London Flooding Review

Non-Technical Summary - Stage 2 Report

May 2022

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Non-Technical Summary - Stage 2 Report

May 2022

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Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	April 2022	S Wilcockson	E Flores Diaz / C Marti	K Macpherson	Stage 2 Non-Technical Summary
B	May 2022	S Wilcockson	L Bowyer	R Bowen	Stage 2 Non-Technical Summary

Information class: Standard

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1 Introduction

On 12 July and 25 July 2021, several London boroughs experienced severe flooding, causing damage to property and infrastructure. To establish why this flooding happened, and how similar events may be managed in the future, Thames Water commissioned an independent expert group (IEG) to lead an Independent Review into the flooding.

The review consists of four key stages:

- *Stage 1: What?* – An objective review of the available data relating to the flooding on 12 and 25 July 2021
- *Stage 2: Why?* – An investigation into the flooding mechanisms and root causes that led to flooding on 12 and 25 July 2021
- *Stage 3: How?* – An assessment of how well Thames Water's assets, including flooding alleviation schemes, critical pumping stations and the overall sewer network, performed on 12 and 25 July 2021
- *Stage 4: What next?* – Recommendations to improve current flood mitigation processes and improve resilience to future flooding events.

2 Stage 2 – what did we do?

2.1 Assessing what could have caused the flooding

During Stage 2, we used the data and models we collected in Stage 1 to assess the flooding mechanisms (the potential causes of flooding) that were involved in the July 2021 flooding events. This will help us to identify how significant each contributing factor was to the impact of the flooding.

To do this, we simulated a range of scenarios, by making small changes to the existing base models provided by Thames Water during Stage 1. These are called sensitivity tests. By comparing these sensitivity tests with the baseline model results, we were then able to see which changes had the most significant impact on the sewer system levels, on surface water flooding and resulting flooding of property and infrastructure. This allows to obtain an insight into what sort of measures or actions might best be adopted to reduce future impacts from similar events.

Table 2.1: Simulated scenarios and findings

Scenario	What we tested?	What we found?
Hammersmith Pumping Station operation	Thames Water told us that one of eight pumps broke down during the event, reducing the total capacity of the pumping station. This sensitivity test compared the impact of the difference in pump rates to see how this affected sewer levels	Medium increase water levels in London Borough of Hammersmith and Fulham; minor increase on water levels in Royal Borough of Kensington and Chelsea, City of Westminster
Lots Road Pumping Station (LRPS) operation	The pumps at LRPS are manually operated, meaning that an operator has to go and physically switch on the pumps when levels in the sewer system are high. Using the records from the pumping station, we replicated what happened on the day to see if the timing of the manual switch-on affected the areas	Minor increase in water levels in London Borough of Hammersmith and Fulham, Royal Borough of Kensington and Chelsea
Pipe Blockage removal	Sewer blockages (e.g. fatbergs, build-up of silt) are included in the model in some locations, where they were found during surveys of the sewer system. They were removed for this sensitivity assessment to see if sewer flows were held up by the blockage, increasing water levels. Stage 3 will look at blockages of gullies.	Had minimal contribution to the flooding
Rainfall trajectory shifts	Summer storms are very localised and intense. We wanted to test what would happen if the storm had occurred over a different area to see if a similar number of people and properties would be affected, or if the location of the storm had a significant impact.	Changed the areas affected, but the scale of impact (number of properties) is not significantly changed if the storm had hit another part of London.
Dry weather flow peak timing	The sewer system takes both dry weather and storm flows. Dry weather flow consists of domestic sewage, trade flows and infiltration of water from the ground and is present in the system all the time. Storm flows occur during periods of	Had minimal contribution to the flooding

Scenario	What we tested?	What we found?
	rainfall and enter the system via road and roof drainage. The timing of the storm (mid-afternoon) occurred when the dry weather flows were low. We wanted to test whether more people or properties would have been affected if the storm had occurred when the dry weather flow is at its highest (approx. 7am).	
Low tide	We wanted to understand what would happen if the events had occurred at low tide.	Low tide reduced water levels significantly in London Borough of Hammersmith and Fulham, Royal Borough of Kensington and Chelsea, City of Westminster, Wandsworth, City of London, Tower Hamlets, Newham, Lambeth and Greenwich
Groundwater infiltration into the sewer	Some flow may enter the sewer from below ground through joints and cracks in the pipes. This can use up capacity which might otherwise be used by storm flows. We have run a model assuming there is no groundwater infiltration to show whether this had an impact.	Had minimal contribution to the flooding

In addition to the sensitivity testing, we also carried out surface water mapping of the affected areas. This involved looking at the amount of rainfall that stayed above ground during the storms, and the amount that entered the sewer network. We concluded that approximately 30% of the rainfall was unable to get into the sewer system. Whether this was due to blockages or the intensity of the event being too great to enter the system via gullies will be investigated in Stage 3. We then ran model simulations to identify areas where rainfall which stayed above ground could have collected and contributed to the flooding. We used this to help determine the root cause of flooding.

2.2 Root cause analysis

We carried out a root cause analysis for each London borough, using areas of reported flooding to help define hotspots. The review of flooding records was greatly improved by the significant photographic and video evidence we received from organisations and the general public. Each flooding hotspot was then reviewed against the records of flooding to determine the likely source of flooding.

The flooding hotspot was then:

- reviewed alongside the model-predicted flood volumes to see if it was in an area predicted to be impacted by water coming from manholes to identify whether there was an issue with local sewer capacity for these rainfall events
- reviewed against the output from the tidal sensitivity test to identify whether it was in a zone affected by the coinciding tidal and rainfall peak
- reviewed against any pumping station delay or failure sensitivity test to identify if this mechanism impacted flooding in the hotspot
- compared with areas at risk of surface water flooding to identify if it was predicted to be in a zone where it is predicted by the model that water can build up.

The analysis identified probable root causes of the flooding for each individual hotspot. Understanding the root cause and how the various factors combined during this event will allow for a complete picture of the types of interventions, and potential policy changes that are needed to address flooding in London.

3 What happens next?

In Stage 3, we will be looking more closely at the performance of Thames Water's flood alleviation schemes (structures and methods put in place to limit damage that may be caused by flooding), critical pumping stations and operational performance of the sewer network on 12 and 25 July 2021.

We will be using the data gathered during Stage 1 and Stage 2 as 'baseline data' to help us get a clearer picture of the 'what, when, why and how' of the flooding events. We will then base our recommendations on these findings.

We will publish the Stage 3 report, along with a non-technical summary like this one, in late May 2022.

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