

# Section 19 Flood Investigation Report: Reigate & Banstead

28 October 2015



SURREY

# Section 19 Report

## Purpose

This document has been prepared specifically for the purpose of meeting the requirements of Section 19 of the Flood and Water Management Act 2010.

The report investigates which risk management authorities (RMAs) had relevant flood risk management functions during the flooding that took place in the winter of 2013/14. The report also considers whether the relevant RMAs have exercised, or propose to exercise, their flood risk management functions. It does not address wider issues beyond that remit.

The supporting data has been put together based on records of internal property flooding and road closure information from a variety of sources. Whilst every effort has been made to verify the locations of the Section 19s identified, the nature of the data and the methods used to collate this information mean that it does not include every occurrence of flooding. This data only identifies where flooding has been reported and is indicative only.

Location Name	Reigate & Banstead; Banstead & Kingswood, Chipstead & Hooley, Horley & Salfords, Redhill and Reigate
Date(s) of Incidents	Winter 2013/14
Section 19 Trigger(s)	Internal property flooding at multiple addresses Road closures

## Glossary

The table below defines some of the frequently used terminology within the flood risk management industry and within this document.

Acronym/Term	Definition
Annual Probability	Throughout this document, flood events are defined according to their likelihood of occurrence. The term 'annual probability of flooding' is used, meaning the chance of a particular flood occurring in any one year. This can be expressed as a percentage. For example, a flood with an annual probability of 1 in 100 can also be referred to as a flood with a 1% annual probability. This means that every year there is a 1% chance that this magnitude flood could occur.
EA	Environment Agency
FEH	Flood Estimation Handbook – by Centre for Ecology & Hydrology offering guidance on rainfall and river flood frequency estimation in the UK.
Flooding Asset Register	The register is a record of all structures or features designated by the EA, the LLFA, the district and borough councils or the IDB which have an effect on flood risk. More information on the Flooding Asset Register can be found on SCC's <a href="#">website</a> and in Schedule 2 of the Flood and Water Management Act (2010).
Flood Risk Management Function	A flood risk management function is a function listed in the Act (or related Acts) which may be exercised by a risk management authority for a purpose connected with flood risk management.
Very Low Flood Risk	Area with a very low probability of flooding from rivers (< 1 in 1,000 annual chance of flooding or <0.1%).
Low Flood Risk	Area with a low probability of flooding from rivers (between a 1 in 1000 and 1 in 100 annual chance of flooding or between 0.1% and 1%)
Medium Flood Risk	Area with a medium probability of flooding from rivers (between a 1 in 100 and 1 in 30 annual chance of flooding or between 1% and 3.33%).
High Flood Risk	Area with a high probability of flooding from rivers (> 1 in 30 annual chance of flooding or greater than 3.3%).
IDB	Internal Drainage Board
Instances of property	This is a count of the reported incidents of internal property flooding that occurred across

flooding	winter 2013/2014. This means that properties which were flooded twice are accounted for twice. It is therefore not a count of the number of properties.
LLFA	Lead Local Flood Authority
Main River	Main rivers are usually larger streams and rivers, but some of them are smaller watercourses of local significance. Main Rivers indicate those watercourses for which the Environment Agency is the relevant risk management authority.
Ordinary Watercourse	Ordinary Watercourses are displayed in the mapping as the detailed river network. An ordinary watercourse is any watercourse (excluding public sewers) that is not a Main River, and the Lead Local Flood Authority, District/Borough Council or Internal Drainage Board are the relevant risk management authority.
RMA	Risk Management Authority
SCC	Surrey County Council
SCG	Strategic Command Group
TW	Thames Water
RBBC	Reigate & Banstead Borough Council
uFMfSW	Updated Flood Maps for Surface Water

## Sources of Flooding

The following report considers the flooding which occurred in the Winter of 2013/14. The table below describes different sources of flood risk.

Source	Description
Fluvial flooding	Exceeding of the flow capacity of river channels (whether this is a Main River or an Ordinary Watercourse), leading to overtopping of the river banks and inundation of the surrounding land. Climate change is expected to increase the risk of fluvial flooding in the future.
Tidal flooding	Propagation of high tides and storm surges up tidal river channels, leading to overtopping of the river banks and inundation of the surrounding land.
Surface water flooding	Intense rainfall exceeds the available infiltration capacity and / or the drainage capacity leading to overland flows and surface water flooding. Climate change is expected to increase the risk of surface water flooding in the future. This source is also referred to as pluvial flooding.
Groundwater flooding	Emergence of groundwater at the surface (and subsequent overland flows) or into subsurface voids as a result of abnormally high groundwater flows, the introduction of an obstruction to groundwater flow and / or the rebound of previously depressed groundwater levels.
Sewer flooding	Flooding from sewers is caused by the exceeding of sewer capacity and/or a blockage in the sewer network. In areas with a combined sewer network system there is a risk that land and infrastructure could be flooded with contaminated water. In cases where a separate sewer network is in place, sites are not sensitive to flooding from the foul sewer system.
Other sources of flood risk	Flooding from canals, reservoirs (breach or overtopping) and failure of flood defences.

## Flood Risk Data Sources

The following sources of data have been used in preparing this report and its associated mapping:

- Fluvial Flood Risk
  - Flood Risk Mapping (Risk of Flooding from Rivers and Sea; EA)
  - Flood Warning and Alert areas (EA)
- Surface Water Flood Risk
  - Updated Flood Maps for Surface Water (uFMfSW) (EA)
- Groundwater
  - Susceptibility to Groundwater Flooding (British Geological Survey)
- Historic Flood Evidence
  - Historic Flood Map (EA)
  - Wetspots (Surrey County Council)
  - Property Flooding Database (Surrey County Council)
  - Historic Flooding Incidents Database (Surrey County Council)

If you are aware of any historical flooding in the area which is not highlighted on the mapping please report it, with any evidence you have (for example photos or videos), to [flooding.enquiries@surreycc.gov.uk](mailto:flooding.enquiries@surreycc.gov.uk).

## **Other Data Sources**

The following sources of data have been used in preparing this report and its associated mapping:

- Geological information
  - Superficial geology (Geology of Britain Viewer; British Geological Survey)
  - Bedrock geology (Geology of Britain Viewer; British Geological Survey)

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# 1. Executive Summary

The purpose of this report is to investigate which risk management authorities (RMAs) had relevant flood risk management functions during the flooding that took place within the boundary of Reigate & Banstead Borough Council (RBC) in the winter of 2013/14. The report also considers whether the relevant RMAs have exercised, or propose to exercise, their risk management functions (as per section 19(1) of the Flood and Water Management Act 2010). It does not address wider issues beyond that remit.

The flooding in Reigate & Banstead was a result of fluvial, surface water, groundwater and sewer flooding. This was caused by unprecedented rainfall during the winter 2013/14 period (275% compared with an average winter). There were approximately 60 incidents of internal property flooding in Reigate & Banstead during winter 2013/14.

The Environment Agency (EA) is the lead RMA for incidents of fluvial flooding from Main Rivers, though Thames Water (TW), Surrey County Council (SCC) and RBBC also performed other functions during that event, some of which were under different legislation including the Civil Contingencies Act 2004 and the Water industry Act 1991. The actions of the authorities are summarised below:

## 1.1. Environment Agency

- Operated Flood Alert and Flood Warning service.
- Sent out flood ambassadors and flood data recorders to the areas affected by flooding.

## 1.2. Thames Water

- No specific flood risk management functions were identified as being directly relevant to the 2013/2014 flooding incident in Reigate and Banstead

## 1.3. Surrey County Council

- Required to close roads as a result of the flooding across Reigate and Banstead
- Removed a grill and carried out silt clearance on Colesmead Road (Redhill).
- Cleared a culvert on Reigate Road, Hookwood.
- Are undertaking an assessment of potential options to reduce flood risk in the Burstow.
- Are carrying out enhanced maintenance works on Holly Lane, Garrets Lane and Bolters Lane (Banstead).
- Constructed a new lagoon and drainage system on Outwood Lane (Chipstead), and swales and soakaways on Holly Lane (Chipstead).

## 1.4. Reigate & Banstead Borough

- Provided sandbags to slow down the ingress of water into properties.
- After the storms and flooding, responded to tree issues as appropriate.
- Promoted the Repair and Renew Grant which provided up to £5000 for residents and businesses that were flooded in order to protect their property from flooding in the future.

## 2. Introduction

### 2.1. Section 19 Investigation Requirement

Under the Flood and Water Management Act 2010 the Lead Local Flood Authority (LLFA) must (to the extent that it considers it necessary or appropriate) undertake an investigation upon becoming aware of a flood incident within its area.

A Lead Local Flood Authority is defined under Section 6(7) of the Flood and Water Management Act as being the County Council for that area. Section 19(1) requires that the investigation determines the risk management authorities that have relevant flood risk management functions and whether each of those authorities have exercised or propose to exercise those functions.

Section 19(2) requires that the LLFA publishes the results of its investigation and notify the relevant risk management authorities accordingly.

This report covers flooding during the winter of 2013/14 only. As flooding was widespread across Surrey, multiple reports have been produced.



## 2.2. Locations of the investigations

This report addresses sites that flooded within the Reigate & Banstead Borough Council (RBBC) area. There are 51 sites in total, spread across five sub areas. There were approximately 60 incidents of internal property flooding in Reigate & Banstead.

Due to the sensitivities in publishing property flooding information, this report does not contain a comprehensive list of the S19 sites but supporting maps showing the sub areas in more detail are available.

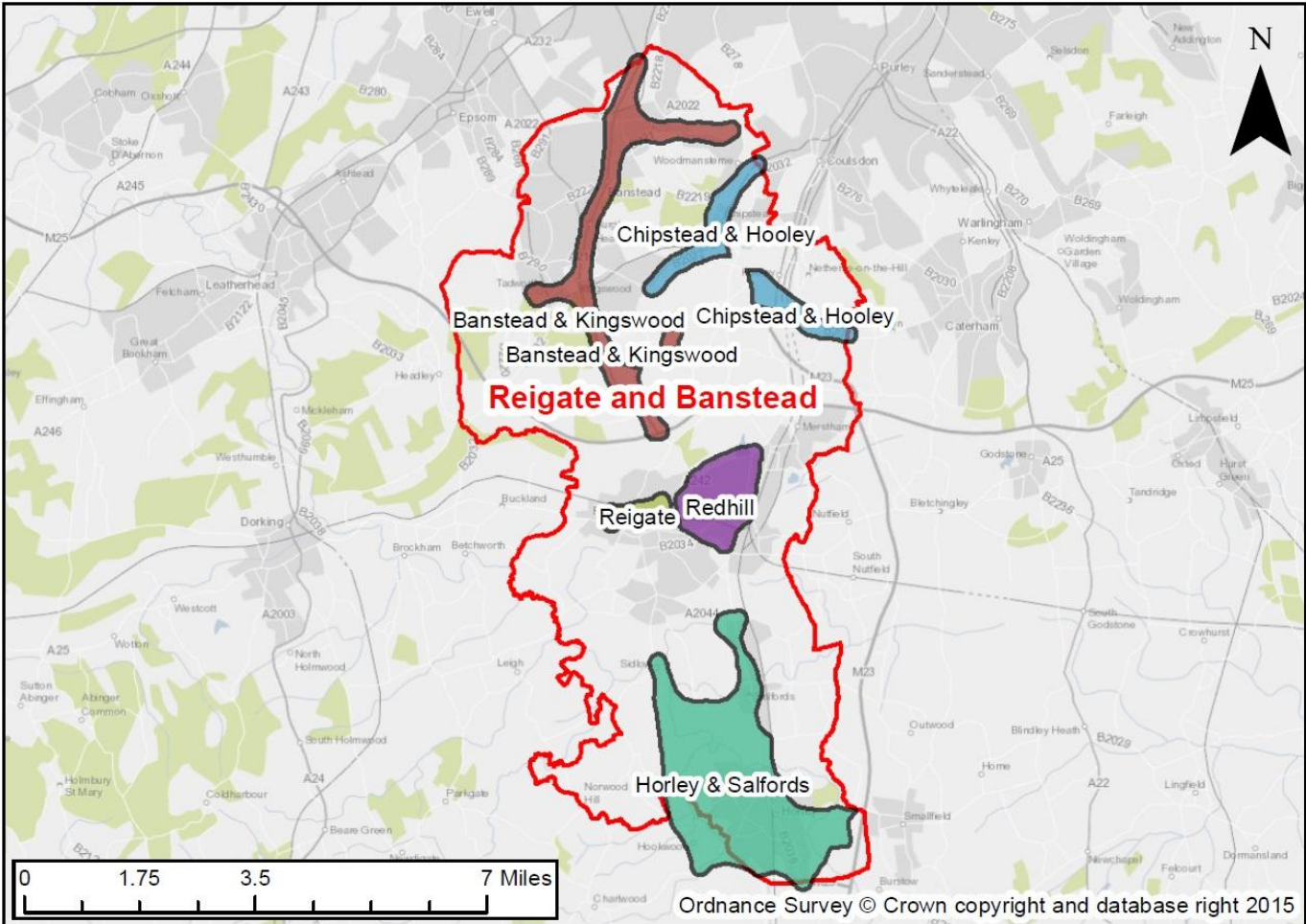


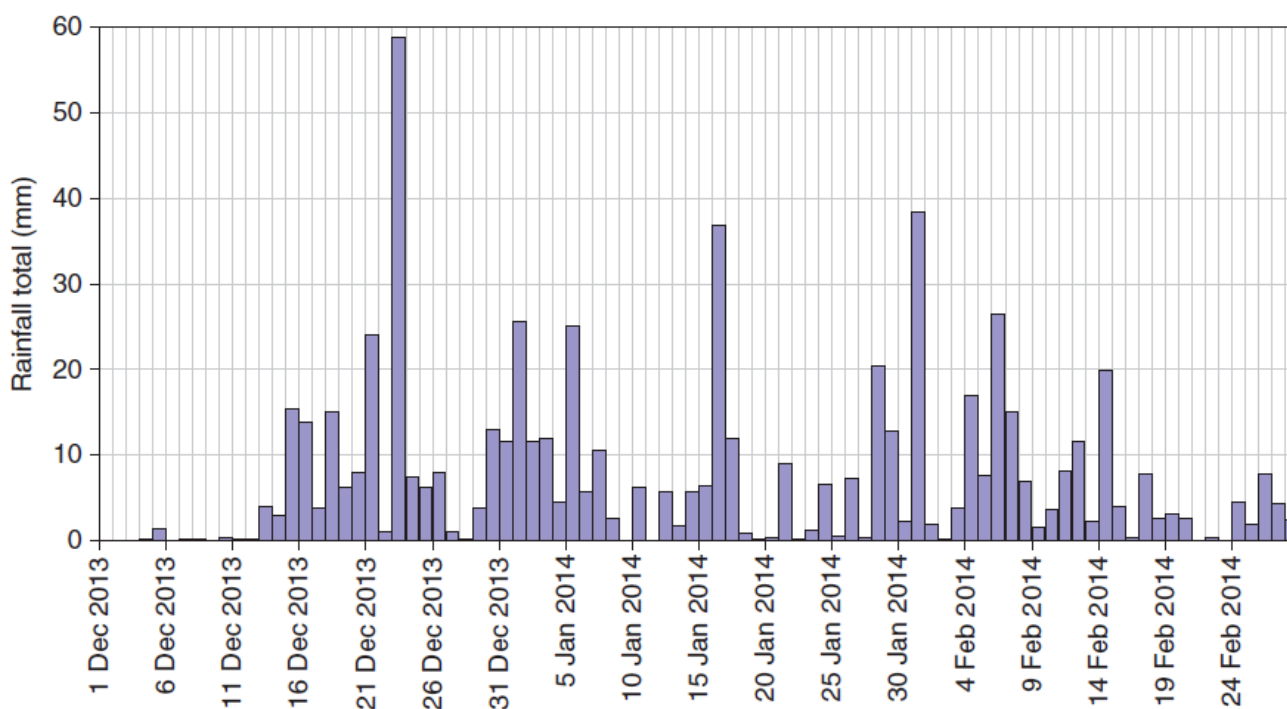
Figure 2-1 Location of Sub areas within Reigate and Banstead Borough for this report

## 3. Background Weather and Catchment Conditions

### 3.1. Weather Conditions

The Met Office reported that the winter of 2013 to 2014 was the wettest winter in England and Wales since records began in 1766, with 435mm of rain being recorded up to 24 February. Parts of South East England received around two and a half times the amount of rainfall that they would normally expect at this time of year. This caused wide-spread flooding across Surrey from a range of sources including groundwater as the levels across the region had risen so high. In some areas of South East England they exceeded records set in 2000/01, which was the last time significant disruption from groundwater flooding was recorded.

Storm events hit the UK on the 18 to 19, 23 to 27 and 30 to 31 December 2013, followed by 3 and 5 of January 2014. These storms came from the Atlantic and were characterised by unusually large and deep areas of low pressure, which brought rainfall and very strong winds. The rainfall is reflected by the spikes in daily rainfall totals, representing major rainfall events, shown in Figure 3-1 below for Charlwood which is just to the west of Reigate and Banstead District Council area.



**Figure 3-1 Daily Rainfall totals at Charlwood, Surrey for Winter 2013-14**

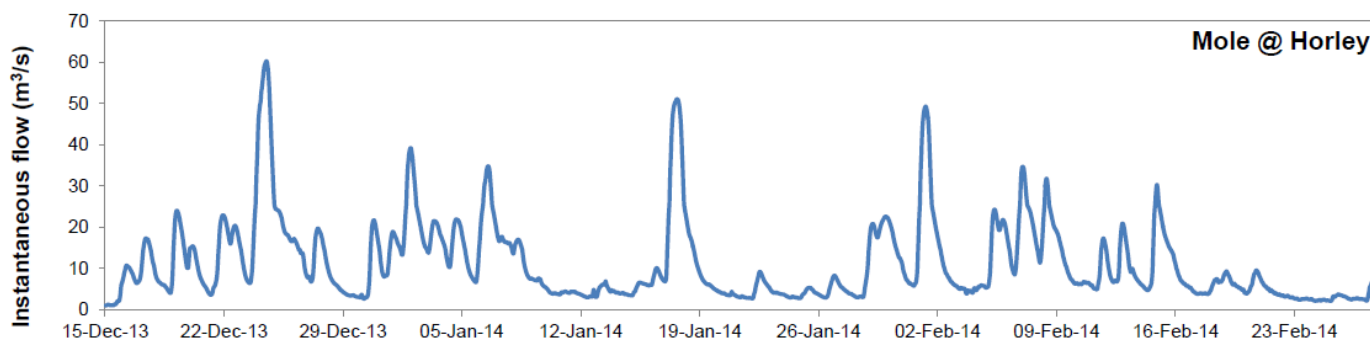
The major storm event occurring on the 23 to 25 December resulted in 50-70mm of rainfall within 24 hours over an area from Dorset to Kent, as indicated by the 60mm of rainfall recorded on the 23 December in Figure 3-1. This represents approximately two-thirds of the monthly average rainfall for December. This individual event was estimated to be a 1 in 14 year annual chance event at Charlwood.

Combined with the saturated soil from the high levels of rainfall leading up to the event, the rainfall gave rise to local pluvial flooding and also fluvial flooding from the River Mole and its tributaries causing flood inundation across the river flood plains in Surrey. The persistent high levels of rainfall for this period lead to a sharp rise in river flows and fluvial flood warnings were in effect across all of the UK. The long duration rainfall return period for 60 days was calculated for the Burstow

catchment (a tributary to the Mole by Horley). It estimated a 1 in 103 year annual chance for winter rainfall at that location.

### 3.2. Catchment Conditions

The southern part of Reigate and Banstead District Council area, as far as Reigate, lies within the Upper Mole catchment. The catchment overlies geology belonging to the Wealden Group which are typically very impermeable in nature, giving rise to a rapid river response to the rainfall events. This rapid response or “flash” response can be seen in the figure below with the sharp peaks on the 24 December 2013, 17 January 2014 and the 1 February 2014.



**Figure 3-2 Instantaneous Flow in the River Mole at Horley Winter 2013-14**

Due to its responsive catchment type, the Mole experienced its maximum peak flow as a consequence of the December 23 rainfall event. However, this winter was characterised by the rapid succession of high flow events. The mean flow at this gauge in Horley is  $1.4\text{m}^3/\text{sec}$ , however  $10\text{m}^3/\text{sec}$  was exceeded 26 times over this winter period.

Communities	Watercourse	Annual Chance (%)	Return Period (years)	Source of estimate
Crawley	River Mole	1.25	80	Analysis of peak flow rates using FEH methods
Dorking, Leatherhead	River Mole	2	50	Analysis of peak flow rates using FEH methods
Cobham, Esher	River Mole	2	50	Analysis of peak flow rates using FEH methods
Gatwick Airport	Gatwick Stream	3.3	30	Analysis of peak flow rates using FEH methods
Redhill	Redhill Brook	2	50	No flow data available, so estimate based on correlation with nearby sub-catchments, and rainfall data

**Table 3-1 Indicative Return Periods for the Mole Catchment Winter 2013-14**

Table 3-1 shows the indicative return periods for the River Mole catchment based on river flow compared to a standard industry hydrology approach. Although the overall winter was the wettest since records began, the return period peak flows in the river are estimated to have been a 1 in 50 year annual chance.

Flow analysis was undertaken on data from the Leatherhead and Dorking gauging stations on the Middle Mole. The largest recorded event was on 23-24 December 2013. Other significant flows were seen at Dorking on 17 January 2014 and 1 February 2014. However owing to the extreme river levels experienced in the middle Mole in relation to the 23-24 December 2013 storm the actual levels exceeded the capacity of the gauging stations at both Dorking and Leatherhead. Consequently peak flows were not recorded at either Dorking or Leatherhead and as such

estimates of event rarity for the middle Mole are therefore inconclusive. The Leatherhead gauge was unable to record the 24 December or 17 January 2014 peaks but did record a flow during the February event.

The “flash” nature of the individual events was witnessed in the Mole with levels reported to have raised by approximately one foot per hour, and following its peak, returning to its regular level 10 hours later.

Outside the flood plain of the River Mole and its tributaries, the main source of flooding was from the intense rainfall. The EA flood maps for river flooding do not show any areas at risk of fluvial flooding in the northern part of the Reigate and Banstead District Council area, north of Reigate.

## 4. Identification of Relevant Risk Management Authorities

There are a range of RMAs which together cover all sources of flooding.

The EA is responsible for taking a strategic overview of the management of all sources of flooding and coastal erosion in England and Wales. They have prepared strategic plans which set out how to manage risk, provide evidence for example their online flood maps, and provide advice to the Government. They provide support to the other RMAs through the development of risk management skills and provide a framework to support local delivery. The EA also has operational responsibility for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea, as well as being a coastal erosion risk management authority. Main Rivers are defined through an agreed map which is updated annually. These tend to be the larger rivers in the country and the EA have permissive powers to carry out maintenance works on them.

LLFAs are responsible for developing, maintaining and applying a strategy for local flood risk management in their areas. As part of this, the LLFA liaises regularly with the EA as well as the other RMAs to ensure that all sources of flooding in their area are being properly managed. They need to produce reports when there is a reported flood, and they have to keep a register of flood management assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses. Ordinary Watercourses are rivers which are not designated as 'Main Rivers'.

District and Borough Councils can carry out flood risk management works on minor watercourses, working with the LLFA. Through the planning processes, they control development in their area, ensuring that flood risks are effectively managed. If they cover part of the coast, then District and Unitary councils also act as coastal erosion RMAs.

Internal Drainage Boards (IDB) are responsible for water level management in low lying areas. Not all areas require an IDB, and they currently cover approximately 10% of England. They work in partnership with other authorities and land owners to actively manage and reduce the risk of flooding.

Water and sewerage companies are responsible for managing the risks of flooding from drainage systems, including both their surface water only systems and combined sewer systems.

Highway Authorities are responsible for providing and managing highway drainage and roadside ditches, and must ensure that road projects do not increase flood risk.

Table 4-1 below summarises the RMAs responsible for the sites within this report. The ticks indicate which authorities have responsibility for which function. SCC is the LLFA. TW is the water company that has responsibility for all sources of sewer flooding. There are no IDBs in Reigate and Banstead.

**Table 4-1 Risk Management Authorities**

Flood Source	Environment Agency	Lead Local Flood Authority	Land Drainage Authority		Water Company	Highway Authority
		Surrey County Council	Borough/District Council	Thames Water	Surrey County Council	
Main River	✓					
Surface Water		✓				✓
Surface Water (on or coming off the highway)						✓
Sewer flooding					✓	
Ordinary Watercourse			✓	✓		
Groundwater		✓				
Reservoirs	✓					

## 5. Strategic Actions and Flood Risk Management Functions

RMA's have defined flood risk management functions under the Flood and Water Management Act (2010). A flood risk management function is a function listed in the Act (or related Acts) which may be exercised by an RMA for a purpose connected with flood risk management. The following section sets out the strategic actions and relevant flood risk management functions that were carried out before, during and after the flooding that occurred across Surrey and particularly in Reigate and Banstead during the Winter of 2013/14.

### Environment Agency

The EA have a number of flood risk management functions, which include (but are not limited to): undertaking and maintaining flood mitigation works/defences, strategic responsibility for managing the risk of reservoir flooding, consenting and enforcement, the provision of strategic flood risk management plans, operation of flood alerts, flood warnings and flood risk management assets and designation of structures and features that affect flood risk. The relevant functions undertaken are listed below:

- Operated Flood Alert and Flood Warning service.
- Operated flood risk management assets during the flooding.
- Carried out flood risk mitigation works.

In addition, the EA carried out the following actions across the county:

- Participated in the Strategic and Tactical Command Groups once a major incident had been declared to respond to the flooding across Surrey.
- Cleared 860 blockages and storm damage incidents reported 1087 pollution incidents reported
- 125 Flood Ambassadors visited 95 locations
- 70 flood data recorders sent to more than 100 locations
- Supported (and are supporting) community groups to help develop their community flood/emergency plans.
- Sent out newsletters to inform residents of their site investigation works and are finalising plans for a regular community newsletter.
- Met with local people to discuss their ideas and are now studying these proposals in more detail.

Specifically in Reigate and Banstead the actions listed below were carried out:

- Operated Flood Alert and Flood Warning service.
- Provided ambassadors to support both local communities and their partners.

### Thames Water

TW have flood risk management functions under the Water Resources Act (1991). Relevant actions of water companies include: the inspection, maintenance, repair and any works to their drainage assets which may include watercourses, pipes, ditches or other infrastructure such as pumping stations.

No specific flood risk management functions have been identified as being directly relevant to the 2013/2014 flooding incident in Reigate & Banstead. However, this investigation has identified other relevant actions carried out by TW.

In addition TW put in place winter arrangements for responding to winter weather conditions. This included triggers for the scaling up of resources and management for a range of foreseeable weather conditions. During the event their main focus was on maintaining customer services, on protecting assets vital for the ongoing delivery of service and on ensuring that where there was service disruption we were able to resume it as soon as possible. To these ends TW carried out the following actions within Surrey:

- Physical protection measures – deployment of flood barriers and sandbags to TW sites (both water and wastewater).
- Regular (often daily) physical checks of unmanned sites to ensure that they were working and in workable condition.
- Optimisation of use of the sewerage network – where possible work such as investigations and sewer cleaning was carried out to ensure that sewers and pumping stations were working to optimum capacity.
- Increased the number of engineers and staff on the ground to investigate flooding reports - Network Engineers visited internally flooded properties where sewer flooding was the primary cause.
- Undertook wide scale clean ups of properties regardless of whether the cause was foul or river flooding.
- Provided a sewer flooding information leaflet for general distribution to properties affected and attended a number of local flood meetings.

## **Surrey County Council**

SCC, as LLFA, have flood risk management functions, which include (but are not limited to); the provision of a Local Flood Risk Management Strategy (LFRMS), designation and maintenance of a register of structures or features that have a significant effect on flood risk, consenting and enforcement works on ordinary watercourses, undertaking works to mitigate surface water and groundwater flooding and undertaking Section 19 investigations. SCC also has responsibilities as a Highways Authority and as an Emergency Responder (under the Land Drainage Act 1991 and the Civil Contingencies Act 2004 respectively) which may relate to flooding. SCC's relevant flood risk management functions undertaken are listed below:

- The LFRMS was published in December 2014.
- No key drainage assets have yet been identified and added to the flooding asset register in Reigate & Banstead.
- Section 19 reports have been produced for the flooding experienced across the County in Winter 2013/14.

In addition SCC carried out the following activities across Surrey;

- Officers inspected flood affected roads, after which defect repairs were undertaken by SCC's contractors; Kier. Where extensive areas of carriageway were damaged by the flooding, they were assessed for inclusion into the Project 400 programme; a targeted programme to resurface and repair roads which were damaged by the Winter 2013/14 floods.
- All flood affected roads in Surrey were assessed for potential schemes that may be included in the Project 400 programme.



- Cleansed and re-opened roads as quickly as possible after the flooding.
- Surrey Fire and Rescue Service (SFRS) pumped flood waters away to protect residents, property and infrastructure during the flooding.
- The Surrey Strategic and Tactical Coordination Groups met for a response meeting in advance of the February 2014 event to set up coordination between authorities.
- Provided sandbags to slow down the ingress of water into properties, and recycled the sandbags after the event.
- Staff attended resident engagement events after the flooding to hear their concerns and gather additional information.
- After the storms and flooding, cleared trees, debris and carried out ditching works to enable the drainage systems to function normally again.
- Operated a call centre throughout the flooding which dealt with residents queries and have since hired a Community Resilience Officer to support communities in becoming more resilient to flooding amongst other issues.
- Administered the Repair and Renew Grant which provided up to £5000 for residents and businesses that were flooded in order to protect their property from flooding in the future.

### **Reigate and Banstead Borough Council**

Reigate and Banstead, as a Borough Council, have the following flood risk management functions: to designate structures and features that affect flood risk and they may also undertake works on ordinary watercourses to reduce flood risk; however this is a permissive power. Reigate and Banstead's relevant functions undertaken are listed below:

- Provided sandbags to slow down the ingress of water into properties.
- After the storms and flooding, responded to tree issues as appropriate.
- Promoted the Repair and Renew Grant which provided up to £5000 for residents and businesses that were flooded in order to protect their property from flooding in the future.

### **All RMAs**

All RMAs under the Flood and Water Management Act (2010) have a responsibility to cooperate and coordinate with regards to their flood risk management functions, including raising awareness of flood risk and the sharing of information. Landowners also have riparian responsibilities under the Flood and Water Management Act (2010) to maintain and undertake any necessary works on assets on their land (with consent from the relevant RMA) which may have an effect on flood risk including watercourses and drainage assets.

## 6. Format of Subsequent Sections

The sites in this report have been grouped into sub areas based on location.

There are 5 sub areas in this report, all within RBBC.

Each sub area will be introduced and information relevant to the whole sub area presented. Responsible Risk Management Authorities will be identified at Sub group level, and their response to the flood event summarised.

Individual site information has predominantly come from existing SCC information (collated from a variety of sources) and the EA datasets. No site visits were undertaken as there are over 500 sites to report on in Surrey; however Borough and District Councils were consulted to collect any further information in relation to the flood events at the relevant sites. If further information is required in relation to any of the sites, requests should be submitted to SCC via [flooding.enquiries@surreycc.gov.uk](mailto:flooding.enquiries@surreycc.gov.uk).

## 7. Sub Area: Banstead & Kingswood

### 7.1. Sub Area Definition

This sub area covers the area of Banstead, Lower Kingswood and Tadworth. It includes the Brighton Road A217, Woodmansterne Lane, Pigeon House Lane and a cluster of roads in Tadworth.

### 7.2. Location and Catchment Description

There are no major water courses in the Banstead & Kingswood sub-area.

During the winter of 2013-14 the groundwater level rose such that the levels in ponds increased and in some cases overflowed. The ground was saturated and water began to lie on the ground surface. The sub area was subject to flooding which resulted in road closures and internal property flooding.

At Burgh Heath, the Brighton Road A217 flooded from surface water flowing off saturated ground onto the road. Other lengths flooded from rainwater collecting directly on the road surface at low points.

The EA flood maps do not indicate any fluvial or significant surface flood risk in this area, nor in the Section 19 sites in Tadworth. Pigeonhouse Lane in Mugswell is clearly identified in the EA surface water flood maps as lying in a surface water flow route. These maps are based on topography and their accuracy is not as robust as the fluvial flood maps, however they can be used to identify general flow routes. The flood risk maps do not take into account climate change. They are designed only to give an indication of flood risk to an area of land and are not sufficiently detailed to show whether an individual property is at risk of flooding.

The geology in this sub area is porous chalk and sandy gravels. There are also superficial deposits of clay underlying parts of the sub area. Under normal conditions, rainwater is absorbed into the ground so there is no major fluvial flow.

The majority of the sub area has a limited potential for groundwater flooding in. However, in the Lower Kingswood area there is a potential for groundwater flooding to occur at the surface.

The sub area is not located within the EA Flood Warning or Flood Alert Areas.

### 7.3. Identification of Relevant RMAs

Following a range of consultation events during and since the floods, the relevant RMAs in this sub area have been identified as being the LLFA and the Highway Authority (both of which are SCC).

### 7.4. Exercised Flood Risk Management Functions and Other Actions

#### Surrey County Council

Pigeonhouse Lane (Chipstead) and (Woodmansterne Lane) Banstead was subject to a temporary road closures during the flooding.

As part of the Wetspots Capital programme, SCC are carrying out enhanced maintenance works on Holly Lane, Garrets Lane and Bolters Lane (Banstead).

Section 5 provides details of SCC's wider flood risk management functions and other relevant actions prior to, during and since the flood incident.

## 8. Sub Area: Chipstead & Hooley

### 8.1. Sub Area Definition

This sub area covers the area of Chipstead and Hooley. It includes Outward Lane B2032, Dean Lane and a cluster of roads around Chipstead railway station and in Hooley.

### 8.2. Location and Catchment Description

There are no major water courses in the Chipstead & Hooley sub-area.

During the winter of 2013/2014 the sub area was subject to flooding which lead to road closures and internal property flooding in the sub area.

The EA flood maps do not indicate any fluvial or significant surface flood risk in the Chipstead & Hooley sub area. Outward Lane in Chipstead is clearly identified in the EA surface water flood maps as lying in a surface water flow route, with parts of Dean Lane also affected by surface water flooding. These maps are based on topography and their accuracy is not as robust as the fluvial flood maps, however they can be used to identify general flow routes. The flood risk maps do not take into account climate change. They are designed only to give an indication of flood risk to an area of land and are not sufficiently detailed to show whether an individual property is at risk of flooding.

The geology in this sub-area is porous chalk and sandy gravel. The majority of the sub area is not underlain by superficial deposits, other parts are underlain by clay. Under normal conditions, rainwater is absorbed into the ground so there is no major fluvial flow.

The majority of the sub area has a limited potential for groundwater flooding in. However, in the south of Chipstead there are areas for potential for groundwater flooding to occur at the surface.

The sub area is not located within the EA Flood Warning or Flood Alert Areas.

### 8.3. Identification of Relevant RMAs

Following a range of consultation events during and since the floods, the relevant RMAs in this sub area have been identified as being the, the LLFA (SCC) and the Highway Authority (SCC).

### 8.4. Exercised Flood Risk Management Functions and Other Actions

#### Surrey County Council

Outwood Lane (Tadworth) was subject to a temporary road closures during the flooding.

SCC have constructed a new lagoon and drainage system on Outwood Lane (Chipstead), and swales and soakaways on Holly Lane (Chipstead).

Section 5 provides details of SCC's wider flood risk management functions and other relevant actions prior to, during and since the flood incident.

## 9. Sub Area: Horley & Salfords

### 9.1. Sub Area Definition

This sub area covers the area of Horley, Hookwood, Salfords and Sidlow. It includes Reigate Road A217, Meath Green Lane, Bonehurst Road and a cluster of roads in the south of Horley.

### 9.2. Location and Catchment Description

The major river in the sub area of Horley & Salfords is the River Mole.

Tributaries of the River Mole include Gatwick Stream and Hookwood Common Brook, which run through Horley and Hookwood respectively. Other watercourses in the catchment include Burstow Stream in Horley & Salfords Stream in Salfords.

During the winter of 2013/2014 the sub area was subject to flooding which resulted in road closures and internal property flooding.

On 24 December 2013 flooding caused disruption on the A23.

Horley & Salfords were subject to flooding during the storms of the 23 and 24 December 2013. The flooding across the River Mole catchment (including Horley) was a combination of surface water flooding, river (fluvial) flooding and groundwater flooding mechanisms. In some areas it was not possible to distinguish between fluvial flooding and surface water flooding

Flow measurements taken from a gauge in the River Mole in Horley demonstrated that the river was subject to a sequence of high flow events over the 2013 – 2014 winter. The mean flow in winter has been recorded as 1.4 m<sup>3</sup>/sec. However, during the December flooding the flow in Horley exceeded 10 m<sup>3</sup>/sec for a total of 26 times, with a peak flow of around 60 m<sup>3</sup>/sec. Details of the peak are given in Table 10-1.

**Table 9-1 Details on the peak river flow in the River Mole, Horley 23/12/13 – 24/12/14**

Gauge	Peak flow m <sup>3</sup> s <sup>-1</sup>	Date of peak	Rank of peak/n years	Single site/pooled	Return period (years)	AEP (%)
Horley	60.3	16:38	2 <sup>nd</sup> out of 53	Single site	51	2.0%
				Pooled	80-100	1.0%-1.3%

Long term river flow volumes are demonstrated in Table 9-2.

**Table 9-2 Return periods of Flow at the River Mole at Horley (December 2013 – February 2014)**

Gauge	Accumulation	Period of review	Return period (years)	AEP (%)
Horley	Maximum over any consecutive 14-days	December 2013	20	5.0%
	Maximum over any consecutive 4 weeks	December 2013	5	20.0%
	Maximum over any consecutive 14-days	January 2014	15	6.7%
	Maximum over any consecutive 4 weeks	January 2014	80	1.3%
	Maximum over any consecutive 14-days	February 2014	73	1.4%
	Maximum over any consecutive 4 weeks	February 2014	121	0.8%

Generally, the return periods were less significant for total flow volumes for durations of less than 14 days (except where the data includes the Christmas Eve Flood event). Although the rainfall peaks were less in February, the river flow volumes were higher due to the saturation of the catchment. River levels in Horley were the highest since the EA started keeping records (approximately 1985).

During the winter of 2013/2014 there was significant surface water flooding throughout the Horley area.

In Horley East the drainage systems on Balcombe Road were severely affected. RBBC received around 4-5 complaints in relation to sewerage issues from local residents.

There were also a number of temporary road closures during the flooding including the Meath Green Lane, Mill Lane, Reigate Road (A217), Lee Street and Tanyard Way.

The EA surface water flood mapping indicates that areas of Reigate Road A217, Meath Green Lane and Bonehurst Road are at risk of surface water flooding. The EA surface water maps are based on topography and their accuracy is not as robust as the fluvial flood maps, however they can be used to identify general flow routes. The flood risk maps do not take into account climate change. They are designed only to give an indication of flood risk to an area of land and are not sufficiently detailed to show whether an individual property is at risk of flooding.

The geology in this sub-area is Weald Clay formation. The majority of the sub area is not underlain by superficial deposits, other parts are underlain by river terrace deposits. The underlying geology suggests that under normal conditions, water does not permeate into the ground and overland runoff is greater and more responsive to rainfall events.

In the majority of the sub area there is a potential for groundwater flooding to occur at the surface.

Large parts of the sub area, particularly the parts in close proximity to the major watercourses, are within the Flood Warning and/or Flood Alert Areas. These are areas for which the EA provides free flood warnings.

### 9.3. Identification of Relevant RMAs

Following a range of consultation events during and since the floods, the relevant RMAs in this sub area have been identified as being the EA, the Land Drainage Authority (SCC/Reigate & Banstead Borough Council), the LLFA (SCC), the Highway Authority (SCC), and Water Company (TW).

### 9.4. Exercised Flood Risk Management Functions and Other Actions

#### Environment Agency

Details of the flood warnings issued by the EA between December 2013 and February 2014 are detailed in Table 8-3.

**Table 9-3 Flood warnings issued by the EA in Horley between December 2013 and February 2014**

Flood warning area	Date	Time	Number warned
Gatwick Stream at South West Horley	23/12/2013	16:38	11
Burstow Stream at East and North Horley	23/12/2013	21:58	1523
Burstow Stream at East and North Horley	02/01/2014	07:20	1530
Burstow Stream at East and North Horley	06/01/2014	13:02	1501
Gatwick Stream at South West Horley	06/01/2014	18:02	146
Burstow Stream at East and North Horley	17/01/2014	08:25	1506
Gatwick Stream at South West Horley	17/01/2014	09:26	146
Burstow stream at East and North Horley	01/02/2014	02:28	1492
Gatwick Stream at South West Horley	01/02/2014	03:41	151
Gatwick Stream at South West Horley	06/02/2014	19:09	150
Burstow stream at East and North Horley	06/02/2014	19:35	1508

During the flooding at Horley from December 2013 to February 2014 the EA provided ambassadors to support both local communities and their partners. During flooding events, the EA Flood Ambassadors visit homes and offer advice and listening to the concerns of residents. The role of the flood ambassadors is to:

- Provide information on the latest flooding situation;
- Raise awareness of the EA's Floodline service and information available on the EA's websites;
- Answer queries and provide advice on what to do before, during and after a flood;
- Maintain the presence of the EA and where possible reassure the public;
- Inform their Area Incident Room of developments on-the-ground and feedback from communities affected.

Section 5 provides details of EA's wider flood risk management functions and other relevant actions prior to, during and since the flood incident.

## **Surrey County Council**

A number of roads were subject to a temporary road closures during the flooding:

- Meath Green Lane (Horley)
- Reigate Road (Hookwood)
- Mill Lane (Hookwood),
- Tanyard Way (Horley)

SCC have cleared a culvert on Reigate Road, Hookwood.

SCC are undertaking an assessment of potential options to reduce flood risk in the Burstow.

Section 5 provides details of SCC's wider flood risk management functions and other relevant actions prior to, during and since the flood incident.



## 10. Sub Area: Redhill

### 10.1. Sub Area Definition

This sub area covers the area of Redhill. It includes London Road/Brighton Road A23, Gatton Park Road, Wray Common Road and Whitepost Hill.

### 10.2. Location and Catchment Description

There are no major watercourses in Redhill - minor watercourses include Redhill Brook and ponds located in Temple Wood and Serpentine Wood. Redhill Brook flows through the town of Redhill before merging with Salford Stream, a tributary of the River Mole. Redhill Brook follows the gap through the North Downs ridge, therefore its catchment includes more permeable deposits. Further attenuation is provided by the water meadows and the marshes upstream of Redhill. The underlying land in Redhill would suggest a less “flash-type” regime. However, Redhill Brook has increased rates of conveyance during flood events, due to the fact that it is heavily culverted and urbanised through Redhill.

Redhill was subject to flooding during the storms of the 23 and 24 December 2013 (Reigate and Banstead Borough Council, 2014). The flooding, across the River Mole catchment (including Redhill) was a combination of surface water flooding, river (fluvial) flooding and groundwater flooding mechanisms. In some areas it was not possible to distinguish between fluvial flooding and surface water flooding.

During the 23 and 24 December storms, Redhill Brook responded quickly to rainfall, with levels during the storm events being much higher than those seen the rest of the winter 2013-2014. The return period for the Redhill Brook catchment estimates are shown in Table 10-1.

**Table 10-1 Indicative return period estimate relating to flooding in Redhill**

Catchment	Community	Peak flow or level and date of peak	Event rarity as annual chance (%)	Event rarity as return period (years)	Source/justification of estimate
Redhill Brook	Redhill	2.46 m ALD on 24/12/2013	2.0	50	Estimate based on correlation with nearby sub-catchments and rainfall data

The return period for Redhill Brook is based on rainfall data. However, antecedent conditions were a major factor in relation to the catchment response, therefore it might be more appropriate to base any assessment of event rarity on peak river flow data. The peak flow river data should also be used with caution, as explained in Section 3.2.

EA flood mapping suggests that areas of Redhill are at risk of fluvial flooding from Redhill Brook. These areas are located close to the banks of Redhill Brook and are predominantly classified as low risk flood areas. However, there are some small patches which are classified as medium to high risk areas.

Gatton Park Road and Whitepost Hill were closed temporarily due to flooding.

The EA Flood mapping suggests that there is a risk of significant surface water flooding in the area surrounding ponds in Temple Wood and Serpentine Wood. London Road/Brighton Road A23, Gatton Park Road are clearly identified in the EA surface water flood maps as lying in a surface

water flow route. A small area of Whitepost Hill is also identified as an area that is at risk from surface water flooding. These maps are based on topography and their accuracy is not as robust as the fluvial flood maps, however they can be used to identify general flow routes. The flood risk maps do not take into account climate change. They are designed only to give an indication of flood risk to an area of land and are not sufficiently detailed to show whether an individual property is at risk of flooding

The Redhill sub area is underlain by sandstone and mudstone layers. The majority of the sub area is not underlain by superficial deposits, other parts are underlain by clay silt sand and gravel. This type of bedrock can have high inter-granular and/or fracture permeability and usually provide a high level of water storage. This type of aquifer is able to support minor watercourses such as those found in the Redhill sub area (i.e. Redhill Brook).

The majority of the sub area has a limited potential for groundwater flooding. However, around the A23 area there is a potential for groundwater flooding to occur at the surface.

The parts of the sub area around Burstow Stream are within the Flood Warning and Flood Alert Areas. These are areas for which the EA provides free flood warnings.

### **10.3. Identification of Relevant RMAs**

Following a range of consultation events during and since the floods, the relevant RMAs in this sub area have been identified as being the EA, the LLFA (SCC) and the Highway Authority (SCC).

### **10.4. Exercised Flood Risk Management Functions and Other Actions**

#### **Environment Agency**

From the end of December 2013, Redhill Brook was diverted into a quarry to alleviate flooding. This meant that for much of January and February, the flows from Redhill Brook were attenuated. The Redhill Brook burst its banks on 31 December and as a consequence the flow ran into an adjacent quarry. Emergency works were instigated to put an out fall in place to prevent a potential disaster. The flow was diverted back into the channel but was afforded some increased attenuation as a consequence of the quarry for January and February. A new channel was cut during March to re-establish the Redhill Brook.

Section 5 provides details of EA's wider flood risk management functions and other relevant actions prior to, during and since the flood incident.

#### **Surrey County Council**

Gatton Park Road (Redhill) and Whitepost Hill (Redhill) were subject to temporary road closures during the flooding.

SCC have carried out works on an ordinary watercourse on Colesmead Road (Redhill), which involved the removal of a grill and silt clearance.

Section 5 provides details of SCC's wider flood risk management functions and other relevant actions prior to, during and since the flood incident.

## 11. Sub Area: Reigate

### 11.1. Sub Area Definition

This sub area covers the area of Reigate. It includes Evesham Road, and Holmesdale Road.

### 11.2. Location and Catchment Description

There are no major watercourses in Reigate - a minor watercourse includes Wallace Brook and Priory Pond in the south of the catchment.

Reigate was subject to flooding during the storms of the 23 and 24 December 2013. The flooding across the River Mole catchment (including Reigate) was a combination of surface water flooding, river (fluvial) flooding and groundwater flooding mechanisms.

During the winter of 2013/2014 the sub area was subject to internal property flooding.

The EA flood mapping indicates that a small area to the south west of the Reigate sub area is at risk of fluvial flooding from Wallace Brook. The extent of flooding in this area is classified by the EA as an area at medium risk from fluvial flooding. Significant risk of surface flooding is indicated on the EA flood mapping between Reigate train station and the A242 and in the area surrounding priory pond. These maps also indicate that there is potential risk of surface water flooding in the area surrounding Evesham Road and Homesdale Road. The surface water maps are based on topography and their accuracy is not as robust as the fluvial flood maps, however they can be used to identify general flow routes. The flood risk maps do not take into account climate change. They are designed only to give an indication of flood risk to an area of land and are not sufficiently detailed to show whether an individual property is at risk of flooding.

The Reigate sub area is underlain by mudstone and sandstone layers. There are no superficial deposits underlying the sub area. EA flood mapping describes the aquifer underlying the sub area as a 'primary aquifer', which are defined as layers of rock or drift deposits that have high inter-granular and/or fracture permeability. They usually provide a high level of water storage. Such aquifers are able support river base flow and hence and the minor watercourses present in Reigate under normal conditions.

The majority of the sub area has a limited potential for groundwater flooding in. However, in the south of Reigate there are more areas with a potential for groundwater flooding to occur at the surface.

The sub area is not located within the EA Flood Warning or Flood Alert Areas.

### 11.3. Identification of Relevant RMAs

Following a range of consultation events during and since the floods, the relevant RMAs in this sub area have been identified as being the LLFA (SCC) and the Highway Authority (SCC).

### 11.4. Exercised Flood Risk Management Functions and Other Actions

#### Surrey County Council

No flood risk management functions relevant to SCC have been identified as specific to the flood incident in this sub area.

Section 5 provides details of SCC's wider flood risk management functions and other relevant actions prior to, during and since the flood incident.

## 12. Conclusion

The objective of this report is to investigate which RMAs had relevant flood risk management functions during the flooding and whether the relevant RMAs have exercised, or propose to exercise, their risk management functions (as per section 19(1) of the Flood and Water Management Act 2010). It should be noted that this duty to investigate does not guarantee that flooding problems will be resolved and cannot force others into action.

The report has identified that the EA carried out actions in relation to the flooding experienced in Reigate & Banstead over winter 2013/14. It has also been established that SCC did not have any direct flood risk management functions in responding to the flood event, but strategic functions and other supportive actions were taken, which have been outlined in the report.

### 12.1. Causes

There were approximately 60 incidents of internal property flooding in Reigate & Banstead. The main cause of the widespread flooding across Surrey was the exceptional and unprecedented amount of rainfall that fell over the months of December, January and February 2013/14, which in turn resulted in major flooding from fluvial, surface water, ordinary watercourse and groundwater sources. The River Mole was the main source of fluvial flooding in the Borough, causing a large number of internal property flooding incidents and road closures in Horley & Salfords, Redhill and Reigate.

### 12.2. Flood Data

While systems are in place to record instances of flooding on a day-to-day basis, it was found that the data format and specific details of flooding records were inconsistent across different organisations. For example, approaches that generically recorded properties as “affected by flooding” did not make clear whether the property was flooded internally. This caused issues when collating the data into a central database, reducing the level of accuracy for some specific flooding records.

LLFAs have a responsibility to manage the risk of groundwater flooding but due to the complex nature of flooding from this source, information on groundwater flood risk is very limited and appropriate only for strategic use and general consideration for specific sites. More information on groundwater flooding incidents and groundwater level monitoring will assist in improving general understanding of groundwater flood risk in Surrey.

The information held by SCC on highway drainage assets and their condition is very limited in many areas, which can make it more difficult to identify the sources and cause of flooding in some instances. Information for smaller watercourses (privately owned or otherwise) is also very limited in some areas.

### 12.3. Role of Local Communities

In addition to the functions and actions carried out by RMAs, there are many ways in which residents and communities can reduce flood risk. Local flood forums existed in Surrey prior to the Winter 13/14 flood event but many more have been set up in the aftermath of this event. The role of RMAs in these local groups is instrumental in educating the public on flood risk and supporting them in implementing their own action plans and resilience measures. These groups also play a vital role in feeding back critical information on localised flooding issues to support the authorities in better understanding local flood risk and identifying potential solutions to mitigate this risk.

There are still widespread occurrences of riparian watercourses and ditches that are not maintained. Keeping all watercourses well maintained will not (in itself) prevent flooding from major flood events but the lack of maintenance of some riparian owned ditches was certainly a contributing factor on the impact of the flooding experienced from the winter 13/14 flood event.

## 12.4. Looking Forward

A vast amount of information on historic flooding was gathered as a result of the winter 13/14 flood event. This data will help highlight the areas most at risk of flooding in Surrey, enable the prioritisation of drainage maintenance works and support business cases when bidding for Government contributions towards major flood defence schemes.

## 12.5. Recommendations

Based on the findings of this Section 19 investigation, it is recommended that:

- All RMAs continue to improve their cooperation, coordination and communication with one another, particularly with regard to their flood risk management functions and during times of emergency.
- All RMAs continue to raise awareness of flood risk and increase the resilience of communities and businesses to flood risk, across Surrey.
- SCC and the EA further develop public awareness and understanding of riparian responsibilities, in order to improve the condition of watercourses across Surrey.
- All RMAs review their current processes for data collection during a flood event, giving consideration to the best practice guidance produced by SCC and the EA.
- All RMAs pass any records of future property flooding in Surrey to SCC for collation in a central database.
- SCC undertake studies where there is significant groundwater flooding to better understand the nature of the flooding and the levels of risk.
- All RMAs review the benefits of proposed flood schemes in the 6 Year Programme of Flood and Coastal Erosion Risk Management Schemes and consider whether partnership contributions may be justified.
- SCC undertake detailed drainage surveys where asset information is limited or non-existent, prioritising areas at greatest risk of flooding.
- SCC formalise the process for investigating major flood events under the S19 duty and agree this process with the Surrey Flood Risk Partnership Board, to ensure efficient partnership working and data sharing for future investigations.

## 13. Acknowledgements

Surrey County Council would like to thank the following organisations and groups for providing information and input into the Section 19 Flood Investigation Report:

- The Environment Agency
- Reigate & Banstead Borough Council
- Thames Water
- Atkins