

Flash floods

– an underlying problem?

John Powell and Jon Ford say geology can help show us where flash floods are likely.

When thunderstorms and devastating floods hit North Yorkshire, last June, the British Geological Survey (BGS) sent a geohazards team to investigate.

The Jurassic rocks of the Hambelton Hills, east of Thirsk and surrounding the villages of Sutton-under-Whitstonecliffe, Boltby, Hawnby, Rievaulx and Helmsley, were deposited 183–150 million years ago. Ancient landslides that formed over the last 12,000 years, after the last ice age, are common along the escarpment and steep-sided valleys. We were checking whether the thunderstorms had reactivated these (particularly where they're close to buildings and homes) and testing how well BGS maps of the floodplain deposits predict flood risk.

Moist air, rising as it passed eastwards over the Jurassic escarpment, triggered the downpours. Rivers and streams broke their banks, causing local but severe flooding along the alluvial floodplains. Road bridges and farm buildings were destroyed or seriously damaged, and some local people recounted waters reaching 2–3m in their houses. One resident told of returning to his house in the afternoon to find his dogs drowned in his kitchen and stone outbuildings swept away. The torrents undercut bridge parapets and

even destroyed the formidable stone bridges at Hawnby and Shaken Bridge.

Most of the lower ground in the flood area is Pleistocene clay-rich till (boulder clay), overlying impermeable Lower Jurassic mudstone. Around Hawnby, the bedrock is Middle Jurassic mudstone and sandstone. These don't absorb water quickly so rain rapidly ran into small streams, which couldn't cope with the torrential flow. The Boltby-Felixkirk area also has a natural 'half-bowl' shape that feeds surface water from streams into Boltby Reservoir and small rivers. The narrow, steep-sided valleys, cut into the Middle and Upper Jurassic rocks around Arden Moor and Hawnby, divert all their flow to the relatively narrow valley of the River Rye, where bridges and buildings between Hawnby and Helmsley suffered the most severe damage.

We surveyed the landslides BGS had mapped in the 1980s, looking for renewed movement. Thankfully, there was none, probably because the water ran off too rapidly to soak into the soil and bedrock.

These Yorkshire hills have a long history of flash floods. In 1754, one destroyed several houses and bridges, washed away cattle and killed 13 people. Fortunately, no one was killed in 2005. Some say the recent flood was due to

climate change, others that this has always happened—just very infrequently. Either way, it's clear that the local geology and topography reinforced the rain's impact. Whatever the underlying cause, geological maps, like those produced by BGS, can undoubtedly help predict the extent of flash floods and landslide risk, and are useful to planners (repairs to the bridges alone are reported to cost over £2 million). And even if such floods have always happened, one of the most likely effects of climate change is to make extreme weather more frequent.

Want to know more?

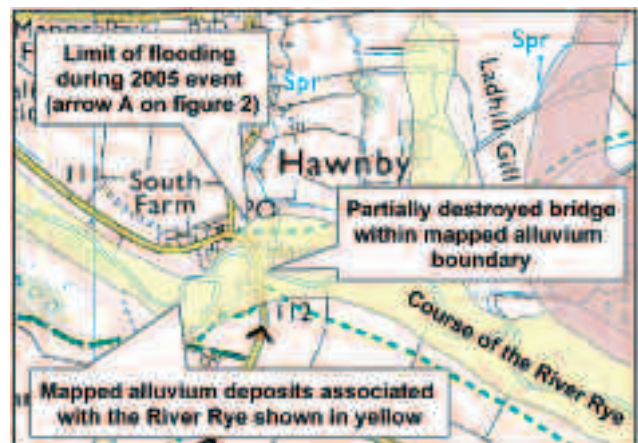
For general information, visit the British Geological Survey web pages: www.bgs.ac.uk/. BGS also holds detailed information about this area in a memoir and map: Powell et al. (1992) *Geology of the Country Around Thirsk*. Memoir of the British Geological Survey, Sheet 52 (England and Wales), and BGS (1992) 1:50,000-scale sheet, Thirsk (52), Solid and Drift editions, Keyworth, UK.

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Pete Hobbs/Helen Reeves/BGS



Inspecting flood damage to the bridge at Hawnby. There's a brown 'tide mark' (arrow A) of debris in the middle distance, indicating the level of the Rye floodwaters. This coincides with the floodplain (alluvium) boundary on the geological map (right). The dashed arrow indicates the direction of flow and a flattened field of small conifers.



Outline of alluvial floodplain of the River Rye, near Hawnby. The mapped floodplain (yellow) accurately predicted the extent of the flash flood.

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