



# Groundwater flooding

BGS science is helping to reduce disruption and expense caused by groundwater flooding

## Factfile

- The Pitt Review (2007) of the summer 2007 floods and the EU Floods Directive (2007/60/EC) both acknowledge the importance of groundwater flooding
- An estimated 1.6 million properties are at risk of groundwater flooding in England and Wales.
- Groundwater flooding of Hambledon, Hampshire in 2000–2001 was estimated to have cost £1.1 m.
- The BGS Groundwater flooding susceptibility map indicates that about 1500 square kilometres (about 1 per cent) of England is highly susceptible to groundwater flooding

## Is groundwater flooding a problem in the UK?

Groundwater flooding can cause major disruption and expense to people and businesses in areas of the UK. For example, groundwater flooding of the Patcham area of Brighton in 2000–2001 cost around £800 000. An estimated 1.6 million properties are at risk of groundwater flooding in England and Wales.

## Is it different from river flooding?

When your house is knee-deep in water, groundwater flooding looks the same as river flooding. However, the flooding processes are different and management of the problem needs to reflect this. Groundwater flooding often persists long after river flooding has subsided.

## Why does groundwater flooding happen?

Groundwater flooding occurs as a result of water rising up from the underlying rocks or from water flowing from dormant springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels.

## How does groundwater flooding emerge?

Groundwater flooding may initially be invisible 'underground flooding'. Flooded basements are an early sign of groundwater flooding. As the water level rises the water may emerge above ground level causing flooding of buildings, roads and farmland.

## What impacts does groundwater flooding have?

Even 'underground flooding' can affect infrastructure and services such as underground trains and sewers. When water reaches the surface the destructive potential also rises. Flooded sewers can overflow causing contaminated water to emerge into streets, gardens and homes. Property can be damaged and people's lives can be turned upside down. The economy is hit by insurance claims, loss of productivity, emergency services costs, etc. The

2000–2001 flooding in Brighton caused extensive damage to the railways and both rail and road journeys were greatly delayed.

Typically the most damage and disruption takes place when flooding coincides with urban areas. Significant groundwater flooding events have taken place in Oxford and Chichester. Such locations are at risk of repeated groundwater flooding.

## Where does groundwater flooding occur?

Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as the Chalk, or may be localised sands and gravels in valley bottoms underlain by less permeable rocks.

## Can groundwater flooding events be predicted?

Existing efforts to predict groundwater flooding events are based on monitoring water levels in boreholes in areas known to be at risk. These systems can give notice (typically days or weeks ahead) of impending events.

"... groundwater flooding can persist for weeks after river waters have receded"

David Macdonald, BGS

Groundwater models can be used to provide accurate early warning systems: BGS have demonstrated this in test catchments, e.g. the Patcham area of Brighton. These can alert authorities to possible groundwater flooding months in advance. Such early warning means authorities can plan their response and possibly even to implement mitigating measures.

## Are groundwater and surface water flooding linked?

Groundwater and surface water flooding often happen together. BGS is examining the role of groundwater in flooding on the Oxford floodplain. We are helping the Environment Agency to manage the risk of flooding in Oxford in a holistic way.

## What legislation applies?

The new EU Floods Directive requires member states to assess the risk from groundwater flooding. BGS has produced a groundwater

flooding susceptibility map which covers England, Wales and Scotland. Councils can use this alongside other information to make their assessments.

## Will climate change worsen groundwater flooding?

The UK Climate Impact Programme (UKCIP) model indicates that, in future, winters may be generally wetter and summers substantially drier across the UK. The greater variability in rainfall could mean more frequent and prolonged periods of high or low water levels. The effects of climate change on groundwater in the UK therefore may include increased frequency and severity of groundwater-related floods. A model we have developed with partners is being used to investigate these possibilities.

## What scientific challenges remain?

Estimating the likelihood that groundwater flooding will occur in a specific location is very difficult. More research is needed to enable the risk of groundwater flooding to be mapped with a good degree of confidence. Ongoing collaborative work involving BGS is addressing this.

Interactions between groundwater and the built environment, e.g. the foundations of buildings, need to be investigated. Urban drainage that is designed to reduce the risk of flash flooding after rainfall could increase the risk of groundwater flooding.

BGS continues to play a significant role in improving the understanding of the role of groundwater to flooding in the UK and the rest of Europe.



More information: [www.bgs.ac.uk/flooding](http://www.bgs.ac.uk/flooding)

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BGS Groundwater flooding susceptibility map