Department for Transport

Met Office

Issued September 2025

Transport hazard summary series

River flooding

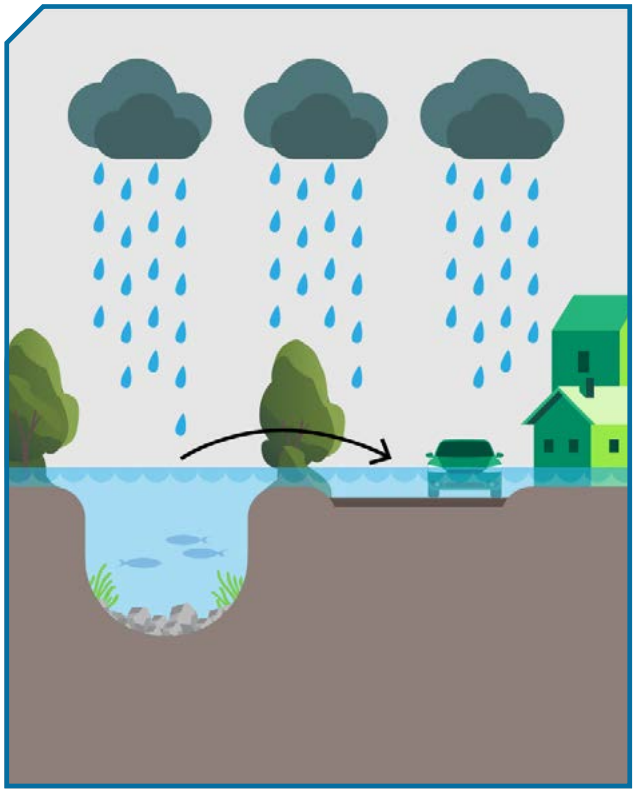
When rivers flood, they can block transport routes and flood stations and terminals. Fast flowing water can destroy bridges and sweep away people and vehicles. Climate change projections for the UK indicate that winters will become warmer and wetter, with rainfall becoming more intense and frequent, making river flooding more likely and severe. In response, the transport sector must become more resilient to deal with these challenges.

The Department for Transport, Met Office and partners have created this series of **transport hazard summaries** to explain natural hazards and other hazards that are not the result of malicious acts, their impacts and how they may change in the future. This summary will introduce what is meant by river flooding and how it can impact transport, and offers further information to help decision makers manage and adapt to these risks.

During Storm Desmond in December 2015, it was estimated that 355km of road were affected and 30 bridges were significantly damaged in Cumbria.*

* Department for Transport, 'Emergency preparedness, response and recovery: Identifying lessons learned by the UK highway sector from extreme weather emergencies (2015 to 2020)', 2021, available at: **https://assets.publishing.service.gov.uk/media/61927d24d3bf7f055d72d4dd/lessons-learned-highway-sector-extreme-weather.pdf**

What is river flooding?



River flooding occurs when the volume of water in rivers and streams rises over or bursts their banks, causing water to flow onto adjacent low-lying land known as floodplains. Transport infrastructure located on a floodplain is at risk of flooding.

Flooding can have different natural causes that can happen at the same time but are distinct. We have created separate **transport hazard summaries** focusing on surface water flooding, groundwater flooding and coastal flooding and erosion.

Figure 1:
High water levels in rivers and streams overflow leading to river flooding.

Where does it occur?

River flooding occurs on low-lying land by rivers. The Environment Agency and Natural Resources Wales produce river flood risk maps for England and Wales showing where there is a high, medium or low likelihood of flooding.*,†

When does it happen?

It is most common during winter after heavy or prolonged rainfall. Rapidly melting snow can also contribute. It is less common in summer as there is usually less rainfall, more evaporation and greater uptake of water by vegetation.

How long does it last?

This depends largely on the size and shape of the area of land that drains into the river, known as the catchment. In small, steep catchments water flows quickly, so river levels can peak suddenly and recede within hours. In large catchments, such as those feeding the rivers Thames or Severn, water drains into the river long after the rain has stopped, so peak levels may not occur for several days, and flooding can persist for days or even weeks.

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* Environment Agency, 'Risk of flooding from surface water', 2025, available at: **https://www.gov.uk/government/publications/flood-risk-maps-for-surface-water-how-to-use-the-map/risk-of-flooding-from-surface-water-understanding-and-using-the-map**

† Natural Resources Wales, 'Flood Risk Assessment Wales Map', available at: **https://naturalresources.wales/flooding/check-your-flood-risk-on-a-map-flood-risk-assessment-wales-map/?lang=en**

What factors increase river flood risk?

- Debris can block water from flowing through bridges or drainage channels, leading to higher water levels upstream.
- A lack of plants and trees to take up water causes more water to run into rivers.
- Building developments on floodplains and where access roads are at risk of river flooding.

How are river flooding events changing due to climate change?

Climate change is projected to significantly alter rainfall patterns in the UK, with winters projected to become wetter overall, even under a low emissions scenario.*,† This increase in winter rainfall is anticipated to make winter river flooding events worse.

UK summers are expected to become drier on average but with more intense rainfall events when they occur, where more heavy rain falls in a short space of time.* This is linked to the amount of global warming, so for every degree of warming in the region, the intensity of extreme rainfall is projected to increase by 5% to 15%.‡ This will increase the severity and frequency of river flooding events across the UK as a result.

Projections indicate an increase in the average amount of water flowing in rivers in winter and reductions in spring and summer.§ Higher amounts of water flowing in rivers can lead to more of the riverbed around bridge foundations washing away. This could make bridges in the UK more likely to get damaged or fail.

Overall, this means the number of transport assets and length of infrastructure networks located in areas exposed to a high risk of river flooding will increase. You can check your yearly chance of river flooding both now and between 2040 and 2060 on the Environment Agency's flood risk maps (please see the 'further reading' section on page 9).

In England, by 2100 with 4°C of global warming, projections show:

- a 32% increase in the length of railway track at risk of river flooding
- a 45% increase in the number of railway stations at risk of river flooding¶

More information on global warming levels and climate emissions scenarios can be found in the transport hazard summary on the changing climate.

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* Met Office, 'UKCP18 Climate Change Over Land', available at: **https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-infographic-headline-findings-land.pdf**

† Slingo, J. and others, 'Latest scientific evidence for observed and projected climate change, in The Third UK Climate Change Risk Assessment Technical Report', 2021, available at: **https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Chapter-1-FINAL.pdf**

‡ Kendon, E.J., Fischer, E.M., Short, C.J. and others, Nature Communications, 'Variability conceals emerging trend in 100yr projections of UK local hourly rainfall extremes', 14, 1133, 2023, available at: **https://doi.org/10.1038/s41467-023-36499-9**

§ UK Climate Risk, 'Flooding and Coastal Change Briefing', 2021, available at: **https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Briefing-Flooding-and-Coastal-Change.pdf**

¶ UK Climate Risk, 'Summary for England (CCRA3)', 2021, available at: **https://www.ukclimaterisk.org/publications/summary-for-england-ccra3-ia/#section-1-about-this-document**

Case studies

In 2020, Storm Dennis brought heavy, persistent rainfall across the UK, notably affecting Wales and the West Midlands. Heavy rainfall landing on already saturated soils rapidly increased river flows, causing major flooding along rivers such as the Wye and Severn, severely impacting transport networks.*,† Emergency responses were further hampered by high winds and landslides.

River flooding led to extensive road closures across Wales and western England. The River Teme flooded the A49 near Ludlow, Shropshire, closing it for approximately 24 hours and leaving vehicles stranded. The Wye Bridge in Monmouth was closed for around two days due to flooding from the River Wye, isolating the community until structural inspections were complete.

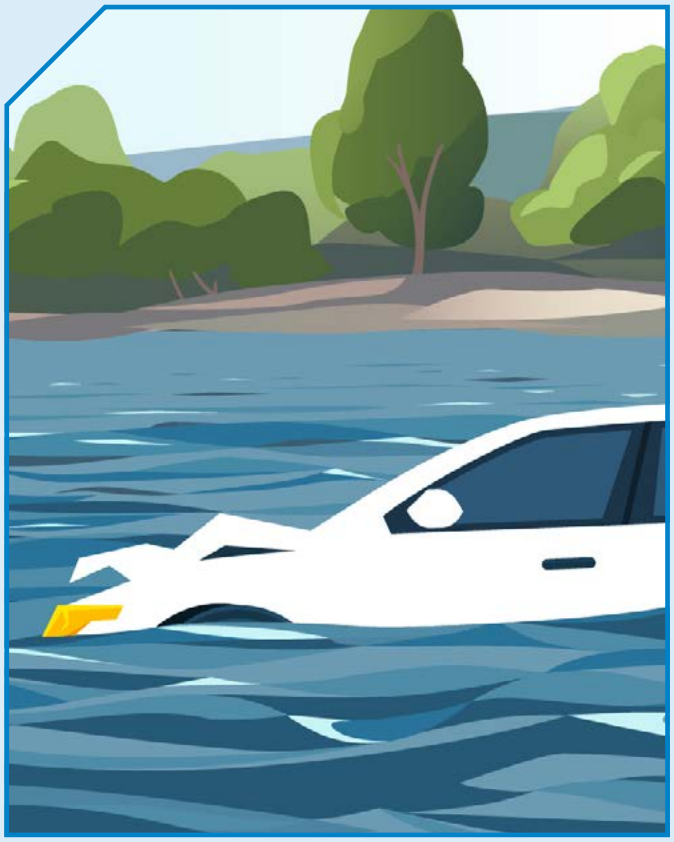
The River Don overflowed, closing Rotherham Central Station for roughly one day, due to submerged tracks and damaged signalling equipment. The Cambrian Line (Shrewsbury to Aberystwyth) was shut for two days as floodwaters from the River Severn undermined track beds, requiring significant repairs.

River flooding caused short-term disruption to port and airport access roads, such as those near the rivers Usk and Taff.

* Met Office, 'Storm Dennis', 2020, 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**

† Natural Resources Wales, 'Floods in Wales: Flood Event Data Summary', 2020, available at: **https://cdn.cyfoethnaturiol.cymru/692376/february-2020-floods-in-wales-flood-event-data-summary-high-resolution-eng.pdf**

Direct transport impacts due to river flooding

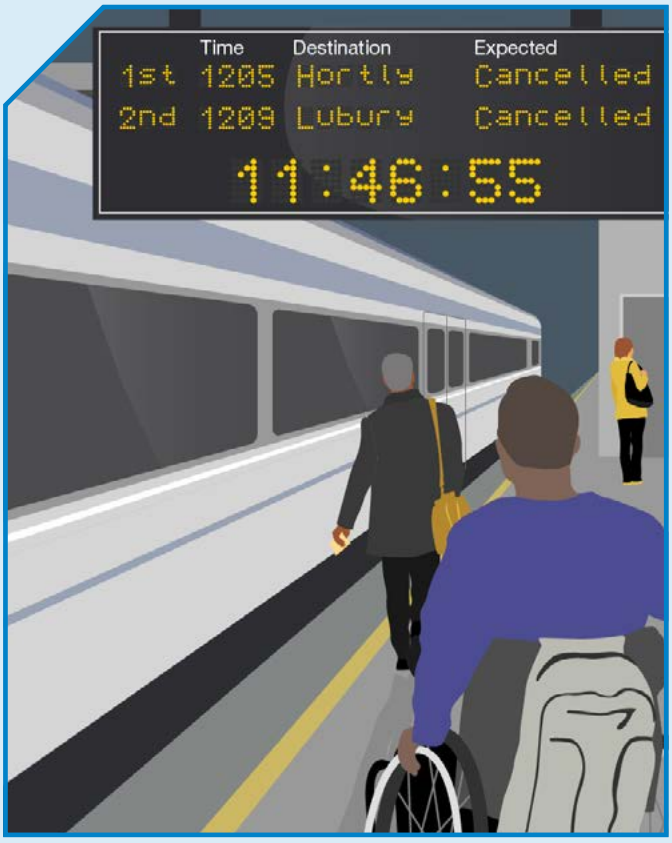


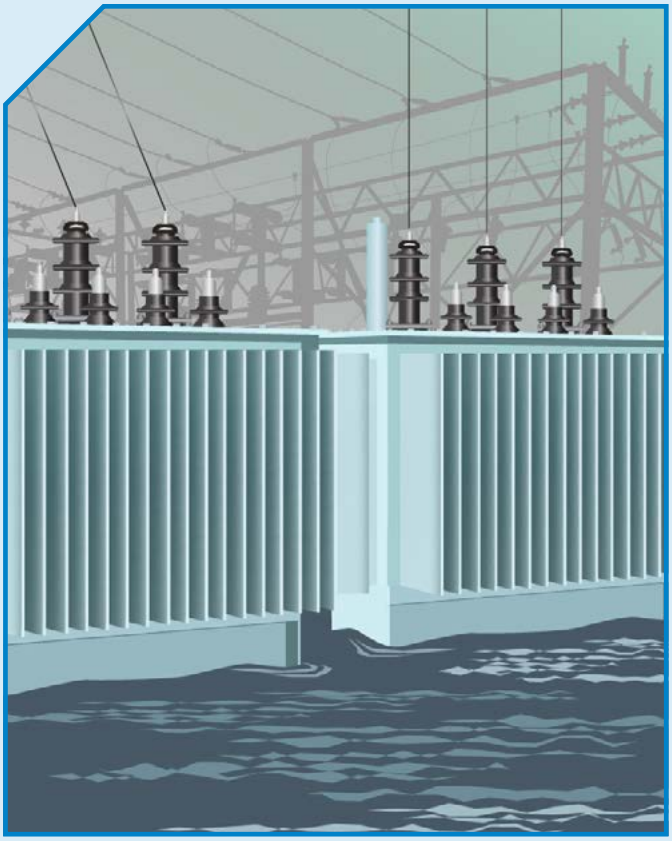
Human health and safety

- Rapidly rising, fast flowing river water can knock people over and carry away vehicles, creating a serious drowning hazard.
- Flooded roads and bridges delay ambulances, fire engines and police vehicles, slowing emergency response and evacuation.
- River search and rescue teams tend to have resources for small-scale operations, so they can be overwhelmed by a major flooding event.

Vehicle and service operations

- Flooded roads are often closed for safety, resulting in detours, service delays or suspension of public transport.
- River floodwaters can stall engines and damage electronics leading to costly repairs.
- Water can disable railway signalling systems or wash debris onto tracks, requiring emergency line closures.





Infrastructure

- Fast flowing rivers cause scour, which is where sediment such as sand, gravel and soil is removed from the bed and banks of rivers by fast flowing water.* Scour can remove the supporting material around roads and railways.
- Bridge structures are particularly exposed to scour, which can lead them to collapse causing lengthy disruptions. Older bridges are especially vulnerable, owing to present day river flows exceeding their original design capacity. They are also more susceptible to blockages due to debris.
- When floodwaters recede, they can leave thick layers of mud, silt, litter and other contaminants such as sewage, sometimes keeping routes or buildings closed for weeks.

Interdependencies: As well as causing power and communications outages, rivers can flood several communities at once, creating widespread road closures and increasing demand for emergency services and maintenance crews. Storm Desmond in 2015 affected multiple river catchments at the same time, severely stretching the ability of the emergency services to respond.†

* British Geological Survey, 'Scour', available at: **https://www.bgs.ac.uk/geology-projects/hazard-and-resilience-modelling/scour/**

† Griffin, A., Kay, A.L., Sayers, P. and others, HESS, 'Widespread flooding dynamics under climate change: Characterising floods using grid-based hydrological modelling and regional climate projections', volume 28, issue 12, 2024, available at: **https://hess.copernicus.org/articles/28/2635/2024/**

Hazards associated with river flooding

Dam collapse

Heavily flooded rivers feeding reservoirs can put strain on dams, raising the risk of structural damage or collapse.

Groundwater flooding

High groundwater levels mean that less rainwater can seep into the ground with more flowing into rivers. Groundwater can also enter rivers from below when levels are high.

Landslides and earthwork failures

River flooding can saturate the slopes that carry roads and rail lines beside rivers, adding weight and weakening the slopes.

Pollution incidents

Heavy rain washes transport-related contaminants such as oil, rubber and heavy metals off roads into rivers. During river flooding this pollution can spread to surrounding floodplains.

Storms

Heavy rainfall associated with storms in autumn and winter often leads to river flooding. Intense rainfall from summer thunderstorms can lead to river flooding in small, fast responding rivers and streams.

Subsidence, soil degradation and sinkholes

Prolonged floodwater can soften clay soils or wash fine material from beneath roads, leading to surface cracking, minor ground movement or rare sinkholes after the flood.

Further information on these hazards can be found in our series of Transport hazard summaries: **https://www.gov.uk/government/collections/transport-hazard-summaries**

Risk mitigation and adaptation

With the projected changes to rainfall in the UK, ways to adapt to the increased risk of river flooding are needed. Mitigation often requires co-ordinated action between transport providers, local authorities, government agencies and other infrastructure owners. Examples include:

- inspecting and clearing drains or channels before storms or heavy rain to prevent debris from forming blockages during river flood events, and raising or reinforcing low-height bridges over rivers
- building transport buildings and storage facilities with flood-resilient, waterproof materials so they resist water damage and can be cleaned and reopened quickly after a flood
- keeping electrical equipment and batteries high above the ground
- preparing flood response plans that specify when to close roads and suitable diversions based on flood forecasts or rising water

Questions for decision makers

- Which transport assets lie in current or future river-flood zones, and which of them are most vulnerable to damage or long closures from river flooding?
- In the event of flooding, are alternative routes planned to key accessways such as roads serving hospitals, emergency services and at-risk communities?
- Are culverts, drains and bridge foundations inspected often enough to catch scour or blockages early?
- What personnel and equipment will you need to respond to flood incidents and are responsibilities well defined during a large-scale flooding event?
- Do you have plans in place to communicate transport disruption and safety messages to the public?
- Are plans in place to evacuate stranded travellers and ensure the safety of vulnerable people?

Further reading

Environment Agency flood map for planning in England – GOV.UK

Flood alerts and warnings – GOV.UK

National assessment of flood and coastal erosion risk in England 2024 – GOV.UK

River catchments, explained – Thames21

Third UK Climate Change Risk Assessment (CCRA3) Future flood risk – Sayers and Partners

Transport Briefing 2021 – UK Climate Risk

UK Water Resources Portal – UK Centre for Ecology and Hydrology

UK Hydrological Outlook – hydoutuk.net

Climate information and risk assessment

See ‘The changing climate’ and ‘Transport hazards, risks and resilience’ transport hazard summaries for more information on identifying and planning for risks to transport and where to find climate data, including more detail on projected changes on a regional level.