Kent County Council

Flood Investigation Report

Location of Investigation: West Kingsdown

Date of incident: 10 June 2019

This document has been prepared by Kent County Council Flood and Water Management Team as the Lead Local Flood Authority under Section 19 of the Flood and Water Management Act 2010, with the assistance of:

- Kent County Council
- Tonbridge and Malling Borough Council
- Kent Fire and Rescue Service

The findings in this report are based on the information available to KCC at the time of preparing the report. KCC expressly disclaim responsibility for any error in or omission from this report. KCC does not accept any liability for the use of this report or its contents by any third party.

This report can be found here where more information can be found about the requirements and trigger for a Section 19 investigation and the roles and responsibilities of Risk Management Authorities.

For further information or to provide comments, please contact us at flood@kent.gov.uk

Summary of event

On the 10th June 2019 heavy rainfall was experienced across the country. 31 flood warnings and 1 flood alert were issued by the Environment Agency across England, with some areas of Kent recording in excess of 100mm of rain in a 24-hour period. The average rainfall for June in Kent is 53 mm[1].

Very heavy rainfall occurred county wide, with areas such as West Kingsdown, Vigo, Snodland and Swanley particularly badly affected.

This report will focus on the West Kingsdown area where around a dozen properties are known to have been flooded by surface water, many of those were affected internally. The locations of the reported flood incidents are shown in Figure 1 and Table 1 provides a summary of the investigated flooding issues, known flood extent and previous reports of flooding.

Since the time of writing this report we are aware that flood events have occurred on the 20 December 2019, affecting Ash Tree Close off the A20 and on the 16 February 2020 affecting the A20. These incidents occurred following heavy rains across the county of up to 30mm in depth on already saturated ground.

KCC Highways have deployed sandbags between the A20 and Ash Tree Close to manage the risk of flooding to properties.

[1] Source: https://www.southernwater.co.uk/water-for-life/regional-rainfall

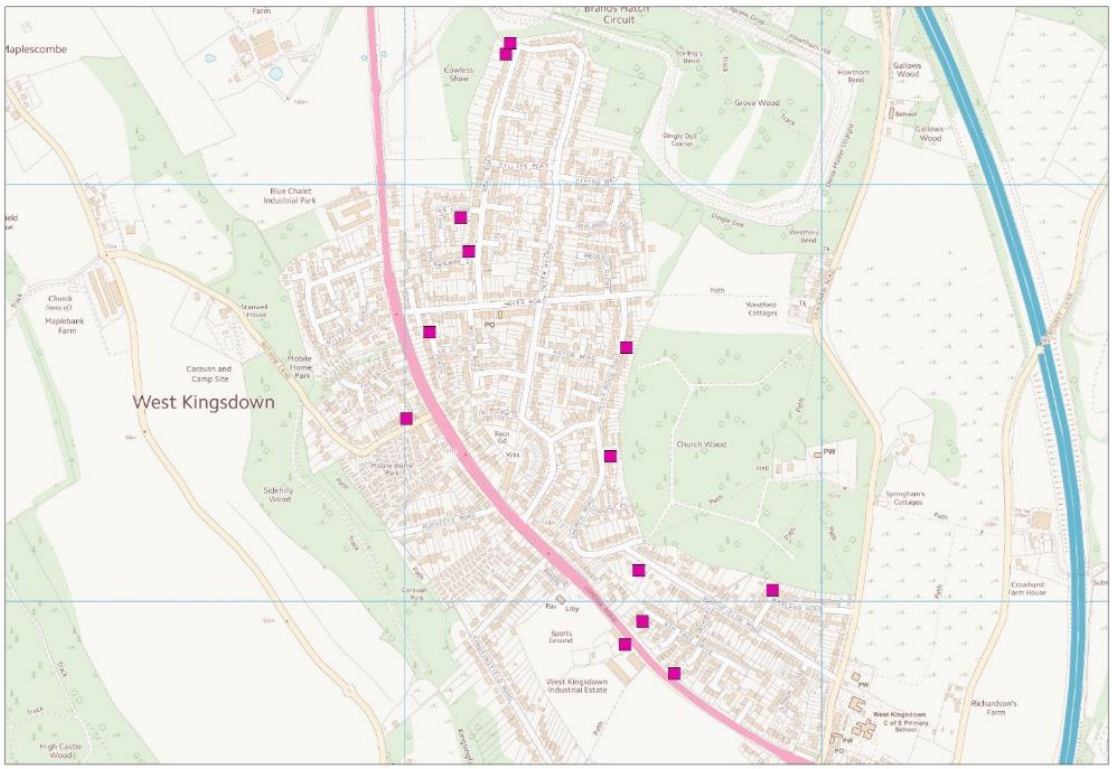

Figure 1 Location of Reported Flood Incidents in West Kingsdown on 10th June 2019

Location	Details of flooding	Source of Information	Previous Flooding Reports[2]
A20 London Road	1 property flooded. Commercial property also internally flooded. Flooding reported to be caused by overland flow from adjacent farmland, causing significant amounts of muddy water to affect the A20 and then flow towards Ash Tree Close.	KCC HTW	17/01/2014, 08/10/2014, 31/05/2016
Ash Tree Close and Ash Tree Drive	5 properties internally flooding. Part of a conservatory wall collapsed. Flood water came from the fields south of the A20 London Road, crossing into Ash Tree Close before flowing further north towards Southfields Road.	KCC HTW	17/01/2014, 13/10/2014
Southfields Road	1 property confirmed to have flooding near the lowest point of the road. Overland flows from the fields south of London Road contributed to the flooding.	KCC HTW	17/01/2014
Neal Road	2 properties affected internally with one resident evacuated by KFRS. Flooding reported to be waist high. 1 property in different location of road suffered external flooding.	KCC HTW KFRS	None
Heaver Wood Road	1 property reported flooding near the lowest point in the road.	KFRS	None
Church Road	External flooding	KCC HTW	None
Phelps Close	Internal flooding to kitchen in 1 property	KFRS	None
Botsom Lane	1 property reported to have been affected by flooding in the dip of the road. Residents reported 'water pouring off the adjacent business park' onto Botsom Lane.	KCC HTW	08/10/2014, 09/08/2017
Primmett Close	1 property confirmed to have flooded near the lowest point in the cul-de-sac.	KFRS	None
Warland Road	1 property confirmed internal flooding near the lowest point of the road.	KFRS KCC HTW	None

Table 1. Summary of investigated flooding, known flood extent and previous flooding reports

[2] Previous reports of flooding are based on data from January 2014 until June 2019 and do not include enquires in maintenance requests such as blocked drains or damaged manhole covers.

Site Location, Topography and Flood Risk

The village of West Kingsdown lies alongside the A20 in the District of Sevenoaks along an area of high ground between Knatts Valley and Fawkham Road. Ground levels along the A20 range from 150 mAOD (above Ordnance Datum) at the northern end of the village to 170 mAOD at the southern eastern end.

Two dry valley features run in a northerly direction through the built-up extent of the village. To the west the dry valley feature begins between Rushetts Road and The Briers, crossing the A20 and travelling along Neal Road. To the east the dry valley features starts in the deciduous woodland, grazed pasture and arable fields around School Lane, overland flow from this area collects in the field corner adjacent to the West Kingsdown Industrial Estate before crossing the A20 and flowing through Ash Tree Close, Southfields Road and Hever Wood Road. Both these valley features cross the Brands Hatch Circuit and converge as they pass under the M20.

Many of the locations affected by surface water flooding lie within these dry valley features and/or at low points in the local topography, runoff will naturally flow to the low points and be channelled along them in extreme weather conditions.

The national surface water flooding provided by the Environment Agency on the gov.uk long term flood risk information map[3] indicates these areas to be at a medium to high risk of surface water flooding. Medium and high risk means that these areas have a chance of flooding of greater than 1% and 3.3% in any one year respectively.

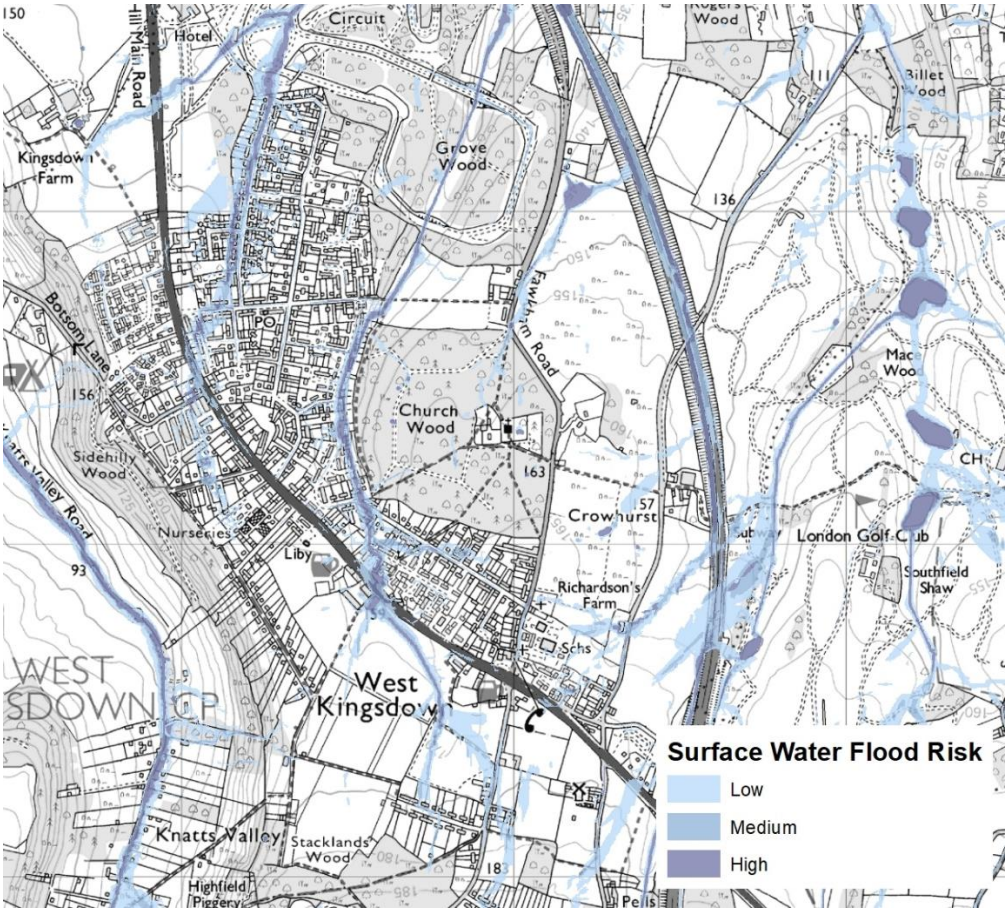

Figure 2 Environment Agency surface water flood map

[3] The flood warning information service long term flood risk maps are publicly accessible by visiting https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

Drainage System Details

Highway run-off is generally discharged via soakaways into the ground throughout this area. It is likely that most private drainage, for residential and commercial premises, also disposes of surface water from their roof and hardstanding via soakaways.

Soakaways rely on the natural permeability of the underlying rock for the water to soak into. They are usually made by digging large manholes that are lined with perforated concrete rings or open jointed brickwork. The manhole provides storage for water as it seeps through the perforations in the chamber into the surrounding Chalk bedrock over a period of 24 to 48 hours, ready to accept a subsequent storm. Prolonged very heavy rainfall or multiple heavy rainfall events within a short period can overwhelm the storage available in these soakaways and result in surface water flooding occurring.

The volume of water stored in a soakaway for highway drainage purposes is likely to have been based on the volume of run-off from a storm with a 20% probability of occurring in any one year (a '1 in 5 year' event). This was a standard approach for the time of their construction. Individual soakaways serve relatively small areas of between two and six road gullies. This forms a series of discrete drainage networks through the village.

Rainfall Details

Rain Gauge	Eynsford TBR
Rainfall	96.16 mm
Time period	21.5 hours (02:00 to 23:30)
Annual Exceedance Probability	1%
	1 in 99.6-year return period

Rainfall around the county is recorded by a series of rain gauges operated by the Environment Agency. These report the rainfall depth recorded over a 15-minute interval or a day. The data can be used with the Flood Estimation Handbook (FEH)[4] web service Event Rarity Calculator to assess the Annual Exceedance Probability (AEP) of the depth of rainfall that occurred. For instance, a rainfall event with an AEP of 1% means that rainfall of this depth or greater would only be expected on average once in 100 years, or 10 times in 1,000 years.

Figure 3 shows the location of the rain gauges and Table 2 summarises the rainfall recorded at the Environment Agency rainfall gauge stations closest to the path of the storm on 10 June 2019.

[4] The Flood Estimation Handbook (FEH), with its subsequent updates and FEH Software, provides the industry-standard methods for assessing flood risk in the UK. It offers guidance on the estimation of rainfall and river flood frequency and development site runoff rates across the UK.

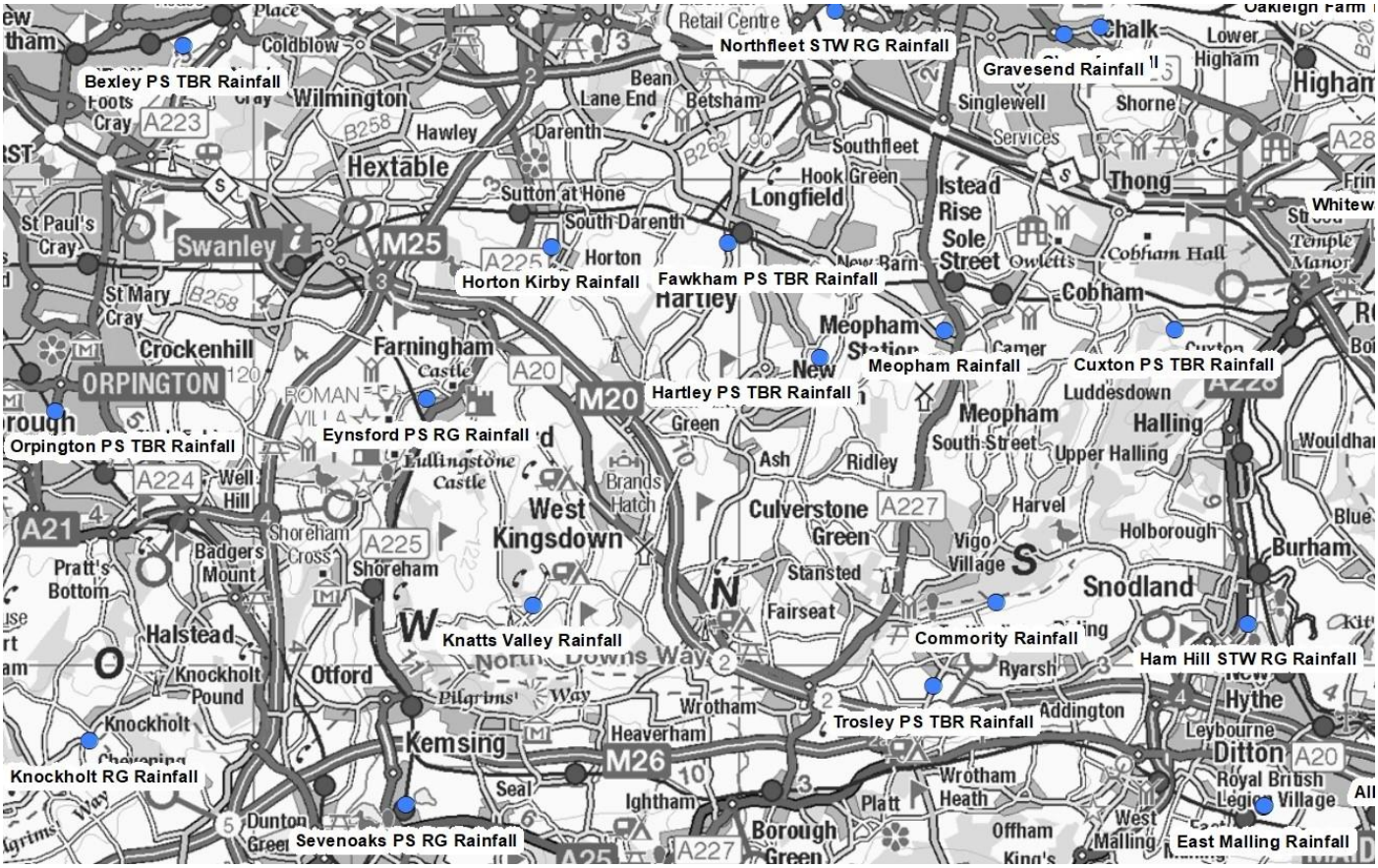

Figure 3 Location of rain gauge stations closest to the path of the storm.

Table 2. Rainfall levels recorded at Environment Agency Rain Gauge station on 10 June 2019.

Rain Gauge	Rainfall	Time Period
Bexley	22.62mm	Daily total
Hartley	70.96mm	01:30 – 22:30
Orpington	94.80mm	01:45 – 23:45
Commority	122.5mm	Daily total
Fawkham	48.60mm	02:00 – 22:45
Sevenoaks	43.86mm	01:45 – 21:15
Eynsford	96.16mm	02:00 – 23:15
Snodland	103.58mm	01:45 – 21:30
Trosley	75.40mm	01:15 – 22:00

The storm tracked broadly from the east to the west across the north downs, this is shown by the high levels of rainfall measured at Ham Hill, Commority, Eynsford and Orpington. Rain gauges to the north and south of this path, Hartely and Trosley respectively, show lower, but still relatively high levels of rainfall. The rain gauges at Fawkham and Sevenoaks which lie further to the north and south respectively show further lower rainfall levels.

The nearest rain gauge to West Kingsdown is located at Eynsford. It recorded 96.16mm of rain on 10th June 2019 from 02:00 until 23:30. Given the consistency of this gauge with the others in the path of the storm this rainfall is considered to be representative of the rainfall experienced at West Kingdown.

Whilst it rained continuously throughout the day, the heaviest rainfall was experienced at after 21:15 when 45.19 mm of rainfall then fell in 1.75 hours.

Flood description

The earliest report of flooding was received at 20:41 at Neal Road after approximately 50mm of rainfall had fallen. The road was flooded at this time to a depth of 10 inches but was not affecting property internally. An out of hours officer attended and closed the road within one hour. There were no other reports of flooding received by KCC at this time.

More widespread flooding occurred after 21:00 following an additional 45mm of rain. Significant overland flows from both greenfield and built areas were reported, particularly along the A20 London Road where muddy run-off flooded the road and continued to flow through Ash Tree Close and towards Southfields Road as shown in Figure 4. This caused extensive damage where the run-off travelled through properties.

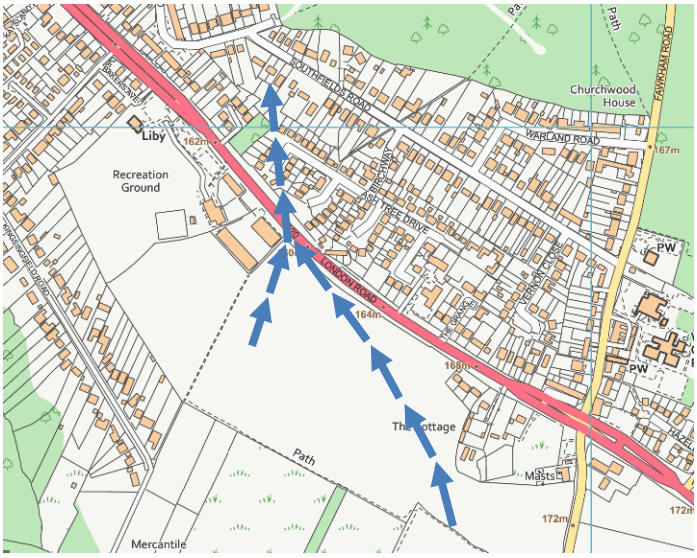

Figure 2 Overland greenfield run-off flows towards A20 London Road and Ash Tree Close

Drainage systems at low points were then overwhelmed by the additional run-off volume as water was trapped with nowhere else to go. Neal Road suffered very deep surface water flooding as water trapped in the topographical low point by the noise bund at the edge of the Brands Hatch Circuit. Tankers were deployed to assist with controlling the flood water as it had nowhere to disperse.

Reports have been received of foul sewers overflowing during the flooding event, but we are unable to confirm whether this occurred to a significant extent. As noted previously, it is not expected that significant flooding would occur from overflowing sewers unless there are any significant misconnections to the public sewers or water inflow through manholes in flooded areas. Residents lifting manholes in properties to control flooding can lead to foul sewer flooding downstream. There is insufficient evidence to determine to what degree flooding can be attributed to exceedance of public foul sewers.

Flooding mechanism

The flooding on 10th June 2019 was caused by the high volume of rainfall that overwhelmed the natural capacity of the ground to absorb rainfall and overloaded surface water drainage infrastructure.

The high volume of prolonged rainfall though out the day will have saturated the soils and filled the capacity of the drainage networks in the village. When the intensity of the rainfall increased in the evening the runoff increased and flow paths deepened leading to significant overland flows from the rural catchment upstream and from the urban catchment within the village. The drainage networks in the village were already full and unable to prevent the deep water that lead to flooding of properties at the topographical low points in the village.

Highway drainage is not designed nor intended to provide drainage for areas outside of the highway boundary. These overland flows significantly increased the volume of surface water run-off contributing to

both highway drainage systems and any private drainage systems. It is also possible during the event that mud, litter and debris in the water compromised the efficiency of road gullies by blinding the grates.

Flood Recovery

After the flood, incident recovery activities included the inspection and cleansing of road drains by KCC. Gully cleansing records from after the event show that of the 91 gullies that were inspected, eight were found to be full. These are not located in the areas that flooded, they are found on the A20 near the junctions with Bakers Avenue and Kingsingfield Road and on Southfield Road.

Inspections of the soakaways throughout the area have not identified any significant defects. Blockages in the drainage network are not considered a significant contributor to flooding within West Kingsdown. Water on the highway drained away once the rainfall had ceased, indicating drainage systems are in operational order, but overwhelmed in this event.

There are also public sewers throughout the village, operated by Thames Water, however these serve as 'foul only' for most connections from residential and commercial premises. As such it is not likely that there will be widespread inflows of surface water to the sewers in normal circumstances. There is no public sewer network dedicated to surface water drainage in this area.

Conclusions and Future Actions

A heavy rainstorm of a 1 in 100-year return period overwhelmed the drainage and led to flooding in West Kingsdown. Overland flows from the rural catchment and from the urban area of the village caused water to collect at local low points and flow paths that caused flooding to properties in the vicinity.

Only one report of flooding was received by KCC during the event with further reports of flooding received in the following days. KCC Highways respond to emergency calls within 2 hours and will take action to make the incident safe, including closing roads and arranging tankers to remove flood water where appropriate. Residents are urged to report flooding, particularly where there is a serious risk to highway safety or property.

Highway drainage is not generally designed to accommodate storms of this severity and it is unlikely that improvements to the highway drainage could prevent a similar flood from happening in West Kingsdown if this rainfall was experienced again. Options to mitigate this risk need to focus on preventing the build-up water at the low points, this includes from the rural catchment upstream and the deep water that collects behind the noise bund for Brands Hatch.

Kent Highways are considering a range of measures to manage flood risk to the highway. These measures include alternations to the existing surface water drainage to interlink the systems on the north and south sides of the road. Along with improvements to existing soakaways such as installation of new deep bored soakaway liners, together with additional pollution controls to ensure mud and debris from the field run-off does not adversely affect upon the soakaways in future. The existing soakaways will be tested as part of the works to help us to determine the residual risk of flooding in conjunction with the surface water modelling.

KCC's Flood and Water Management Team have commissioned surface water modelling to understand the level of flood risk in the West Kingsdown area. This will be more detailed than the currently available surface water flood map, which are a high-level overview of risk for an area. Once the results of the modelling are available, opportunities for improvement will be considered and assessments carried out on potential improvements.

It should be noted that improvements must be cost-beneficial (i.e. is the costs of delivering them must be outweighed by the benefits they provide). Any improvements made are unlikely to completely eliminate the risk of surface water flooding - all measures can be overwhelmed by an event of sufficient extremity. Even if the standard of protection is increased in the future, it is unlikely that flooding in a similar event could feasibly be prevented.