Section 19 Flood Investigation

Key findings

Flood location: Prowse Avenue and Abercorn Dell, Bushey Heath

Number of properties flooded: 2

Trigger flood event date: 23 June 2016

Previous flood event: 27 June 2009

Flooding mechanism: Surface water sewer surcharging and surface water runoff

Identified risk management authorities: Thames Water Utilities Ltd, Highway Authority, Lead Local Flood Authority

Investigating officer: James Lester

Date published: 03/09/2018

Summary: Steep catchment with surcharging and surface water runoff flooding going through houses at the bottom.

1. Introduction

1.1. Background

How the LLFA became aware of the flooding
Hertfordshire Fire and Rescue Service record of calls.
Property damage reported to Hertfordshire County Council as the Highway Authority.
Lead Local Flood Authority flood incident questionnaire survey.

Reasons for investigating
Due to the flood frequency of properties flooded, Hertfordshire County Council (HCC) as Lead Local Flood Authority (LLFA) have investigated the flood incident under Section 19 of the Flood and Water Management Act (FWMA) 2010 and published this report.

1.2. Location of investigation site

Site address: Prowse Avenue and Abercorn Dell, Bushey Heath
District: Three Rivers
Regional flood and coastal committee: Thames
Environment Agency Operational Area: West Thames
Sewerage company: Thames Water Utilities Ltd

Figure 1 Prowse Avenue and Abercorn Dell

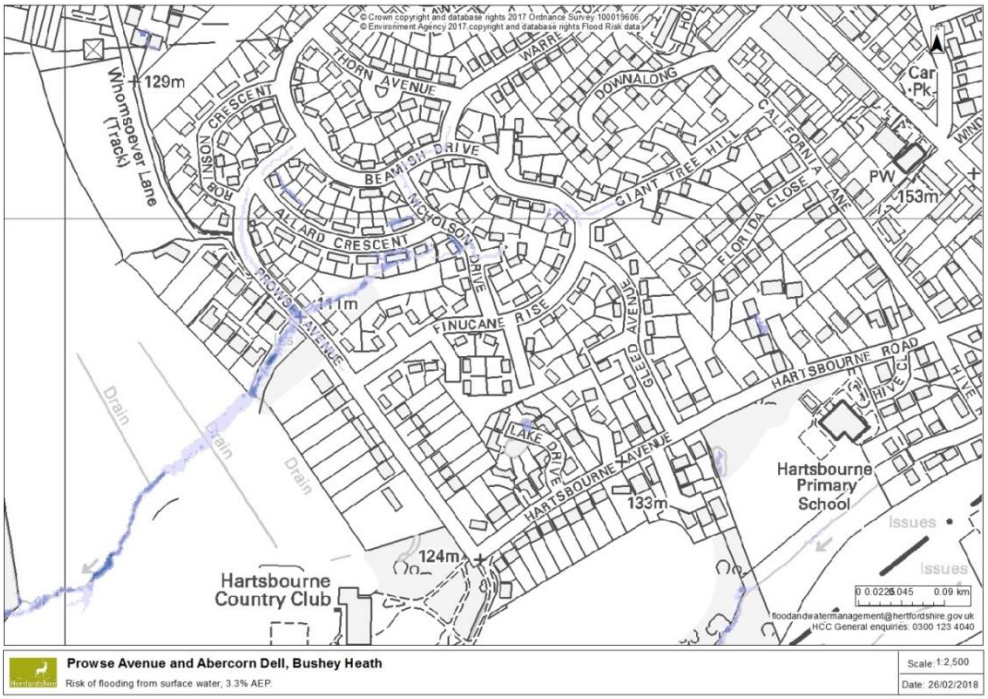
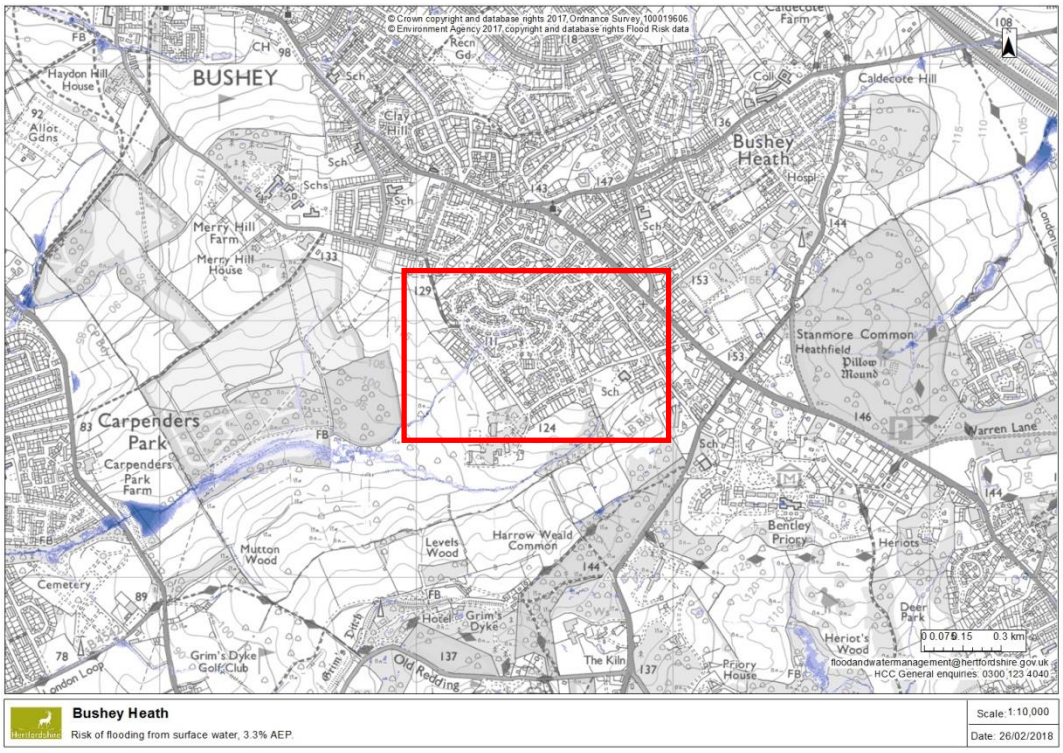


Figure 2 Bushey Heath



1.3. Anecdotal evidence

Fire and Rescue Service (FRS)
Two calls received by the FRS: 18:16 & 18:43, 23/06/2016. Both reported flooding inside. One reported sewerage coming into property. Attended by the Fire and Rescue Service.

Highway fault reporting service

- Leak reported near 39 and 41 Prowse Avenue (22/01/2009). Passed to Thames Water.
- Road flooded outside 39 Prowse Avenue, 23/01/2009.
- Mud and earth washed down the hill [Prowse Avenue] by heavy rain.
- Internal damage during flash flooding, 27/06/2009.
- Road flooded, logged 15/01/2016
- 23/06/2016 – Road flooded and 'Drains are over flowing, manhole cover has come off causing a flood.'

Thames Water Utilities Ltd (TWUL)

- 7 sewer flood incidents have been recorded for the postcode sector WD23 1. This is the highest level of precision at which TWUL will release their data.
- Some blockage jobs in the area over the last few years. Recent issue of roots in the lateral of a property that required a root cut.

Questionnaire survey
A questionnaire survey was sent out to all residents in Hertfordshire who may have been impacted by the 23 June 2016 flood event. This was conducted by HCC as the LLFA. The purpose of the questionnaire was to establish the extent of the flood event, the number of properties impacted and an indication of the mechanisms that caused flooding to property or critical infrastructure.

- Two properties on Prowse Avenue at the lowest point of the road confirmed internal flooding.
- One property on Abercorn Dell reported external flooding.
- Flood water described as coming from Prowse Avenue and the drains and coming from there to Abercorn Dell.
- Drain cover on Prowse Avenue came off.
- Flood event in June 2009 flooded garages, gardens, and a house on Prowse Avenue. Similarly to the 2016 event, flooding came from the road and the drains.

Site Visit

Figure 3 The gradient on Prowse Avenue

1.4. Description of local drainage

Public sewers

Prowse Avenue is served by surface water and foul water sewers which are the responsibility of Thames Water Utilities Ltd (TWUL). In this catchment, the sewer networks for foul water and surface water are separate. TWUL's networks must operate within the rules laid out as part of the Water Industry Act 1991.

These were not specifically surveyed as part of this investigation, however, according to Thames Water Utility Ltd's records, the area drains via a 525mm diameter surface water sewer onto the Hartsbourne Country Club. Into this 525mm sewer connects a 375mm surface water sewer from the west under Prowse Avenue, a 450mm surface water sewer from the north, and two 225mm surface water sewers from the east under Prowse Avenue.

Highway drainage

There are gullies on Prowse Avenue to help drain the road. The connectivity of these has not been confirmed but they will connect either to the public surface water sewer or soakaways. It is not the role of highway drainage to prevent flooding to property so a more detailed understanding of the highway drainage network has not been pursued. Prowse Avenue is on an 18 month gully clean cycle.

Abercorn Dell is a private road and is not maintainable by Hertfordshire County Council as the Highway Authority.

Any other drainage
No other issues identified.

Historic watercourses
Figure 4 shows that before the houses were built, there were two local watercourses with ponds as their sources which converged in the area of the flood site. This is relevant because it is evidence of how the lie of the land directs surface water. Now that the area is developed, water can be expected to still follow similar paths.

Figure 4 1898 map National Library of Scotland

1.5. Hazard map

Nationally recognised Flood Hazard Ratings have been developed by the Environment Agency for England as there is an acceptance that not all flood risks can be managed and there is a requirement to estimate the current risks from flooding to people, the economy and the environment.

A national flood hazard rating methodology was developed with four classes in order to better and more simply highlight risk. For the flood hazard map in relation to Prowse Avenue and Abercorn Dell, see Figure 5. The Hazard Map predicts that the degree of flood hazard which properties on Prowse Avenue are under is no more than a low - <0.75 on the flood hazard scale. However, the road in between 39 and 24 Prowse Avenue is predicted to be dangerous (either due to deep or fast flowing water) following a rainfall event with 3.3 % chance of happening in any one year.

Figure 5 Hazard map

The hazard rating is only as good as the data which it is based on and small differences in the topography data can have significant implications. The context of the flood hazard map should be considered when reading it.

2. Causes

2.1. Rainfall Analysis

There was heavy recorded rainfall on 23 June 2016. The rainfall was typical of a summer thunderstorm that swept through Hertfordshire. Figure 6 shows that the 23 June event was the third and most intense such storm that Bushey Heath had experienced to date that summer. The Figure 7 rainfall graph shows the intensity of rain every five minutes during 23 June 2016. A sharp peak of rainfall at an intensity of approximately 100 mm/hr was recorded at 18:15. Figure 8 is a rainfall radar map of the rainfall at the time of the flood event. It shows that the rainfall at Bushey Heath was estimated to be of an intensity of between 64 and 128 mm/hr.

The closest rain gauge to Bushey Heath is in Stanmore about three kilometres away. Thunderstorms' intensity varies greatly over short distances. Therefore, a rain gauge about three kilometres away is unlikely to reflect the thunderstorm which passed over Brain Close on the 23 June 2016 at 18:15. Instead, the rainfall data referred to in this section are predictions based on measurements of the moisture content of the air using radar. The calculation of the return period of the event as being 1 in 35 years is based on historical standards which climate change would make outdated. Whether or not return periods calculated using this method are representative of contemporary conditions, the fact that it is a consistent method allows for comparison between storms.

Figure 6 Rainfall totals from 1 January to 30 June 2016

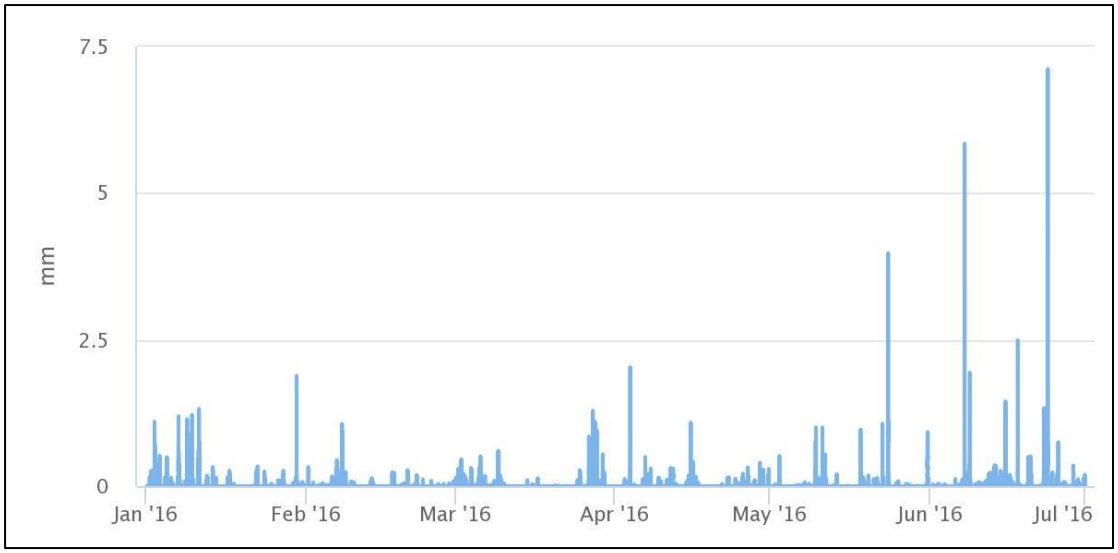


Figure 7 Rainfall intensity, 23 June 2016

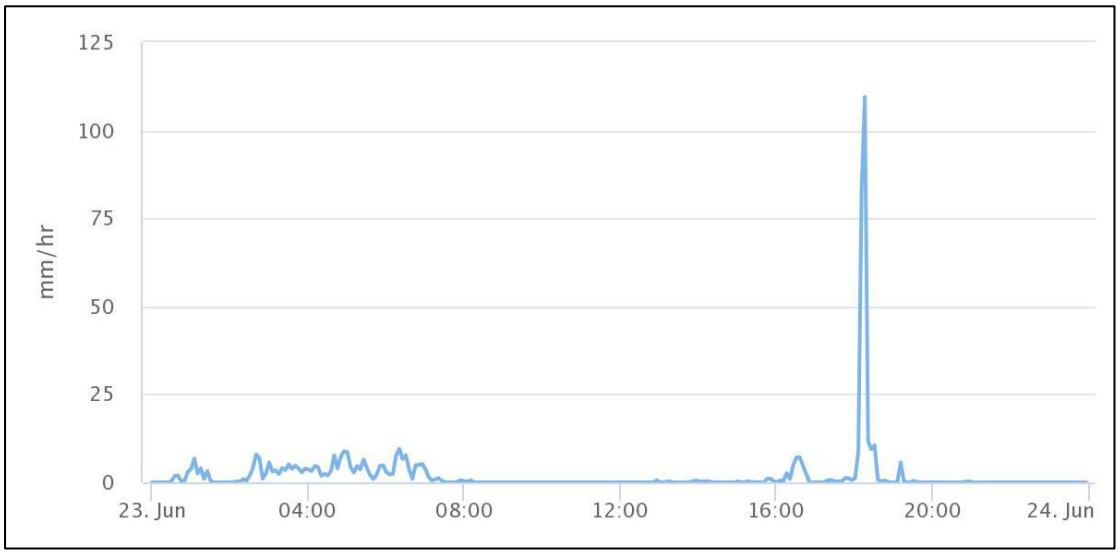
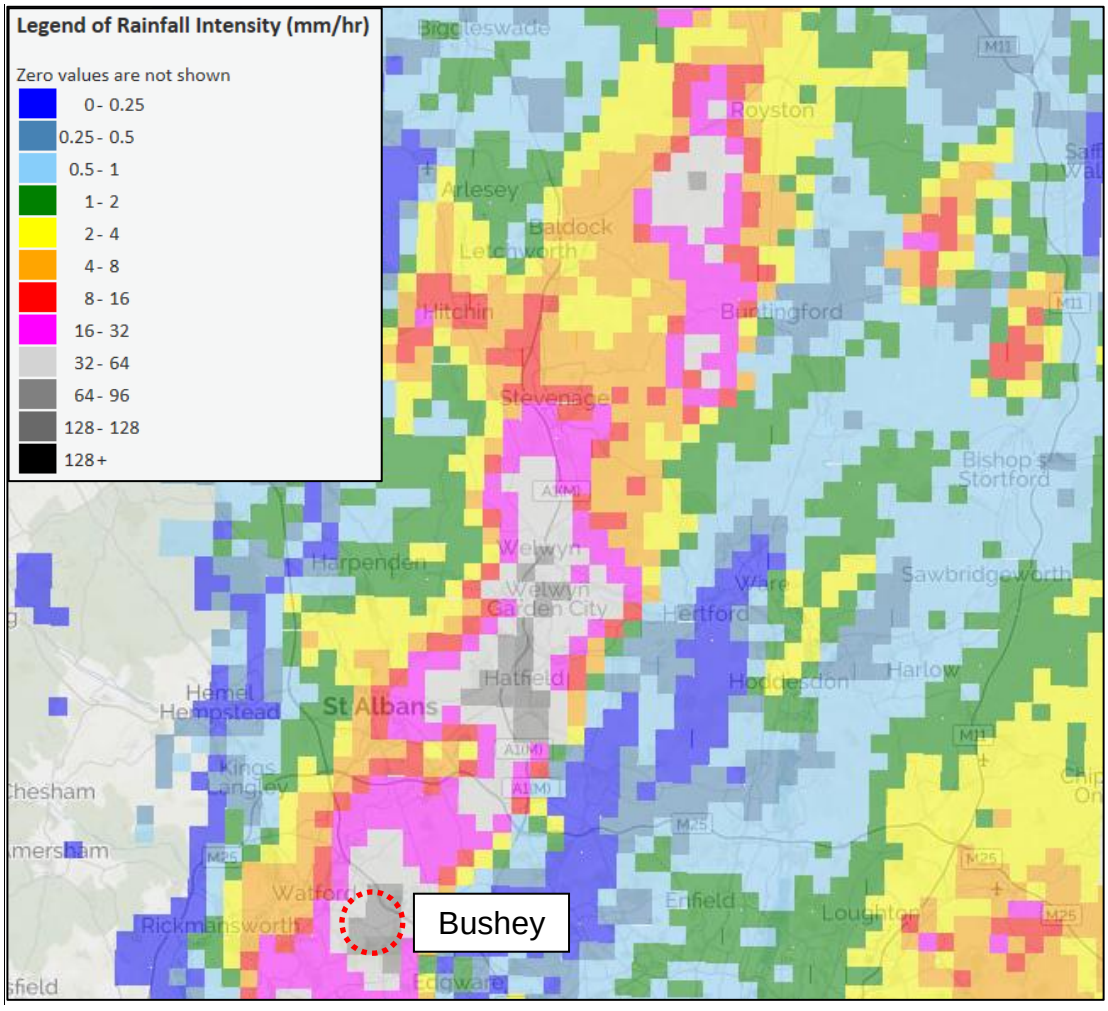


Figure 8 is a radar rainfall map of the intensity of rainfall across Hertfordshire at the time when rain was most intense in Hatfield. It estimates rainfall in Hatfield to have been of an intensity of between 96 and 128 mm/hr.

Figure 8 Rainfall radar map – Hertfordshire at 18:15, 23 June 2016



2.2. Assessment of local drainage systems

This assessment considers the condition and capacity of structures, such as any culverts, watercourses, highway drainage and access structures.

Public sewers
The anecdotal reports of a manhole/drain cover coming off and flooding coming from the drains suggests that the sewer was surcharging.

Most surface water sewer networks are not designed to manage extreme rainfall – rainfall with a return period of 1 in 20 years or above. Hence, surcharging of public surface water sewers during extreme rainfall events does not necessarily mean that there is an operational problem with the sewer, e.g. a blockage.

Highway drainage
Hertfordshire County Council in its capacity as the Highway Authority is responsible for draining the rainfall which falls on the highway. Highway gullies are designed to capture and drain moderate rainfall from the highway. Overland flow which enters the highway from adjacent land adds to the volumes of water that the gully network is required to drain away. Highway drainage would not be expected to cope with the rainfall event on 23 June 2016 because of its very high intensity. Even where gullies are placed to receive large volumes of water, the volume that they can discharge is limited by the outlet pipe sizes and the available capacity in the downstream network.

Any other drainage
No other drainage

Open watercourse conditions
Not applicable

Historic watercourses
The public surface water sewers are along the line of the historic watercourses so it is assumed that the surface water sewers carry the flow which historically would have been discharged by the historic watercourses.

2.3. Overland flow

Extent of impermeable area
Bushey Heath is a suburban area with a mix of permeable and impermeable surfaces. Water can not soak through impermeable surfaces so all the rain which falls on these areas will runoff.

Slope
The flooded area is a topographical low point so surface water from the surrounding areas will flow towards the incident area.

Kerbs
Dropped kerbs provide a pathway for water to exit the road.

Road higher than receptor
Yes, the road is higher than the houses so any water coming off of the road will run towards the houses.

Threshold
The threshold of a property is the height at which water could enter. The properties which flooded internally have low thresholds.

3. Roles and Functions

3.1 Authorities' Responsibilities

Part of the role of Hertfordshire County as the Lead Local Flood Authority is to identify the risk management authorities (RMAs) that have relevant flood risk management functions. Those RMAs and their relevant powers and functions are set out below.

Hertfordshire County Council as the Lead Local Flood Authority
The receptor was flooded by surface water runoff (as well as water which had surcharged from the surface water sewer). HCC as LLFA has permissive powers to manage flood risk from surface runoff and groundwater (all under s14A of LDA 1991).

Hertfordshire County Council as the Highway Authority
The highway was flooded. The Highway Authority maintains the parts of the road network which are highway maintainable at public expense which includes provision of drainage and also has permissive powers under the Highways Act 1980 to manage flooding of the highway.

Environment Agency
The Environment Agency has powers and a regulatory role around main rivers and also provides flood warnings in certain areas.

District Council
As well as powers of designation, Hertsmere Borough Council is the RMA holding the powers to manage flood risk from ordinary watercourses under s14A of the Land Drainage Act 1991. Hertsmere Borough Council also has permissive powers to manage flood risk from ordinary watercourses. They lead local resilience forums when a major incident is declared, and have a flood risk management function via their role as the Local Planning Authority including the publishing of strategic flood risk assessments. Flooding as a nuisance can come under the remit of the Districts' environmental health teams.

Water company
TWUL manages the public surface water and foul water sewer networks in this area of Hertfordshire. TWUL manages flooding from their network in line with their business plan approved by OfWAT.

TWUL, like all water and sewerage companies, are required to keep a register of all instances of internal and external flooding of properties, this is referred to as the flood risk register. This register is used as the evidence to justify improvements to the surface water network.

Only TWUL has the authority to alter the surface water sewer and to manage the flood risk associated with it.

Internal Drainage Board
There is not an internal drainage board in this area.

Riparian Landowner(s)
Riparian landowners have a responsibility not to do or allow anything to unduly affect the flow of water in a watercourse which runs through their land. However, there are no watercourses in the area.

Property owners
The owners have the final responsibility for their property.

3.2. Functions exercised or proposed to be exercised

Hertfordshire County Council as the Lead Local Flood Authority
- Have carried out an investigation using their powers under Section 19 of the FWMA 2010 and written and published this report.
- It has been decided that this area of flood risk will be taken forward as a non-modelled hotspot in the Hertsmere surface water management plan.

Hertsmere Borough Council
Beanie blocks installed in place of the usual kerbs at the side of the road by Hertsmere Borough Council.

Thames Water Utilities Ltd
TW undertook a study by in 2012 to investigate the interaction between the surface water and foul sewer network.

4. Recommendations

Hertfordshire County Council as the Lead Local Flood Authority:
It would be difficult to implement any flood prevention measures due to the fence line and the location of property at risk. The recommended action is to undertake PLR work at this location.

Hertfordshire County Council as the Highway Authority:
Maintenance on the drainage curb that has been implemented is a potential option here.

Environment Agency:

District Council:

Water company:
Investigate surface water sewer to find out whether there is a capacity issue.

Internal Drainage Board:

Riparian Landowner(s):

Property owners
Increasing the flood resistance of individual at risk properties should be considered as an option. Property Level Resistance (PLR) measures are appropriate where flooding is not expected to last for a prolonged period of time, water is not moving fast, and where it is generally not deeper than 600 mm. It should be noted that measures may not completely stop the entry of flood water and may only serve to delay the time of entry.