WEATHER WARNING

Recent floods in Germany and across Europe have raised questions about the effectiveness of approaches to stormwater monitoring and management. **Nadine Buddoo** reports.

The storms in Germany caused extensive damage to rail and other infrastructure

German officials are still calculating the extent and cost of the damage from extreme rainfall and subsequent floods that engulfed parts of the country in July.

The floods caused serious damage to more than 600km of railway track and 80 stations as well as affecting roads and bridges, and putting some dams at risk of collapse.

Alongside the devastating impact on critical infrastructure, more than 180 people are known to have died.

According to reports, almost twice the amount of rainfall usually recorded in July fell on parts of Rhineland-Palatinate and North Rhine-Westphalia in just 48 hours.

University of Reading professor of hydrology Hannah Cloke explains that the extreme rainfall impacted flashy catchment areas – those that react quickly to rainfall events – where small rivers rapidly became "fierce beasts".

She adds that the flood warning system in Germany is very complicated. One of its main challenges comes from a fragmented system where flood management responsibilities are often delegated to

KEY FACT

80

Number of railways stations damaged by recent floods in Germany

people who lack the expertise to make critical decisions.

"In the future, it would perhaps be better to have expert support in understanding the risk from these very heavy rainfalls," she says. In addition, Cloke would like to see improved risk mapping that considers the impact of a changing climate and which incorporates more data.

"There's also an issue around the warnings not working and there's an issue around them not being listened to or people being unable to imagine the water rushing through and destroying their home. They just assumed it would never happen in their home town," she says.

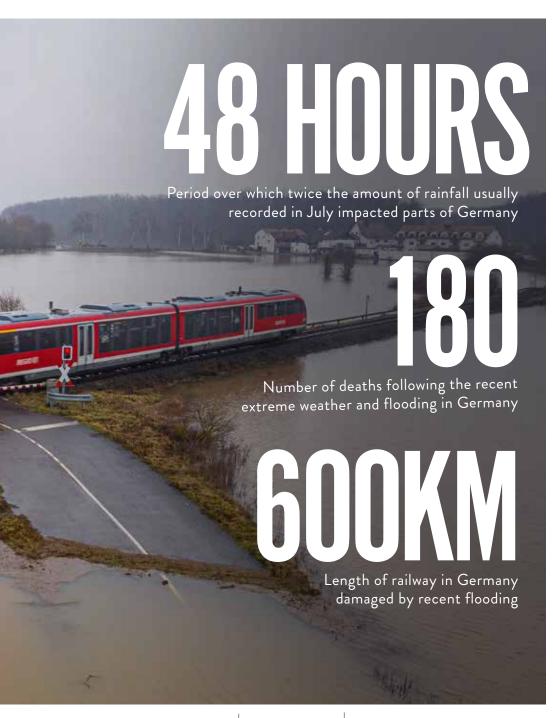"A good warning system has a whole chain of things involved in it. You have to have good weather

> **It would perhaps be better to have expert support in understanding the risk from these very heavy rainfalls**

forecasts and good starting conditions from satellites and observations.

"You also have to have a good understanding of the hydrology and where the water is going in order to have a good flood or hazard forecast," Cloke explains.

"But then you've got to understand the impact [of heavy rain] and you've got to be able to take a decision based

48 HOURS

Period over which twice the amount of rainfall usually recorded in July impacted parts of Germany

180

Number of deaths following the recent extreme weather and flooding in Germany

600KM

Length of railway in Germany damaged by recent flooding

Some people felt that they had had no warning at all. Others ignored the warning and they were asleep when the flood came

of hydrogeology and water management Oliver Stoschek agrees that stormwater management poses a significant challenge for Germany. While he agrees that the damage to infrastructure was largely unavoidable, he believes the loss of life could have been prevented if there had been better information management.

"I don't think [the impact of the extreme weather in Germany] was due to a problem with forecasting. The issue is with information exchange and that needs to be improved," he says.

Stoschek explains that because the flood warning information was not taken seriously in some areas, sewer systems and dams were not emptied to accommodate the heavy rainfall.

He believes that using digital tools like DMT's Safeguard which monitors water levels, would allow better, maybe automatic, control of stormwater management systems and reduce flood risk.

"If you have a more or less automatic system which takes the information from a forecast, then it will automatically start providing storage areas [for excess water]," he says.

"There is a lot of research underway which is looking at using artificial intelligence, for example, to deal with a storm event and use existing infrastructure in an optimised way to minimise damage."

NEW TECHNOLOGY

Tackling the impact of extreme weather on infrastructure through the greater uptake of monitoring and surveillance technology is also high on the UK agenda.

In the UK, following the fatal Stonehaven derailment in August 2020 where a passenger train struck

on the impact forecast. Then you have to issue a warning to the public and that warning has to be heard, acted upon and understood by those who are on the ground."

Cloke adds that because various regions across the country were affected, different challenges impacted different areas, and this ultimately contributed to the

devastating loss of life.

"In some places the warnings were issued well in time and the evacuations were implemented, so people got out of the way," she says. "But in other places some people felt that they had had no warning at all. Others ignored the warning and they were asleep when the flood came."

Consultant DMT Group's head

> **" We're increasingly exploring the links between keeping our soils healthy for not only the ecosystem but for flood protection**

debris washed out from a drain following heavy rainfall, Network Rail established a weather advisory taskforce and a earthworks management taskforce. They were asked to consider how the railway can better cope with extreme weather.

Dame Julia Slingo, who led the weather advisory taskforce, admits that the traditional tools used by Network Rail to monitor ground conditions were inadequate.

Speaking at *NCE*'s Future of Floods conference, Slingo said: "If we are going to get to grips with this challenge, we are going to have to have a much better sense about what is going on hydrologically at the level of the railway track.

"Network Rail has traditionally used things such as soil moisture indices, which are modelling products, or it has used an old system called Morex which gives you something about soil moisture deficit.

"Neither of them are appropriate for understanding the risk here."

She added: "In my report we actually very much highlighted a new product called Relative Wetness […] which takes the hydrology of soil types […] and provides operational, timely estimates of the wetness of the soil across the country at the kilometre scale […] and gives a really fantastic map of where the biggest earthworks risks are or risks of potential landslides."

Slingo said that new technologies such as sensors, drones, helicopters and satellite imaging, along with algorithms and data analytics could play a greater role in mitigating the risks posed by extreme weather.

Slingo added: "Weather is a very dynamic thing, so we felt that 21st

Roads and bridges were also damaged by the flooding in Germany

century digital technologies provided a great opportunity to have a more dynamic and visual presentation of the hazards and potential impacts on the rail network than currently Network Rail receives."

Aside from the use of new technology to monitor and predict risk to infrastructure, Cloke would like to see a focus on agriculture and natural flood management in the UK and across Europe.

"In the UK, we're increasingly exploring the links between keeping our soils healthy for not only the ecosystem but for flood protection and drought protection as well. That's definitely something I would like to see more widely implemented across Europe, certainly for the slower and smaller floods.

"For the more violent floods, I think that it's much clearer that risk mapping and getting people out of the way of the flood water has to be the priority." **N**

NEW TOOLKIT

DMT Group has launched a new toolkit with a range of digital solutions for civil infrastructure and engineering, which can be applied to stormwater management.

It brings together technologies like building information modelling, geographic information system and real time monitoring.

DMT Middle East director Hazem Hanafy says: "Central to this toolkit is DMT's capability in 3D ground modelling, which has a direct application in the management of stormwater in urban environments.

"DMT's integration of civil 3D modelling into the Navisworks [3D software] platform takes place following the design stage to ensure potential weaknesses are identified, and to ensure no clashes with other utilities."