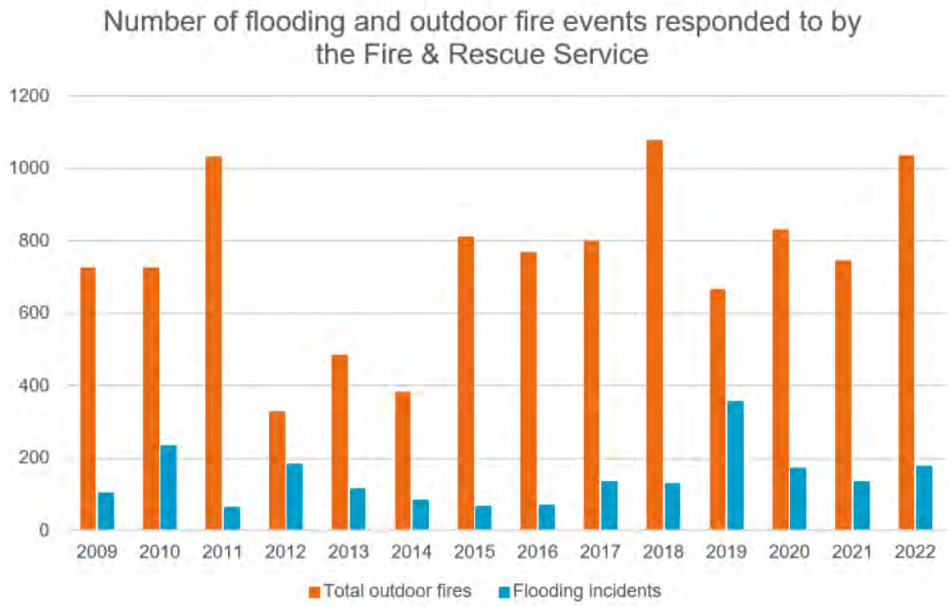


**Figure 10:** Number of flooding incidents and outdoor fires responded to by Hereford & Worcester Fire and Rescue Service per year since 2009.




Some quotes from the Fire and Rescue Service Annual Service Reviews in recent years demonstrate how severe weather can affect response levels and service provision:

- *"The record-breaking high temperatures in July and August 2023 brought tremendous pressure to fire and rescue services across the country, with 15 services calling 'a state of major emergency'. Our own Service was equally challenged dealing with an unprecedented number of wildfires across difficult terrain in extreme heat [...] To put it in context, in July and August we attended 374 secondary fires (mainly outdoor fires [...]), an increase of over 220% on the same period in 2021".*

- *"Although 2020 will go down in history as the year of Covid19 [...] the early months will be remembered for the wide-scale, high-impact flooding that hit both Herefordshire & Worcestershire during February and into March. In response to this unprecedented incident, all of our teams worked fantastically well under difficult, protracted and often challenging circumstances [...]" "44%of the increase [in total incidents 2019/2020] was caused by an upsurge in special services, mostly during the flooding in October 2019 and February 2020."*

- *"About a third of the increase [in total incidents 2018/2019] was because of an upsurge in grassland, woods and crop fires, mostly during the 2018 summer heatwave."*

The Impact Assessment results also show how some of the most significant severe weather events impacted the emergency services. There have been occasions where the Fire and Rescue Service issues warnings to the public, including warnings to take care in the heat to prevent public health concerns, such as during the heatwaves in 2013 and 2022, and warnings to not travel during the floods on Christmas Eve 2020, with the hopes of reducing a potentially overwhelming high number of calls. In February 2014, 2,000 servicemen and women from the military were sent to Herefordshire to support the local services including making and distributing sandbags, flood barriers and general emergency service support, highlighting that services at times can struggle to cope with demand.

There have been a few extreme incidences between 2008 and 2022 where flooding has caused serious harm, in particular a 66-year-old man was swept to his death by a flash flood in June 2012. However, the emergency services are generally extremely effective at preventing death or serious injury during flooding events. For example, of the 23 total flooding incidents documented in the Impact Assessment, at least 14 of them included the Fire and Rescue Service rescuing people in vehicles stranded in floodwater (Figure 11). Whilst it is a testament to the emergency services that this many rescues are conducted successfully, this is an extremely high number and indicates the need for even stronger communication to the public on the dangers of driving through floodwater in heavy rain.

**Figure 11:** Data from the Impact Assessment research on Fire and Rescue Service responses to incidences during significant weather events from 2008 to 2022.

| Date | Weather Event | Fire and Rescue Service response |
|---|---|---|
| 25 November 2009 to 16 January 2010 | Snow | 120 responses |
| 28 June 2012 | Flooding | 30 responses |
| 18 July 2013 | Extreme Heat | Over 3,000 calls |
| 12 February 2014 | Flooding, High winds | "Inundated" |
| 27 October 2019 | Flooding | 134 rescues |
| 14 November 2019 | Flooding | Over 100 rescues |
| 15 February 2020 | Storm | 204 rescues |
| 24 December 2020 | Flooding | Over 40 rescues, over 50 calls |
| 13 July 2022 | Extreme Heat | Responses to 143 fires (94 fires in open) |

## 4.3.3 Impacts and vulnerabilities in different sectors

### Key Points

- High temperature-related events have the greatest impact on people's health. The NHS in Herefordshire reported 66 overheating incidents in clinical settings and 57 excess heat deaths between 2016 and 2022.
- Homes were impacted in at least 24 of the 41 events recorded. The most significant impact on homes is flooding, which occurred in at least 17 of the events recorded. When homes are flooded, more often than not local businesses are also flooded.
- Twenty-eight of the events recorded impacted roads, and 16 impacted railways, showing the transport sector is regularly impacted by severe weather. More work is still required to reduce the number of road traffic incidents during cold weather, particularly vehicles stranded in floods and accidents due to icy roads.
- Train delays and cancellations can occur due to all types of severe weather. These usually result in a cost to the railways, but high temperatures on public transport can also pose a risk to people's health.
- There were limited data available on the impacts to agriculture, but it is well understood that severe weather is having a major impact on this industry in Herefordshire, particularly significant due to the rural nature of the county.

- It should not be forgotten that the natural environment can also suffer significantly during severe weather events, particularly when not managed effectively.
- Electricity and water supplies can often be impacted by severe weather, with one of the most significant recent impacts being from high winds and flooding in February 2014 meaning 2,000 homes were without power. As well as disruption to people's services, the strain on the utility providers is also important to consider.

## Public health and NHS

In Herefordshire between 2016 and 2022, there were 22 'heat periods' (i.e. periods of extreme heat) that caused a total of 57 excess heat deaths (see figures 12 and 13).

**Figure 12:** Number of excess heat deaths in Herefordshire each year from 2016 to 2022, both during the summer months and specifically in periods of extreme heat. Negative numbers effectively mean 'fewer excess heat deaths than one would expect compared to the average'.

| Year | Excess deaths in summer months | Excess deaths in 'heat periods' |
|---|---|---|
| 2016 | 2 | 6 |
| 2017 | 38 | 14 |
| 2018 | -23 | -5 |
| 2019 | 32 | 12 |
| 2020 | 35 | 0 |
| 2021 | 102 | 20 |
| 2022 | -12 | 11 |

**Figure 13:** Number of excess heat detahs in Herefordshire in significant heat periods

| Date of heat period | Excess deaths |
|---|---|
| 17 to 23 June 2017 | 12 |
| 21 to 30 July 2019 | 10 |
| 05 to 15 Aug 2020 | 10 |
| 16 to 23 July 2021 | 18 |
| 08 to 17 Aug 2022 | 11 |

In addition, between 2016 and 2022, the NHS Estates Returns Information Collection (ERIC) has reported 66 overheating incidents, where temperatures in wards or other clinical areas in NHS Trusts exceeded 26 degrees Celsius (Figure 14). Most of these data are from the Wye Valley NHS Trust. The Herefordshire and Worcestershire Health and Care NHS Trust recorded overheating occurrences only in 2021/22, and in this instance the two Trusts' data have been added together.

**Figure 14:** Number of overheating incidents in wards or clinical areas in NHS Trusts per year between 2016 and 2022.

| Year | Overheating occurrences triggering a risk assessment (No.) |
|---|---|
| 2016/17 | 10 |
| 2017/18 | 6 |
| 2018/19 | 8 |
| 2019/20 | 7 |
| 2020/21 | 22 |
| 2021/22 | 13 |

The ERIC data also started documenting flood occurrences in 2021/22. As of yet, none have been recorded in Herefordshire, but this could be used in the future to assess severe weather impacts on the health service.

These data show it is extremely important that the Council works in collaboration with health and social care providers to prevent not only overheating in healthcare facilities, but also to help protect the most vulnerable in their own communities and homes from excess heat.

## Homes and communities

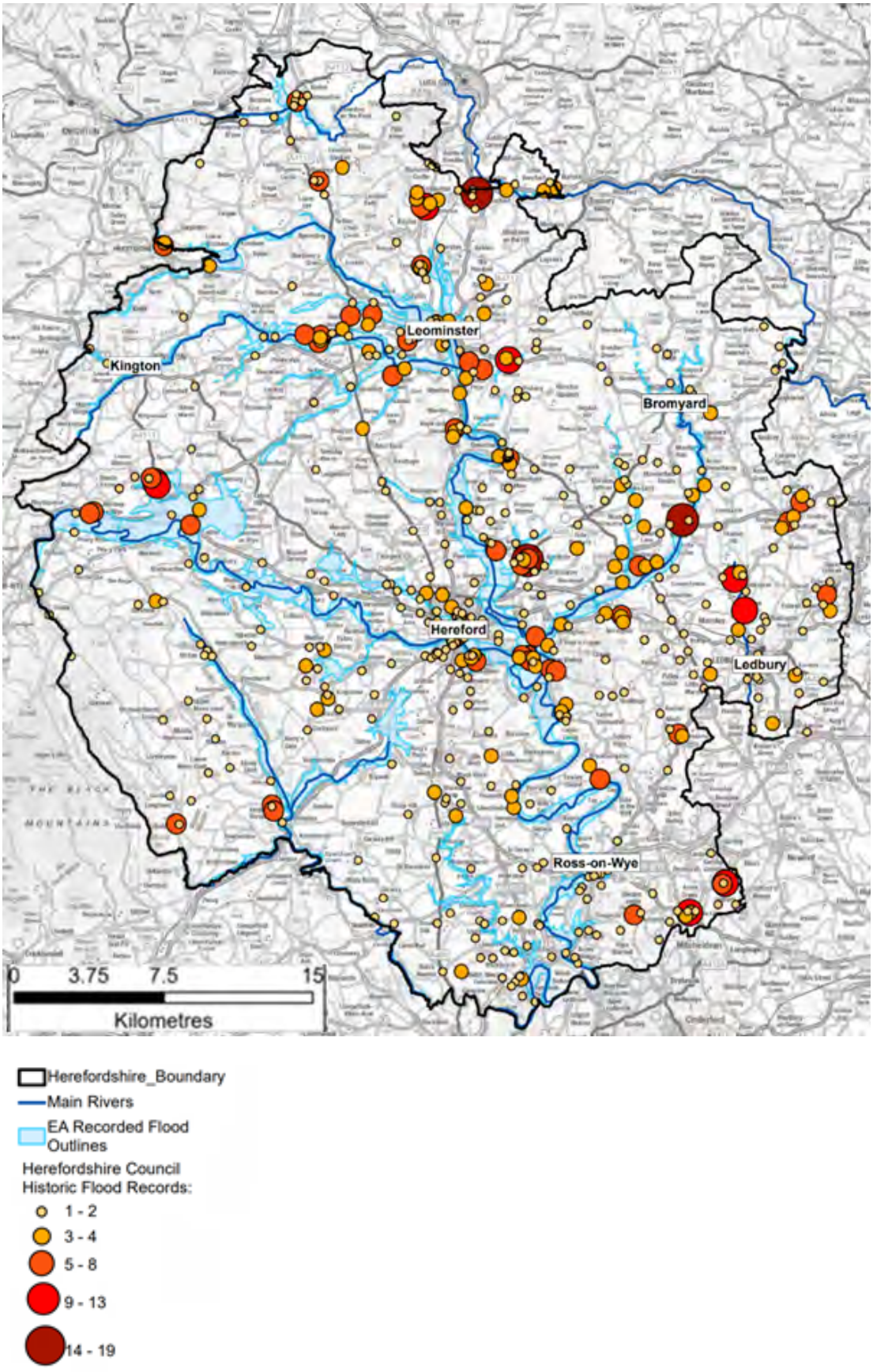
Homes were impacted in at least 24 of the 41 events recorded. The most significant impact on homes is flooding, which occurred in at least 17 of the events recorded. Some of the most significant, wide-scale impacts on homes during floods are outlined in Figure 15. These values come from the 2019 Strategic Flood Risk Assessment or are based on Community Flood Recovery Grant numbers received by Herefordshire Council. The date given is called a start date because often flooding events span multiple days or weeks.

**Figure 15**: Number of properties flooded or affected by flooding during some of the most significant flooding events between 2008 and 2022.

| Start Date | Homes flooded/affected by flooding |
|---|---|
| 28 June 2012 | 260 |
| 12 February 2014 | 220 |
| 27 October 2019 | 87 |
| 15 February 2020 | 545 |

Figure 16 details flooding incidences in Herefordshire taken from Herefordshire Council's historical records. Areas particularly prone to flooding include those within river catchments, particularly the Severn, Wye and Lugg catchments, although urban areas are also at risk of flash flooding. For more detailed exploration of areas at risk of flooding, visit the Government website or the accompanying Technical Report.

**Figure 16:** Map showing the location of flooding incidents that Herefordshire Council have a record of



There have been a handful of incidents not related to flooding that have caused damage to homes, including trees hitting properties, flying debris during high winds, and homes being cut off by snow. The most significant incident of snow cutting homes off took place on 26 February 2018 during the 'Beast from the East' where more than 25 homes where cut off by ten foot snowdrifts in Hegdon Hill, Stoke Lacy.

Schools have also been known to close during snow, flooding and heatwaves in Herefordshire, with schools impacted in at least 11 of the events recorded.

## Transport

Twenty-eight of the events recorded impacted on roads, and 16 impacted railways, showing the transport sector is regularly impacted by severe weather. The significance of this impact varies, from minor roads being flooded regularly in particular hotspots without leading to too much disruption, to landslides washing away parts of railway tracks (October 2019) or severe flooding causing sinkholes (August 2020).

**Photo:** Road closure in Hereford due to flooding of River Wye, © Herefordshire Council

Although flooding of minor roads is common and does not cause huge disruption to transport, long-term damage to roads can be a major cost to the Council as reflected in some of the data above, and lead to accessibility difficulties for local communities. Also, minor flooding and icy weather can enhance the demand on the emergency services as road traffic accidents increase. As mentioned earlier, of the 23 total flooding incidents documented, at least 14 required a response by the Fire and Rescue Service through rescuing people in vehicles stranded in floodwater. These accidents also have a clear impact on the health and safety of the population.

'Do not travel' warnings have been implemented both by the Council and by the railway Train Operating Companies and/or Network Rail when conditions are too severe, such as in February 2022, and guidance is readily available on the Council website regarding how to travel safely in severe weather. However, the evidence indicates that more work is still required to reduce the number of incidents on the road during cold weather.

Train delays and cancellations due to severe weather can occur for a range of reasons, from flooding of tracks, signalling boxes or stations, to wind or high temperatures causing speed restrictions. These are likely to cause impacts on passengers, such as through missed medical appointments or not being able to get to work. High temperatures are also a concern, as they can slow or delay services and people can remain stuck on trains for longer than planned, posing a risk to people's health. Rail disruptions due to severe weather also cost the railway industry through refunds due to cancellations and cost Network Rail due to repairs required to infrastructure should damage occur.

## Businesses

When homes are flooded, more often than not local businesses are also flooded. Flooding or other damage to buildings such as fallen trees during a storm will cause medium-term financial damage to the business due to the cost of repairs and potentially remaining closed for a long period. For example, a B&B in Hereford lost around £40,000 over six months after flooding in October 2019.

Following severe snow or flooding, supply chains can also be impacted, as occurred following the 'Beast from the East' in 2018.

## Agriculture

As described earlier in this report, there were limited data available on the impacts of severe weather on agriculture, but it is well understood that severe weather is having a major impact on this sector in Herefordshire, particularly significant due to the rural nature of the county. Below are the main documented examples of severe weather impacts that have affected agriculture during the period 2008-2022.

- **2010:** Crop sales in Herefordshire reached record prices, some up to £100 an acre, up around 20-30% on the previous year due to a lower supply. This was recognised to be a result of both a hard winter and drought during the summer.
- **2012**: Harvests were poor, with some orchard crop yields down 40% in 2012, and the Bishop in Ledbury acknowledging the increasingly difficult harvests and conditions for farmers with drier winters and wetter summers during the Harvest Festival.
- **2013**: Farmland was destroyed by a combination of rain and snow with the National Farmers Union quoting that droughts, floods, and a long, cold winter over the past year had "knocked the stuffing out of the industry". The Royal Agricultural Benevolent Institution, which provides charitable grants to farming families, saw a rise in emergency payments in 2013 compared to previous years.
- **15 February 2020**: A case study on the BBC showed a Herefordshire farm under water alongside the general sentiment that farms had been significantly impacted during the flooding in February 2020.

## Natural Environment

The natural environment can also suffer significantly during severe weather events, particularly when not managed effectively.

**Photo:** Blackfriars Rose Gardens with dried out grass, © Herefordshire Council

Hot and dry conditions can have a significant impact on wildlife, making it much easier for open fires to start and to spread. Reduced river flows or higher water temperatures can cause problems for fish and wading birds, with the Environment Agency having to annually rescue fish from the River Wye in summer months. The heatwaves in 2022 were particularly damaging for the natural environment, with dead fish found in the River Wye due to high water temperatures of up to 24°C, with reports that wildlife was still suffering the effects by November.

Storm events can also negatively impact the natural environment, such as high winds felling trees. An example of this occurred recently when a culturally significant 360-year-old oak tree at Belmont Haywood Country Park was felled.

During heavy rain, rivers can burst their banks, with the River Wye being particularly vulnerable to this in Herefordshire. During extreme cold events such as the “Beast from the East” in February 2018, rivers have even been known to freeze.

Severe weather events can also prevent people accessing natural spaces for a range of reasons, which is an important factor in maintaining good health and wellbeing.

## Utilities

Electricity and water supplies can often be impacted by severe weather. High temperatures can cause electricity substations to have to be cut off due to fire risks, or cause water to expand and increase in pressure causing burst pipes. High winds and storms can damage power lines or substations causing power cuts, with some of the most severe examples occurring in February 2014 where 2,000 homes were without power, and during storms Eunice, Dudley and Franklin where over 1,200 homes were without power. Freezing temperatures can also impact water supplies, either whilst frozen or when thawing out, causing pipes to burst.

As well as disruption to people’s services, the direct strain placed on the utility companies is important to consider. During flooding and high winds in February 2014, Welsh Water prevented any disruption to water supplies after they lost power to water and wastewater treatment works and pumping stations, but at the expense of 1,400 staff working and 250 of these working overnight.

# 5 Case Studies

This section picks out a selection of examples of severe weather events that have occurred in Herefordshire over the past 15 years, where a high amount of detail has been provided by the various sources consulted. This aims to bring to life how severe weather can impact various different aspects of Herefordshire's society.

## 5.1 Cold weather example: Beast from the East

**Date:** Started on 26 February 2018

**Event Significance:** **Very Low** Likelihood | **Severe** Impact.

**Weather conditions:** The Beast from the East from February to March 2018 caused subzero temperatures and extreme levels of rain and snow, with over 50mm in the first half of March alone. Most notably, ten foot snowdrifts from Wales reached Stoke Lacy and the River Wye froze in some parts. As the snow melted in early March, floods occurred throughout the county.

**Photo:** Snow at Cradley, Herefordshire, © Unsplash

**Emergency services** were documented as requiring to respond to road accidents due to snow and icy roads, with the Fire Service struggling to reach some road traffic incidents due to the snow. Mountain rescue teams brought supplies to families in Stoke Lacy impacted by the snowdrifts. NHS staff struggled to get to work, resulting in non-urgent planned surgeries being cancelled and volunteers driving NHS staff to work in 4x4 vehicles.

**Herefordshire Council** closed all libraries, stopped all school transport services and gritted over 1,000 miles of road. £97,000 was spent to fix a village hall roof and £1.3 million of cold weather payments were provided by central Government, which were then disseminated by the Council. The Council also spent a significant amount of time initiating gritting of roads.

**Transport:** There were several county-wide road closures and public transport cancellations and delays.

**Homes, Businesses and Communities:** More than 25 homes in Hegdon Hill, Stoke Lacy were cut off by ten foot snowdrifts and stuck in their homes for almost a week. Business supply chains were also affected, meaning that panic buying took place with shops emptying; almost all shops and businesses were closed in Hereford. Extra rest centres were also opened to feed and house the homeless and those in need. Farmers in the community also helped to plough snow away to allow emergency vehicles to reach incidents.

## 5.2 Flooding example: Autumn 2019

**Date:** 26 October 2019 – 14 November 2019

**Event Significance:** October: **Medium** Likelihood | **Severe** Impact.
November: **High** Likelihood | **Major** Impact.

**Weather Conditions:** Heavy rain across three months, including nearly a month's worth of rain in 24 hours in some areas on 26 October and around the same in one night on 14 November. Rivers Teme, Frome and Wye reached high levels, with the Wye at its highest levels since records began, five metres over the usual. Localised flooding also occurred in mid-December albeit with much milder impacts.

**Photo:** Flooded home in Bodenham, Hereford © Herefordshire Council

**Emergency Services** were inundated with calls, requiring coordinated efforts between the Fire and Rescue Service, West Mercia Police, the Council, BBLP and community groups. Over the weekend of 26 and 27 October, the Fire and Rescue Service attended 46 incidents of vehicles in flood water on the Saturday, rescuing 21 people and one dog from vehicles and one pedestrian on a flooded road. They rescued 43 people and 12 dogs from flooded properties on 27 October, including 18 care home residents. Alongside Severn Area Rescue Association, they visited 56 properties at risk of being isolated in Symonds Yat and used a Water Response Vehicle to get a nurse to a patient in Tenbury Wells. On 14 November, in 24 hours the Fire and Rescue Service attended 46 incidents of vehicles in water and rescued 97 people and one dog. They also responded to six properties where floodwater had created electrical hazards. Also in November, flood defences were erected in Hereford and debris was washed along the Wye and removed near the Old Bridge by the Environment Agency.

**Homes, Businesses and Communities:** Flood Recovery Grants show at least 87 properties, and 11 businesses were severely impacted by the October floods, with one B&B in Hereford stating they lost £40,000 of business over six months. Eighteen residents from Manor Care Home were evacuated and relocated using boats to Credenhill Care Home. Houses on Greyfriars Avenue were severely flooded, and people were out of their homes for a month whilst repairs were carried out. Community response groups were reported to be involved in a major clear-up the following week when water levels subsided. In December, less severe impacts included some road closures and one school closure.

**Herefordshire Council:** The Flood Recovery Grants totalled £68,100. Throughout the course of the two events, several school bus services ceased to operate and at least 20 schools and some libraries were closed. The Council's Adult Social Care Team worked with Manor Care Home residents and their families to find appropriate temporary accommodation. BBLP responded to nearly 100 emergency jobs over the weekend in October, drafting in extra resource and working longer shifts alongside the Council's Health, Safety and Resilience Team to cope with flood water and debris on roads, and gritters were deployed on the Sunday evening.

**Transport:** Major and minor roads were closed and disrupted, including by a landslide near Walford Sawmills. Part of the train track at Pontrilas was washed away by floods and 500 tonnes of ballast and 300 tonnes of foundations had to be replaced. Rain caused disruption and cancellations of train services in and around Hereford and Ledbury railway station flooded.

## 5.3 Storm example 1: Dennis and Jorge

**Date:** 15 – 23 February 2020

**Event Significance:** Storm Dennis: **Low** Likelihood | **Severe** Impact.
Storm Jorge: **Medium** Likelihood | **Moderate** Impact.

**Photo:** Flooding in Hereford,
© Herefordshire Council

**Weather Conditions:** Storm Dennis took place on 15 February and brought with it heavy rain which landed on already saturated ground as a result of the recent Storm Ciara. Hundreds of flood warnings were issued in Herefordshire; two of the five biggest floods ever recorded in Herefordshire occurred during this period. The River Wye flooded to more than half a metre higher than any previous incident for 110 years, and reached the highest recorded level in Hereford at 6.11m and at Ross-on-Wye at 5.10m. The River Lugg also burst its banks. In addition to the rainfall, persistent and very strong winds with gusts of over 50 knots were recorded. Flooding continued into the weeks following Storm Dennis, with Storm Jorge on 23 February and heavy rain another week later further exacerbating the problem as rain fell on saturated ground and already high river levels (which again exceeded four metres on 24 February).

**Emergency Services:** During Storm Dennis more than 200 people were rescued by the Fire and Rescue Service from vehicles and properties. During and after Storm Jorge, a multi-agency response was carried out for at least ten days, including the Fire and Rescue Service, Environment Agency, West Midlands Ambulance Service, Highways England, West Mercia Police, and communities. This response included rescues and evacuations, running rest centres in areas including Hereford, Ross-on-Wye and Leominster, and coordinating/supporting flood recovery. The Fire Station in Peterchurch was flooded, as was the ambulance station in Leominster which was subsequently permanently vacated.

**Herefordshire Council:** Fifty-one roads required extensive work to repair damages, which cost upwards of £1.6m. The Council waived the need for a permit so residents could dispose of flood damaged items and gave out 545 Community Recovery Grants and 207 Business Recovery Grants for all flooding in Feb 2020, which together with Council tax discounts and Business Tax Rate Relief for those affected by the floods cost the Council £204,706.66. The Council and BBLP were also called out to at least 10 incidents concerning trees between 14 and 20 February.

**Transport:** Major travel disruption occurred as roads were blocked, including part of the M54 and several A-roads. The B4424 between Fownhope and Hereford was closed for two weeks after a landslip, causing a 90-minute diversion for coaches taking children to school near Ross. Eighty local roads became impassable and, as of 27 February, there were still 27 road closures in place around Fownhope, Holme Lacy, Walford and Leintwardine. In addition, railway lines were damaged including the Newport and Abergavenny lines which feed into Herefordshire at the end of February.

**Homes and Businesses:** As well as the 545 homes/properties and 207 businesses impacted by flooding resulting in Flood Recovery Grants, three primary schools were flooded and farms were significantly impacted (see this case study of a Herefordshire farm under water). Staff from a care home were driven into work by a local farmer in their tractor as flooding continued after Storm Dennis.

## 5.4 Storm example 2: Eunice, Dudley & Franklin

**Date:** Week commencing 14 February 2022

**Impact Assessment:** **Very Low** Likelihood | **Severe** Impact.


**Photo:** Storm damage in Herefordshire © Herefordshire Council

**Weather Conditions:** Storms Eunice (14 February), Dudley (15 February ) and Franklin (20 February) caused heavy rain, flooding and high winds. By 16 February there were eight flood alerts in place for the West Midlands, mainly covering Herefordshire and Shropshire. Some flood warnings for Herefordshire were increased to 'severe' by 17 February. Water had reached 4.7m in Ross-on-Wye. An amber warning for wind was announced on 18 February, with 60 mph winds recorded.

**Emergency Services:** A multi-agency response (also known as a Tactical Coordination Group) was coordinated, this time across Herefordshire, Worcestershire and Shropshire, including Hereford & Worcester Fire and Rescue Service, Herefordshire Council, West Midlands Ambulance Service and the Environment Agency, but also Shropshire Fire and Rescue Service, Shropshire Council, Worcestershire County Council and Telford & Wrekin Council. High winds caused debris and a callout to the Fire and Rescue Service to stop a trampoline blowing onto a main road. West Mercia Police and the Fire and Rescue Service were enforcing road closures and clearing fallen debris to reopen the roads as quickly as possible. Flooding meant the Fire and Rescue Service had to evacuate homes and temporary barriers were erected in Hereford.

**Herefordshire Council:** Balfour Beatty received 1,000 calls and attended 208 emergency jobs with regards to fallen trees and debris, infrastructure and roads. Dozens of schools were also closed in the region, including Ashfield Park Primary School in Ross-on-Wye.

**Transport:** A 'do not travel' warning from West Midlands Railway was issued for Herefordshire and beyond, and many rail cancellations took place affecting many train operators. On 22 February, a landslip meant trains between Hereford and Shrewsbury were cancelled for three days. Old Bridge was also closed temporarily due to high river levels and there were also several road closures, including in areas such as Leintwardine, Walford and Adforton.

**Homes and Businesses:** Over 1,200 homes in Herefordshire were without power at one point, and severe flooding caused the evacuation of homes in Hereford and Eardisland. A large tree fell onto a roof of Holme Lacy House Hotel in Hereford, but fortunately no casualties were reported.

## 5.5 Heatwave example: Summer 2022

**Date:** 13 July – 17 August 2022

**Impact Assessment:** **Medium** Likelihood | **Major** Impact.

**Photo:** Hereford Cathedral in the sunshine © Unsplash

**Weather Conditions:** The heatwave started in July and continued/fluctuated well into August, and an official drought was declared in Herefordshire following the 'driest summer for 50 years, and the driest ever recorded for Southern England'. The highest temperature of 33.8 degrees Celsius was recorded in Ross-on-Wye, one of the top five highest temperatures in the UK. Dates on which, by Met Office definition, official heatwaves occurred were on 10 to 25 July, 30 July to 05 August, 08 to 17 August and 23 to 25 August. On 11 August, an amber heat warning was put into force by the Met Office, alongside warnings that wildfires could become 'exceptional'.

**Emergency Services:** It was reported that the emergency services were preparing for excess health problems. Open fire related calls trebled in Herefordshire and Worcestershire compared to the previous summer; there were 143 call outs to fires with 94 being to fires in the open. The two biggest open fires were 40,000 and 80,000 hectares respectively. Police had to divert traffic away from a field fire near Marden, and an open fire near the M5 carriageway meant that it was partly closed. Another open fire close to an electricity substation impacted properties in the HR1 postcode area of county.

**Public Health:** On the 17 July an Exceptional Fire Severity warning was announced by the Met Office and people were advised to stay at home. A drought was declared on 30 August, at which stage schools had to be closed due to concerns about extreme heat.

**Natural Environment:** Dead fish were found in the River Wye due to high water temperatures, up to 24 degrees Celsius. There were extremely low river levels recorded, and water was pumped into the river from the Elan Dam and Caban Coch reservoir by the Environment Agency. It was reported that the dry weather was still negatively impacting wildlife as far into the future as November.

**Homes, Businesses and Communities:** On 09 August, burst water mains due to high water temperatures meant water was cut off in Bromyard. Farmers' fields and equipment were destroyed in open fires, and a heritage railway service was suspended due to fire fears.

# 6 Summary of key findings

To conclude this report, below is a summary of some of the key findings uncovered by the research undertaken to complete the Severe Weather Impact Assessment.

- **Forty-one** severe weather events were identified between and including 2008 and 2022.
- **Twenty-six** of these events we have determined to be 'significant' or of 'high significance.'
- Of the events classed as being of 'high significance,' **11 were associated with flooding** (some of which also included high winds), three were related to heatwaves and dry conditions, and two were associated with extreme cold and snow.
- **Only 14 of the 41 events took place in the first half of the 15 year period** (01 January 2008 to mid-July 2015). This may suggest an increase in the number of events over time, or it could be due to greater documentation or ease of access of information in more recent years.
- **Flooding is the most common** event type, followed by cold-weather related events.
- **There is a well-coordinated response to flooding events** in Herefordshire, and whilst most investment into dealing with severe weather has been to reduce flood risk, flooding still has the greatest impact on costs and disruption to people's lives.
- **Other severe weather events are less well prepared for**, especially heatwaves. This is likely due to their less frequent occurrence compared to flooding, but the impacts of heatwaves are still exceptionally significant and must be considered in future planning.
- In addition, despite flooding being most common, **high temperature-related events have the greatest impact on people's health**.
- The sectors most commonly impacted by severe weather in Herefordshire **are transport (particularly roads), homes and businesses.** Again, flooding generates the greatest impact, with at least 17 of the 41 events resulting in flooding affecting homes.
- Anecdotal evidence also shows that **agriculture is also significantly impacted** by severe weather in Herefordshire.
- Twenty-eight of the 41 events documented **impacts on roads** in Herefordshire, primarily due to flooding or heavy snowfall.
- **Natural environment, infrastructure and utilities have also all been affected** by severe weather in Herefordshire, leading to knock-on effects to people and services.
- So that the Council and other organisations can continue to monitor the impact of severe weather events, the database should now be **continuously updated** to capture events that have taken place in 2023 and onwards, such as the September 2023 unseasonable heatwave.

# Appendix 1: Detailed Methodology

This section details the process undertaken to the research and collation required to complete the Impact Assessment.

## Impact Assessment development

This report has summarised the findings of an Excel database that captures all severe weather events that have occurred in and that has in some way impacted Herefordshire over the past 15 years. For each identified event, the following information has been searched for and documented:

- The date the event occurred.
- The type of weather event, e.g. extreme heat/heatwave, heavy rain, high winds, storm, snowfall or extreme cold.
- The consequence of the event, e.g. flooding, water scarcity, fallen trees/debris, fires etc.
- The conditions at the time of the event using local weather station data.
- The specific location of the impact, although it should be noted that many events occurred across many areas of the county.
- The response from and impact on emergency services and Herefordshire Council, and other front-line responders as documented.
- Specific impacts on a range of factors, including transport, homes and businesses, agriculture, natural environment, schools, electricity and water supplies, tourism etc.
- An 'significance score' for each event (see Significance Assessment section below), giving an indication of the overall severity of the impact of each event.

The accompanying database is a 'working document', meaning it should be updated continuously from this point forward. Whenever a severe weather event occurs, this spreadsheet can henceforth be used to easily document the event and the impacts as described above, as a way to understand how vulnerable different regions and sectors are to severe weather and evaluate how prepared the Council and other services are.

The database includes three tabs:

- 'Main Impact Assessment': the full list of events and impacts documented.
- 'Weather Station info': includes links to the two main weather stations used to identify the weather conditions in Herefordshire at the time the events took place.
- 'RAG Matrix': shows how the assigned impact and likelihood values determine an overall significance value for each event.

# Using the Impact Assessment Database

The Main Impact Assessment tab in the accompanying database includes drop-down options on each column heading to allow for filtering of different types of weather events. For example, should one wish to only display events that have occurred in 2008, or only events that are deemed to be 'highly significant', this can be easily achieved. Adding additional impacts to this spreadsheet simply requires one to start typing in the next row down from the most recent event.

To calculate the significance of an event, use the likelihood and impact guidelines provided in this report (see 'Significance Scoring of Events' section further on in this appendix) to determine numeric values for each, then use the RAG Matrix to find the significance.

Following the analysis and collation of the impact assessment, key points and messages were extracted to create this report. This includes the categorisation of the long list of impacts into sectors to identify any emerging patterns or to ascertain whether there is evidence suggesting impacts befall certain sectors more than others. Summaries of a few of the most significant events have also been included to provide more specific examples of the vulnerability of Herefordshire to severe weather and guide the overall opinion on Herefordshire's preparedness for future events.

# Research

## Desk-based research

Desk-based research was carried out to uncover severe weather events that have been documented in the Impact Assessment. Advice from Herefordshire Council was taken on relevant publications to peruse and which stakeholders within and outside of the Council may have relevant information to share.

Firstly, we accessed sources that contained information on the major weather events that have occurred in recent years, and what the impacts of these were. These sources were summaries of named storms and historical weather factsheets from the Met Office, and the 'Notable Historic Flooding Events' list included in the Strategic Flood Risk Assessment (SFRA) (2019) written by Herefordshire Council.

Next, a trawl of local digital media and some social media was used, searching a range of key words related to the weather events and their consequences. This was done using Advanced Search techniques, meaning only results including "Herefordshire" and published between 2008 and 2022 were shown.

Finally, a more detailed search was conducted to find more information on specific dates of events already identified from the previous searches. This was also carried out using local digital and social media, but we also utilised an advanced Google search and the Herefordshire Council website to identify further information.

Keywords that were used to undertake the search included the following:

- Storm
- Winds
- Gales
- Snow
- Rain
- Flood
- Heatwave
- Drought
- Record temperature

- Climate change
- Natural disaster
- Wildfire
- Field fire
- Forest fire
- Bushfire
- Storms Abigail, Barney, Clodagh, Jake, Dennis, Eunice, Dudley, Franklin
- Dates of specific events (e.g. floods from SFRA, heatwave seasons 2019-2022 etc.)

Media sources used during the research to identify and record severe weather events that have occurred in Herefordshire between 2008 and 2022 are as follows.

| Source Type | Sources |
|---|---|
| Local Digital Media | • BBC Hereford & Worcester<br>• Hereford Times<br>• Ledbury Reporter |
| Search Engine | Advanced Google Search |
| Social Media | • Hereford & Worcester Fire and Rescue Service Twitter<br>• Hereford & Worcester Fire and Rescue Service Facebook |
| Herefordshire Council Resources | • Strategic Flood Risk Assessment 2019<br>• Council Website (Blogs)<br>• Council Flood Recovery Grants |
| Public domain data | • Met Office historical weather fact sheets<br>• Met Office named storm list<br>• Hereford & Worcester Fire and Rescue annual service reviews<br>• Public Health England Heatwave Mortality Data<br>• NHS ERIC overheating incidences |
| Weather Station Data | • Shobdon Weather Station<br>• Hereford (Credenhill) Weather Station |

## Stakeholder engagement

Alongside the desk-based research, interviews were also conducted with various stakeholders to gauge their opinion on the vulnerability and preparedness of their organisation/ service area, and Herefordshire as a whole, with regards to severe weather. Stakeholders also recollected personal accounts of weather-related events they remember experiencing in the past 15 years.

A list of stakeholders interviewed is outlined below. Note that there were a few other individuals in addition to this list with whom contact was made, but who did not respond to a request to interview. It should be noted that interviews also focused on discussions around future climate change, as well as their experiences of severe weather impacts in the recent past.

- Biodiversity/ Natural Environment (Herefordshire Council)
- Education (Herefordshire Council)
- Emergency Planning/ Public Health (Herefordshire Council)
- Flood risk (Herefordshire Council)
- Highways (Herefordshire Council)
- Internal Drainage Board

- National Farmers Union
- National Trust
- Planning (Herefordshire Council)
- Talk Community (Herefordshire Council)
- Welsh Water
- Wye Valley AONB
- Wye Valley NHS Trust

We also ran a workshop on 03 July 2023 that brought together the above stakeholders and others, at which further examples of impacts were extracted. We will also be convening a webinar for community groups in early September 2023, running a workshop specifically for local Councillors on 05 October 2023 and consulting with the Herefordshire Climate Board on 17 October 2023, all of which may uncover further examples which can be added to this report at a later date.

## Datasets

We also requested data that could help to quantify some of the impacts and that could be used in the creation of the Impact Assessment. However, it should be noted that much of these data were not accessible or shared after the initial creation of the Impact Assessment and this report. The datasets that we were able to access and analyse are listed below.

| Dataset accessed | Sources |
|---|---|
| List of named storms since 2008 (overall description of storm, wind speeds and dates) | Met Office |
| Descriptions on dates, locations and meteorological observations during severe weather event | Met Office |
| Notable historic flooding events (locations, dates, number of properties impacted) | Strategic Flood Risk Assessment (SFRA) 2019 |
| Weather conditions (precipitation, wind speed, maximum temperature, minimum temperature) | Shobdon and Credenhill weather stations |
| Qualitative descriptions of events | Local media |
| Herefordshire Flood Recovery Grants | Flood Team, Herefordshire Council |
| Fires responded to by the Fire and Rescue Service each year (split into outdoor, grass/woodland/crop fires) | Hereford & Worcester Fire and Rescue Service Annual Service Reviews |
| Flooding incidents responded to by the Fire and Rescue Service each year | Hereford & Worcester Fire and Rescue Service Annual Service Reviews |
| Quotes from the Fire and Rescue Service on their response to severe weather events | Hereford & Worcester Fire and Rescue Service Annual Service Reviews |
| Excess heat deaths in NHS 2016 to 2022 (in summer months, heat periods total, specific heat periods) | Public Health England heatwave mortality monitoring |
| Overheating incidents in wards or clinical areas in NHS Trusts per year between 2016 and 2022 | NHS ERIC |

Data that we either requested but did not gain access to, that is not publicly available or that could potentially be analysed where it is available, is set out below.

**Sector:** Emergency Services

| Potential Data | Potential Sources |
|---|---|
| Daily, weekly or monthly numbers of fires and floods responded to by Fire and Rescue Service | Hereford & Worcester Fire and Rescue Service (Home Office data were not comprehensive) |
| Police incident statistics to incidents related to severe weather | Home Office FOI request, West Mercia Police |
| Demand on ambulances and incident report/statistics on response numbers | West Midlands Ambulance Service |
| A&E demand, including the number of admissions due to heat/floods/cold, number of admissions during dates events took place, dates A&E was on 'high alert' status etc. | Office for National Statistics, Wye Valley Trust, UK Health Security Agency (UKHSA), Herefordshire Council Public Health Team |
| Rest centres/shelters opened | Herefordshire Council Emergency Planning Team, Talk Community Team |
| Number of volunteers responded to incidents | Talk Community Team |
| Number of people/homes evacuated | Herefordshire Council Emergency Planning Team, Talk Community Team |

**Sector:** Public Health

| Potential Data | Potential Sources |
|---|---|
| Number of temperature/severe weather related deaths (overall, on specific dates, and in the hottest months) | Office for National Statistics |
| Winter mortality | Winter mortality in England and Wales Statistical bulletins - Office for National Statistics |
| General health and climate change data | Health Effects of Climate Change in the UK report published in 2012; this is due an update |
| Wellbeing after severe weather events | Talk Community could include relevant weather impact related questions in their community health and wellbeing survey |

**Sector:** Financial

| Potential Data | Potential Sources |
|---|---|
| Insurance payouts following a severe weather event | Risk Management Team at Herefordshire Council, Insurance Company data |
| Reconstruction costs of public buildings (such as schools, council housing) | Herefordshire Council Planning Team |
| Costs to railways (repairs and maintenance, compensation costs due to disruption) | Network Rail |
| Maintenance/reconstruction costs of roads | Herefordshire Council Highways Team and/or Finance Team |
| Business lost and business grants given | Chamber of Commerce, small business groups, Herefordshire Council Finance Team |
| Crop damage and farming grants given | NFU, Royal Agricultural Benevolent Institution |

**Sector:** Utility Services

| Potential Data | Potential Sources |
|---|---|
| Water service disruption | Welsh Water |
| School closures | Herefordshire Council Education Team |
| Energy supply disruption | National Grid |
| Railway disruption (delays to rail services due to weather-related incidents) | Network Rail |

**Sector:** Natural Environment

| Potential Data | Potential Sources |
|---|---|
| Incident reports responding to environmental damage in Herefordshire, e.g. saving fish from dried rivers, clearing rubble after storms, topping up reservoirs etc. | Environment Agency, Herefordshire Council Natural Environment Team and/or Emergency Planning Team |
| Hosepipe ban dates | Welsh Water, Herefordshire Council Emergency Planning Team |
| Determine thresholds for flooding in different areas from river levels/flow rates alongside rainfall totals | Environment Agency website |

# Significance Scoring of Events

## RAG Matrix

In order to give an estimate of the severity of each severe weather event documented in the Impact Assessment, a simple risk assessment technique was used, determining both the 'likelihood' of a given event occurring, and the 'impact' of that event. Each level of likelihood and impact was assigned a numerical value, which could then be multiplied together to gain an overall 'significance' of an event. These calculations can be displayed in a 'RAG Matrix', as outlined below.

| | | Likelihood | | | | |
|---|---|---|---|---|---|---|
| | | **Very Low 1** | **Low 2** | **Medium 3** | **High 4** | **Very High 5** |
| **Impact** | **Severe 8** | 8 | 16 | 24 | 32 | 40 |
| | **Major 5** | 5 | 10 | 15 | 20 | 25 |
| | **Moderate 3** | 3 | 6 | 9 | 12 | 15 |
| | **Minor 1** | 1 | 2 | 3 | 4 | 5 |
| | **Negligible 0** | 0 | 0 | 0 | 0 | 0 |

The purpose of assigning an overall significance level to each event is to identify what type of weather events should be a priority for Herefordshire to prepare for. We have also chosen to weight impact higher than likelihood, as rarer events may still have a devastating impact and should be prepared for. The assignment of a significance value is a subjective one; someone else undertaking the same assessment may assign slightly different values to a proportion of the events. However, it is still a useful indicator of how impactful each event was, allowing for a degree of prioritisation.

## Determining Likelihood

There is no definitive way to determine the likelihood of each individual weather event in Herefordshire given the data available. Therefore, data on the average weather in Herefordshire, including maximum temperatures and rainfall, and the Met Office descriptions of expected climate and weather patterns in Herefordshire, were used to create a systematic process for evaluating a range of qualitative factors of an event to assign a quantitative level of likelihood of a similar event occurring in Herefordshire again. Shown in the table below is how we can deduce likelihood to a weather event occurring, based on the characteristics of Herefordshire and the wider West Midlands, and the likely effect these characteristics could have on a particular scenario occurring when a severe weather event takes place. Using this, we have assigned an estimated likelihood (out of 5) to this scenario occurring in Herefordshire in any given year.

**Weather type:** Heavy rain or not enough rain

| Patterns in West Midlands | Scenarios | Estimated likelihood (out of 5) |
|---|---|---|
| Particularly common along the Welsh border. "Prolonged rainfall can [commonly] cause flooding, particularly in winter and early spring as soils are near saturation". | • Heavy rain causing flooding in Herefordshire during November to March. | • 4 or 5 |
| | • Heavy rain causing flooding in Herefordshire during April to September. | • 3 or 4 |
| | • Heavy rain causing a river to burst its banks. | • Minus one from scores above as this is particularly severe. |
| The Severn and Wye Valleys are particularly prone to flooding. | Heavy rain in the Severn or Wye valley causing flooding in Herefordshire. | 5 |
| Wales is particularly wet with very heavy rainfall. | Heavy rain in Wales causing flooding in Herefordshire. | 4 or 5 depending on summer vs winter. |
| The Welsh hills create 'rain shadows' in Herefordshire outside of the wet Severn and Wye valleys, making drought more common and flooding less common in these areas. | Heavy rain causing flooding in Herefordshire outside of the Severn or Wye Valleys. | Minus one from score above. |
| It is relatively common for the less rain-prone areas to have extremely low river levels, or to dry up completely. | • River Teme drying up. | • 5 |
| | • Rivers other than River Teme drying up. | • 3 |

**Weather type:** Thunderstorms

| Patterns in West Midlands | Scenarios | Estimated likelihood (out of 5) |
|---|---|---|
| Thunderstorms are not as common in Herefordshire as some other areas of the country, but when they happen it is usually between the months of May to September, peaking in July and August. | • Storms late September to early May. | • 2 |
| | • Storms late May to early September. | • 3 |
| | • Multiple storms in one week. | • Minus one from scores above. |

**Weather type:** Frosts and Snow

| Patterns in West Midlands | Scenarios | Estimated likelihood (out of 5) |
|---|---|---|
| Frosts and some snowfall that does not stay on the ground during November to April is common in Herefordshire, but rarely occurs outside December to March. | • Frosts and some snowfall December to March. | • 4 or 5 |
| | • Frosts and some snowfall November or April. | • 3 |
| | • Frosts and some snowfall May to October. | • 1 |
| Larger snowfall that stays on the ground is less common at only around six days a year, and snowdrifts are very rare. | • Significant snowfall (over a few centimetres and lasts more than three days). | • Minus two points from scores above (0 May to October) |
| | • Snowdrifts. | • 1 |

**Weather type:** Winds

| Patterns in West Midlands | Scenarios | Estimated likelihood (out of 5) |
|---|---|---|
| | High winds (over 4 or 5mph). | 2 or 3 |
| Herefordshire is quite a sheltered area of the country, therefore high winds lasting for more than a day are rare. | Very high winds (over 25mph), gales, or high winds for more than two days. | 1 |

**Weather type:** Temperature

| Patterns in West Midlands | Scenarios | Estimated likelihood (out of 5) |
|---|---|---|
| The normal minimum temperature in winter months ranges from just below 0 up to 1.5 degrees Celsius. | Temperature lower than around 0 degrees Celsius. | 2 |
| Although particularly extended hot spells are uncommon, it is more common to have a maximum temperature over 22 degrees around Herefordshire, in the summer months, particularly in July. | • Warm temperatures but under 22 degrees Celsius from May to September. | • 5 |
| | • High temperatures over 25 degrees Celsius from May to September. | • 3 or 4 |
| | • Temperatures over 30 degrees Celsius for more than a few days. | • 3 or 4 |
| Temperature extremes, with hot summers and cold winters, are a key characteristic of the Midlands climate. | Where something has been described as significantly different to recent years, such as crop prices, but the events themselves are not particularly extreme. | 3 or 4 |

## Determining Impact

Similar to likelihood, a range of factors have been assigned a quantitative impact value in order to compare events and calculate an overall significance for each event. Due to the nature of measuring impacts, many of these factors are quantitative. For example, the more properties damaged in a flood, the higher the impact. Some factors are, however, qualitative descriptions for which significance is subjective, so these should be evaluated on a regular basis to ensure the Impact Assessment is still fit for purpose and that everyone involved in updating it is using the same guidelines to judge significance. As more data become available to use when logging weather events, these should also be incorporated. The below table shows the qualification of different potential impacts of severe weather events to determine impact level.

| Category | Event | Impact level |
|---|---|---|
| Community Disruption | • Mild disruption, but for more than four days (e.g. some rail delays, Council or emergency services have slightly higher response but no major incidents etc.) | • **Major** or **Severe** |
| | • Whole streets or areas cut off from flooding or snow | • **Major** |
| Property Flooding | • A few properties flooded | • **Moderate** |
| | • More than ten properties flooded | • **Major** |
| | • Hundreds of houses flooded or properties in multiple towns affected | • **Severe** |
| | • Occurrence of rescues | • At least **Major** |
| Service Disruption | • Loss of water or power supply in less than 100 homes | • **Moderate** or **Major** |
| | • Loss of water or power supply in more than 100 homes | • **Major**or Severe |
| | • Any significant infrastructure damage (railways, roads, buildings) | • **Major**(sometimes **Moderate** depending on scale) |
| | • Farming industry suffered with poor harvest performance | • At least **Moderate** |
| Emergency Services | • Warnings from emergency services disseminated (e.g., 'do not travel') due to flood, fire, heat etc. | • **Moderate** to **Major** |
| | • Increased strain on emergency services or health service | • At least **Moderate** |
| | • Any severe injuries | • At least **Moderate** |
| | • Any deaths | • **Severe** |
| Weather Warnings | • Yellow weather warning | • **Moderate** to **Major** |
| | • Amber weather warning | • **Major** to **Severe** |

# Reflections and Next Steps

Based on the range of research methods used, there is a high confidence that all significant and highly significant severe weather events that have taken place in Herefordshire in the past 15 years have been included in this Impact Assessment. However, there will always be more information on the impacts of said events to include. This section reflects on the methods used to complete this research and provides suggestions for creating a more thorough Impact Assessment and provision of more details when documenting each new event going forward.

There are some limitations with using a media trawl, which is why the work has been supplemented by other sources. These limitations include:

- There may be a bias towards more recent events in media reports found, which may lead it to look as if the number of severe weather events has increased over time, when they may not have.
- Flooding and storms are more likely to be reported on than heatwaves, as flooding has caused more damage to property and equipment and so has more tangible effects.
- The media often reports open fires as 'wildfires' when they may not necessarily fit this definition, and it is hard to determine whether they were caused by severe weather.
- Media reporters may not always have access to relevant supporting datasets, such as insurance and public health, which may play down the impacts on these sectors.

Other limitations to creating the most comprehensive list of impacts possible include:

- Some data are available online but include a paywall to access, including more comprehensive data on weather conditions at the time of events and insurance payments.
- There was some difficulty with retrieving data from stakeholders within and outside of Herefordshire Council in time for the writing of this report. However, the stakeholder interviews being carried out and further discussions internally within the Council may result in the acquisition of more data to further improve the comprehensiveness of the Impact Assessment as it is continually updated. It is also important to note that this is a living document and will continue to be updated into 2024, and data will continue to be requested and subsequently analysed on an on-going basis.
- We have also suggested earlier in this report potential datasets that may be beneficial to access, and there may be others it is decided would be helpful to use to enhance the accuracy of the Impact Assessment, that one cannot access or uncover. In this situation it is suggested that a relevant Council department or external partner that could potentially commence recording such data is identified.

# Appendix 2: Glossary

## Severe weather

Severe weather events are those that fall outside of the normal distribution for a particular area and include storms, drought, flooding and heatwaves, all of which have affected Herefordshire within the last 15 years. Such events can cause significant disruption to people, services and businesses in the local area.

## Flooding

Flooding can be caused by a large amount of rain in a short period, exceptionally long periods of rainfall, rapidly melting snow, high river levels caused by heavy rain/snow in other areas, or a combination. Flash flooding is when areas flood very quickly, normally due to heavy rain, and because of this it can happen in areas where there are no water sources, such as rivers. As the Met Office describes, "heavy rain only usually causes flash flooding when there are other factors, for example, when drains in the road are blocked so that the water cannot drain away, or at the bottom of steep hills as there is nothing to catch the water as it runs down the hill".

## High winds

High winds (sometimes called gales) can cause disruption including fallen trees, debris blocking roads, debris striking vehicles, properties and people, as well as the wind itself causing damage to infrastructure. Because of this, high winds sometimes cause facilities to close or rail services to be delayed or cancelled. Sometimes, the emergency services or authorities will issue 'do not travel' warnings.

## Snow/Ice/Extreme Cold

Snow and ice can lead to hazardous road conditions, transport disruptions and accidents. Increased road accidents as well as snow accumulating on power lines can lead to power outages, and snow melting can sometimes cause flooding.

Extreme cold or cold spells (i.e. periods of prolonged low/below-average temperatures) can lead to increased energy demands for heating, transport disruptions, damage to crops and vegetation and health risks from exposure to extreme cold temperatures.

## Heatwave/Drought/Water scarcity

Drought is a term used by authorities to describe a certain level of water shortages, normally defined by a period of at least two weeks of no (or very little) rainfall. Water scarcity has also been used to describe the events in this assessment, as there are times where water shortages have not impacted the public, but there has been an impact on agriculture and/or water suppliers.

The Met Office defines a heatwave as a period of at least three consecutive days where the temperature has been hotter than usual (normally at least 25 degrees Celsius). It is important to consider that periods of high temperatures can significantly impact industries and public health without being classified as a heatwave.

## Increased/exacerbated Fires

Prolonged periods of high temperatures combined with low rainfall can increase the likelihood of fires, particularly outdoors where vegetation is dry and fire catches or spreads more easily. Other factors during hot weather can also increase the likelihood of outdoor fires, including the public's increased use of (e.g.) disposable barbeques, or farming equipment catching fire if it malfunctions in the heat. It should be noted that the fires documented in the Impact Assessment have not been defined as 'wildfires' as this cannot be confirmed with the information available.

-END-