



**Flood Investigation Report for the flooding on
Cheltenham Road on 27th November 2018**

April 2019

FLOOD INVESTIGATION

1. Introduction/background

1.1 Responsibility of the lead local authority

In agreement with the West of England Partnership, the Lead Local Flood Authority (LLFA) must conduct a full flood risk investigation in an urban area if flooding affects five or more properties. This is applicable to the entire Bristol City Council (BCC) area.

The Flood and Water Management Act 2010 (FWMA) also outlines BCC's responsibility to conduct flood investigations, as the LLFA for Bristol:

S.19 Local authorities: investigations

- (1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate—*
- (a) which risk management authorities have relevant flood risk management functions, and*
 - (b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.*
- (2) Where an authority carries out an investigation under subsection (1) it must—*
- (a) publish the results of its investigation, and*
 - (b) notify any relevant risk management authorities.*

The threshold set by BCC for conducting formal investigations into flooding is when 5 or more properties flood internally. Therefore, since more than 5 properties were reported to have flooded internally, BCC must complete an investigation into the flooding at Cheltenham Road.

This report is based on knowledge from the flood event obtained from site visits during and after the event, conversations with residents and business owners, desk study and investigation.

2. Site Information

2.1 Location and Topography

Cheltenham Road is located north of central Bristol (between Redland and Montpelier), as shown on Figure (1). Its grid reference is Easting: 358,873; Northing: 174,685.

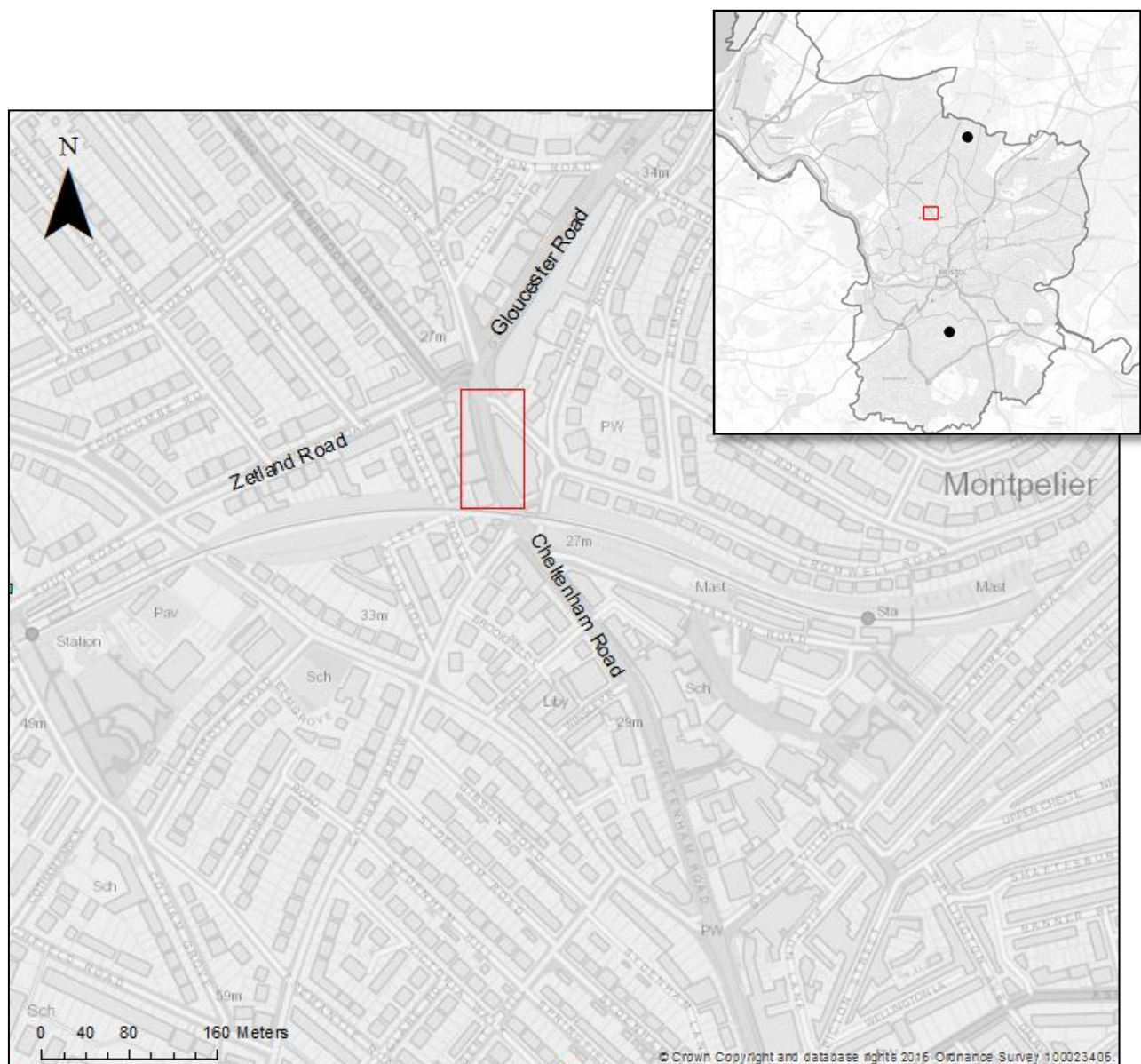


Figure 1: Cheltenham Road Location – the investigation site location is marked by the red square.

The flood occurred on the northern end of Cheltenham Road where it meets Gloucester Road at the Zetland Road Junction. The area that flooded lies within flood zones 2 and 3 and is relatively low lying; several roads converge downhill into it (Cotham Brow, Station Road, Zetland Road, Gloucester Road). During heavy rainfall, these areas also have fast moving overland flow routes as shown by figure 2. Both these factors mean that this section of Cheltenham Road is susceptible to surface water flooding during heavy rainfall.

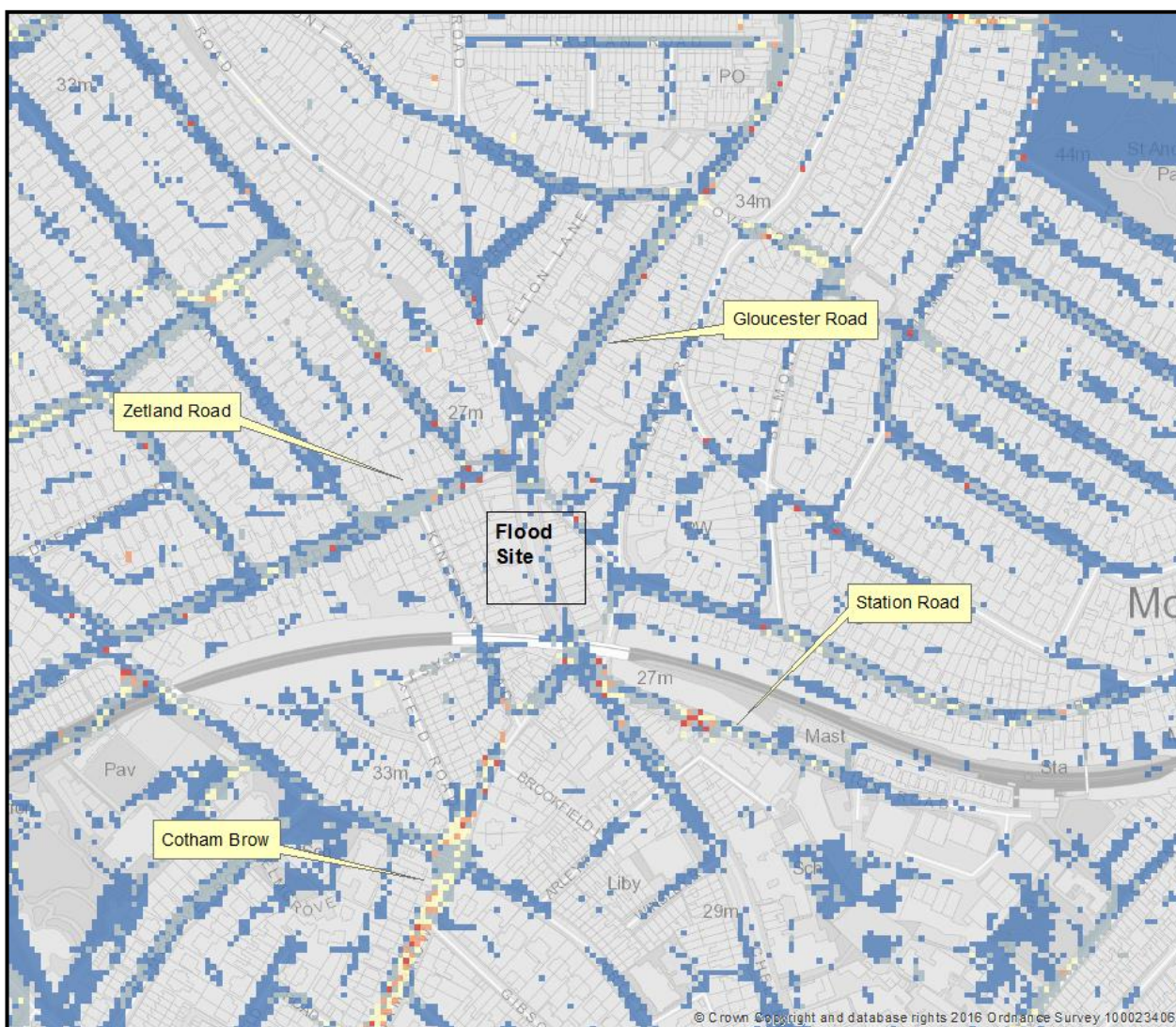


Figure 2: Surface water velocity results extract from the Bristol Surface Water Management Plan. Figure demonstrates the overland flow routes of surface water with the red and yellow representing the areas where the water is moving at highest velocity. The labelled roads slope downhill onto the site and the figure indicates that there is very little water movement on the flood site as it is mostly clear from any colour, this shows that water is collecting here.

2.2 Drainage Characteristics

Figure 3 shows the site's drainage system. The immediate catchment is heavily urbanised and therefore predominantly served by positive drainage systems (highway gullies/drains as well as run-off from properties connecting in to public surface water sewers). The area has a significant amount of drainage infrastructure because it has historically been an area known to have drainage issues. A number of the sewers connect directly into the Northern Storm Water Interceptor, which is 4800mm in diameter, or into the combined sewers.

The Cranbrook is culverted (1200mm diameter) within the vicinity of the investigation area, this culvert also connects into the Northern Storm Water Interceptor downstream of the site.

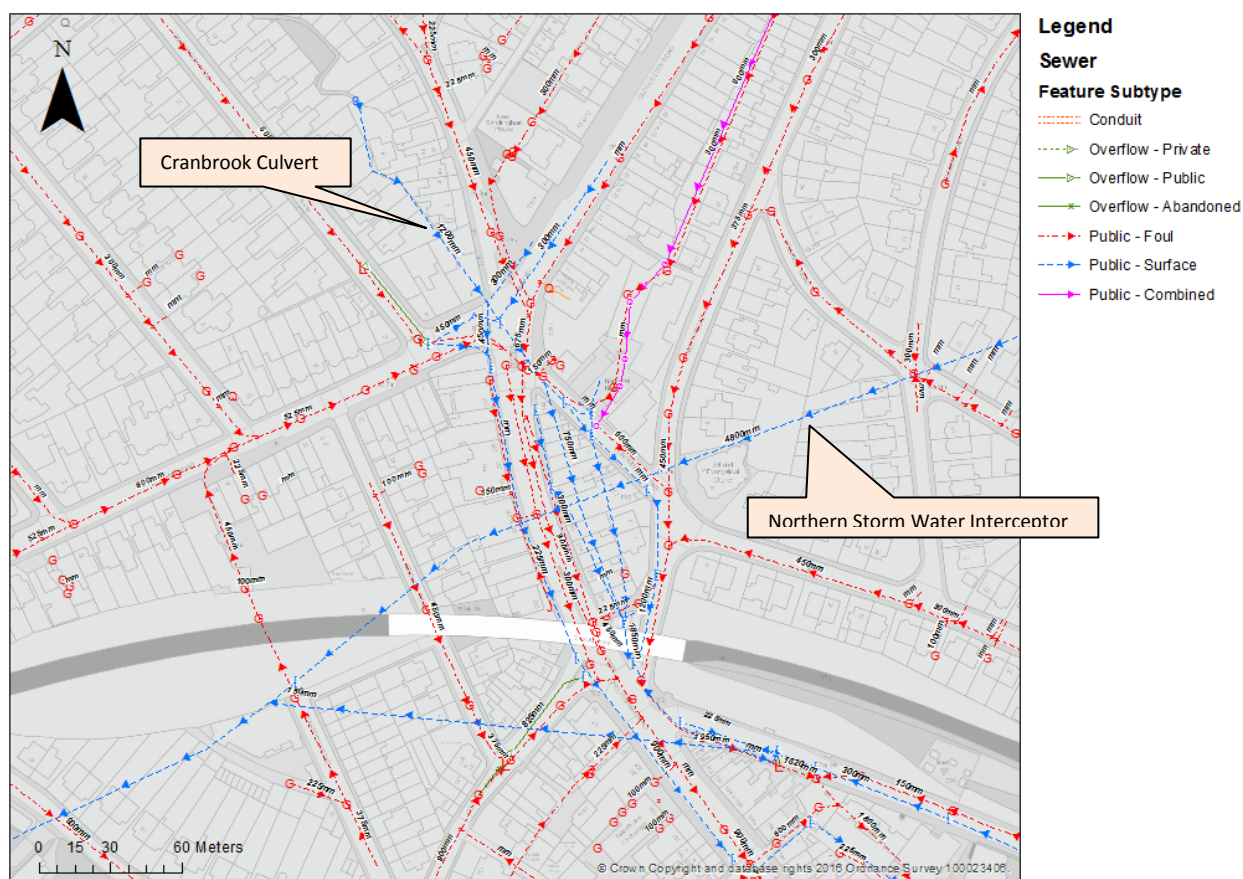


Figure 3: Public sewers and highway drainage for Cheltenham Road

3. Investigation Findings

3.1 Flood Event

On 27th November 2018, during a wet and stormy day, Bristol suffered heavy rainfall across the city. Despite no weather warnings being issued, about 10mm of rain fell from 8:30 – 15:15, according to BCC's rain gauge on Filton Golf Course, which is approximately 5km from the site. Almost half of this fell between 14:30 and 14:45, as shown by figure 4 below. Our calculations show that the amount of rain that fell has a return period of 0.5 years. Given the time of year and the weather on the day (stormy and windy), a significant amount of debris was on the ground, which will have exacerbated the problem.

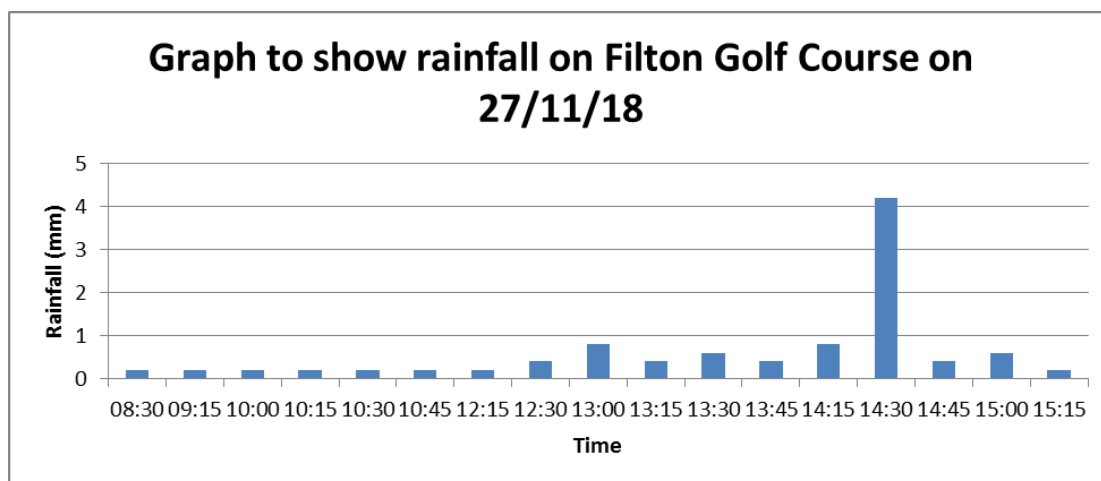
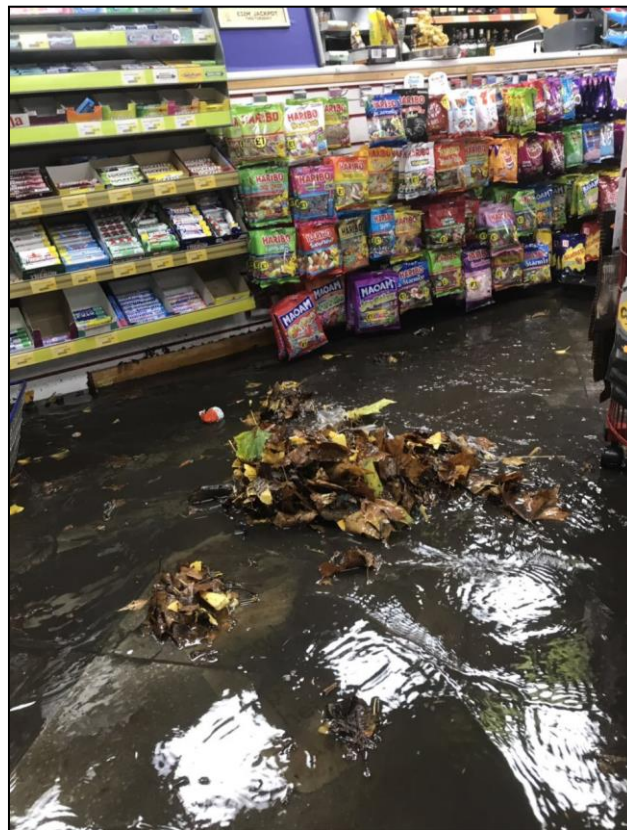


Figure 4: Graph showing the rainfall on 27/11/2018, taken from the tipping-bucket rain gauge at Filton Golf Course

As a result of the rainfall, BCC Flood Risk and Data management team were notified at 15:15 that Cheltenham Road had flooded. A highways maintenance contractor was issued an instruction to attend the site and check/clear the gullies. Observations of the site indicated that flood water started to drain down slowly. The contractor attended site at approximately 15:50 and cleared gullies of debris, which allowed the water to start to drain away at a faster rate and the road was soon clear of flood water. Some occupants took action to clear gullies themselves to prevent more severe flooding and others attempted to block water from entering their properties by sealing their doors. Despite their best efforts, several properties were flooded internally.

3.2 Flood Extent

The entirety of the road was flooded with reports that it was 300mm in depth in some places, this disrupted traffic as cars and buses had to slow down to travel through. Approximately 10 commercial properties were flooded internally as a result of this event. The internal flooding varied in severity with some residents suffering more damage than others. Some occupants reported that their stock was damaged as a result of the flooding, and others were forced to close their shop for several hours in order to clear away the water and leaves, causing them to lose business as a result to the flood. An additional three properties were flooded in their doorways and other occupants reported that had they not taken action to clear the gullies themselves, they would have also suffered from flooding.



Plates 1 and 2 showing some of the flooding inside and outside properties on Cheltenham Road

3.3 Previous events

As a low lying site, this area is known to have a history of flooding, and BCC records state that some properties in this area have flooded before, particularly in May 1981, August 1984 and May 1936. The majority of the records are unclear as to the nature of these events but anecdotally we are aware there have been sewer capacity issues in the past, which has led to a number of drainage schemes in the area, hence the amount of drainage infrastructure shown in figure 3.

Residents also report that Cheltenham Road floods regularly, approximately two or three times a year but has not lead to internal flooding, this is believed to be the result of debris blockages.

3.4 Possible Causes

From our investigation we have found that there are two possible causes for this flood - surface water or blocked/blinded gullies. We have ruled out tidal flooding because this site isn't in a tidal flood zone. We have also ruled out fluvial flooding because we have had no reports of the Cranbrook overflowing and the amount of rainfall was not significant enough to cause fluvial flooding, especially as the Cranbrook connects into the Northern Storm Water Interceptor. Our modelling shows that it would take a 1 in 100 annual chance event for fluvial flooding to be likely here.

1. Surface water

Heavy rainfall led to increased surface water. This was exacerbated by the fact that the site is low lying with several roads sloping downhill onto it, causing a lot of surface water to collect here. As shown by figure 2 above. The drainage infrastructure may have had a lack of capacity as a result of increased surface water in the area. However, whilst the rainfall was heavy it was not deemed sufficient to result in sewer capacity exceedance. As explained in section 3.1, the return period of the rainfall was low and has been experienced many times in recent years. If sewer capacity was the cause, we would expect to have received significantly more reports of flooding than has been received.

Therefore sewer capacity has been discounted as the cause of the flooding.

2. Blocked and blinded gullies

During our investigation, occupants cited blocked (silt or debris within the gully pot itself) and blinded (debris lying on top of the gully grid) gullies as the main cause for the flooding. Given the time of year and the fact it was a windy day, officers can confirm there was a lot of vegetation and debris being deposited on gullies and drainage infrastructure throughout the city include the site's catchment. This means that across the catchment highway gullies were unable to convey water into the sewer network, resulting in it flowing down to the investigation area. Such flows were likely to have overwhelmed gullies in the flooded area, which themselves were likely to be blocked or blinded with debris. Evidence to support this is the fact that when it stopped raining it was observed that water started to drain slowly away. In addition, water drained away quickly following attendance of highways maintenance contractors on site, providing evidence to suggest blocked or blinded gullies was the primary cause of flooding. In addition, the fact that water drained quickly once blinded gullies were cleared also indicates that the flooding was unlikely to have been caused by blocked sewers.

When carrying out post-event investigation, officers observed that some of the gullies along Cheltenham Road were blocked with silt, as shown by plats 3 and 4, this is likely because our team only cleared the ones that were reported or due to them becoming blocked again.



Plate 3: A blocked or blinded gully within the flood investigation area on Cheltenham Road, taken on the 30th November 2018.



Plate 4: A blocked gully within the flood investigation area on Cheltenham Road, taken on the 30th November 2018.

4. Responsible Party

As part of the flood investigation, BCC must identify who the relevant risk management authority (RMA) is in order to ascertain whether such RMA discharged their duties under the Flood and Water Management Act (2010) or not.

The Environment Agency is responsible for managing the flood risk from main rivers and the sea. They are not considered to have any function to carry out in response to this event because, as per section 3.4, we discounted tidal and fluvial flooding from being a cause of the flooding on Cheltenham Road.

Wessex Water is the sewerage undertaker within Bristol, responsible for providing public surface water sewers, which receive drainage from buildings and other hardstanding areas. As per section 3.4, it was not a sewer capacity or blockage issue, therefore Wessex is not responsible here.

Bristol City Council is the Lead Local Flood Authority, which means it has a duty to investigate flooding incidents to the extent that it considers necessary. It also has the responsibility for managing local flood risk, including the risk from ordinary watercourses, surface water and groundwater. BCC is also the Highway Authority which means it has a duty to discharge surface water from the highway.

The LLFA duty to investigate flooding incidents has been carried out through the production of this report.

In line with section 3.4, the predominant cause of flooding was blocked or blinded gullies, which is the responsibility of the Highway Authority. According to our systems the majority of the gullies were cleared in November 2017 which is considered to be an appropriate amount of time between cleanses. It should be noted that managing leaves is difficult because on a wet and windy day there is a constant supply of vegetation, meaning that it is unreasonable to expect the Highway Authority to keep the highway network across the city completely clear of debris. In addition, as soon as the Highway Authority became aware of the flooding problem they instructed maintenance crews to clear the debris. As a result it is deemed the Highways Authority has discharged their duty under the FWMA. However, despite reasonable efforts, a number of gullies were observed to be blocked as shown by figures 6 and 7, demonstrating that the frequency at which the gullies block may be more than once a year.

5. Recommendations and conclusions

The flooding on Cheltenham Road occurred as a result of heavy rainfall in the area combined with a series of blocked/blinded gullies on Cheltenham Road and the surrounding roads, causing the surface water to continue flowing downhill and collect on the site. Therefore, it is recommended that BCC reviews its frequency of checking and clearing the gullies along Cheltenham Road. BCC could also work with Bristol Waste to review the frequency with which they clear debris off the road. They currently clear Cheltenham Road using a mechanical sweeper once every two weeks, as well as doing daily litter picks. If they were to increase the frequency of this during the autumn, when leaf fall is at its highest, then this would help prevent gullies becoming blocked/blinded. It is noted that BCC is moving towards a risk and data based gully cleansing programme, as such they are putting reasonable measures in place to reduce the risk of future

occurrences across the city. The Highway Authority will regularly and formally report the progress of this data and risk based approach to the LLFA to ensure the risk of future similar flood events is reduced. It is also recommended that BCC consider a highway drainage scheme to reduce the risk of future blockages.

As a result of sections 4 and 5 it is deemed that the relevant risk management authorities, the LLFA and Highway Authority, have discharged their duties under the FWMA.

Appendix A – Site visit notes

Date: 30 th Nov 2018	Weather Conditions: Mostly dry, some light rain
Attendees: Nina Dawe Abigail Hall	Location: Top of Cheltenham Road between Zetland Road Junction and North Road
Event/Source of flooding: Heavy rainfall which all collected in this low lying part of the road. Several blocked gullies in the surrounding area preventing the surface water from draining away.	
Flood extent: The road, which has a fairly steep camber, was completely flooded with reports it was 300mm deep. Several commercial properties were flooded internally and several others had flooding in their doorways.	
Properties effected (amount/type): All commercial properties: shops, restaurants, barber, tattoo shop. About 10 flooded internally 3 flooded in the doorway	Type of flooding: Surface water flooding
Drainage Characteristics: The area is served by several surface water sewers which drain into the Northern Storm Water Interceptor. Some also drain into foul sewers. As shown by figure 2.	
Previous Events: Reports from residents that the road floods 2 or 3 times a year but doesn't usually flood properties.	