

30th April 2014

Buckinghamshire County Council

Flood Investigation Report

The Willows, Aylesbury, 7th February 2014



Photos from the Bucks Herald – 7th February 2014

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Revision Schedule

Buckinghamshire County council **Flood Investigation Report**

30/04/2014

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1	22/04/2014	Draft for Review	Alex Back	Karen Fisher
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Executive Summary

This report has been produced by Buckinghamshire County Council to investigate the flooding that occurred on the Willows housing estate in Aylesbury on 7th February 2014. The report is being produced to detail the event and to improve responses to flood events in the future by making recommendations.

A section 19 investigation is a statutory requirement for Lead Local Flood Authorities (LLFA) required under the Flood and Water Management Act (FWMA) 2010. The LLFA in the area of Aylesbury is Buckinghamshire County Council. On becoming aware of a flood in its areas, a LLFA must, to the extent that it considers it necessary or appropriate, investigate:

- which risk management authorities have relevant flood risk management functions; and
- whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

It was deemed necessary to produce this report as the flood incident exceeded Buckinghamshire County Council's criteria for carrying out a Section 19 investigation with more than 5 residential properties within 1km².

This report will be published and all Risk Management Authorities relevant to the flood event will be informed of the Section 19 report.

The aim of the Section 19 investigation is to give an explanation of what happened in the flood event and what were the Risk Management Authorities (RMAs) responsibilities during the event. The recommendations are there to help the RMAs learn lessons from the event and to move forward with management of the flood risk in the future

The flood on 7th February 2014 occurred after a long period (over 6 weeks) of above average rainfall leading to a saturated catchment and the Stoke Brook and Sedrup Ditch close to capacity. The high rainfall in the early hours on 7th February 2014 created too much surface water runoff for the surface water drains and the water courses to convey downstream and away from the roads.

The main conclusions show that the catchment was saturated from heavy rain in the previous months. The river levels were high from heavy rain and surface runoff and these levels were increased by tree and vegetation debris and rubbish from fly tipping. It is possible that the culvert under the A418 was blocked and this culvert may be too small to convey flood flows. Resources around the area were very

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stretched with different flood events. The operational response to this event was slow initially and the co-ordination between the different RMAs could be improved.

A list of recommendations is included in the report which is intended to ensure that the flood management, warning and response to events are improved going forward. All the RMAs will be involved in taking forward these recommendations.

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1. Introduction

1.1 Background to investigation

This report covers a Section 19 flood investigation for the area of the Willows in Aylesbury. Flooding occurred in this area on three occasions during winter of 2013/2014 on 24th December 2013, 5th January 2014 and 7th February 2014 the most serious of these incidents was on 7th February 2014 when 79 houses in this area flooded.

A section 19 investigation is a statutory requirement for Lead Local Flood Authorities (LLFA) required under the Flood and Water Management Act (FWMA) 2010. The LLFA in the area of Aylesbury is Buckinghamshire County Council. On becoming aware of a flood in its areas, a LLFA must, to the extent that it considers it necessary or appropriate, investigate:

- which risk management authorities have relevant flood risk management functions; and
- whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

Where a LLFA carries out an investigation, it must:

- Publish the results of its investigation; and
- Notify any relevant risk management authorities.

Buckinghamshire County Council as LLFA has established a criteria for Section 19 flood investigations which can be found in the appendices. The flood event in the Willows area of Aylesbury is being investigated under section 19 of the FWMA as it meets the criteria of:

- internal flooding (including to basements) to five or more residential properties within an area of 1km²

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1.2 Site Location

The Willows housing estate is located in the west of Aylesbury to the south of the Oxford Road (A418) and to the west of Ellen Road as shown in Figure 1 (National Grid Reference SP 80865 12685).

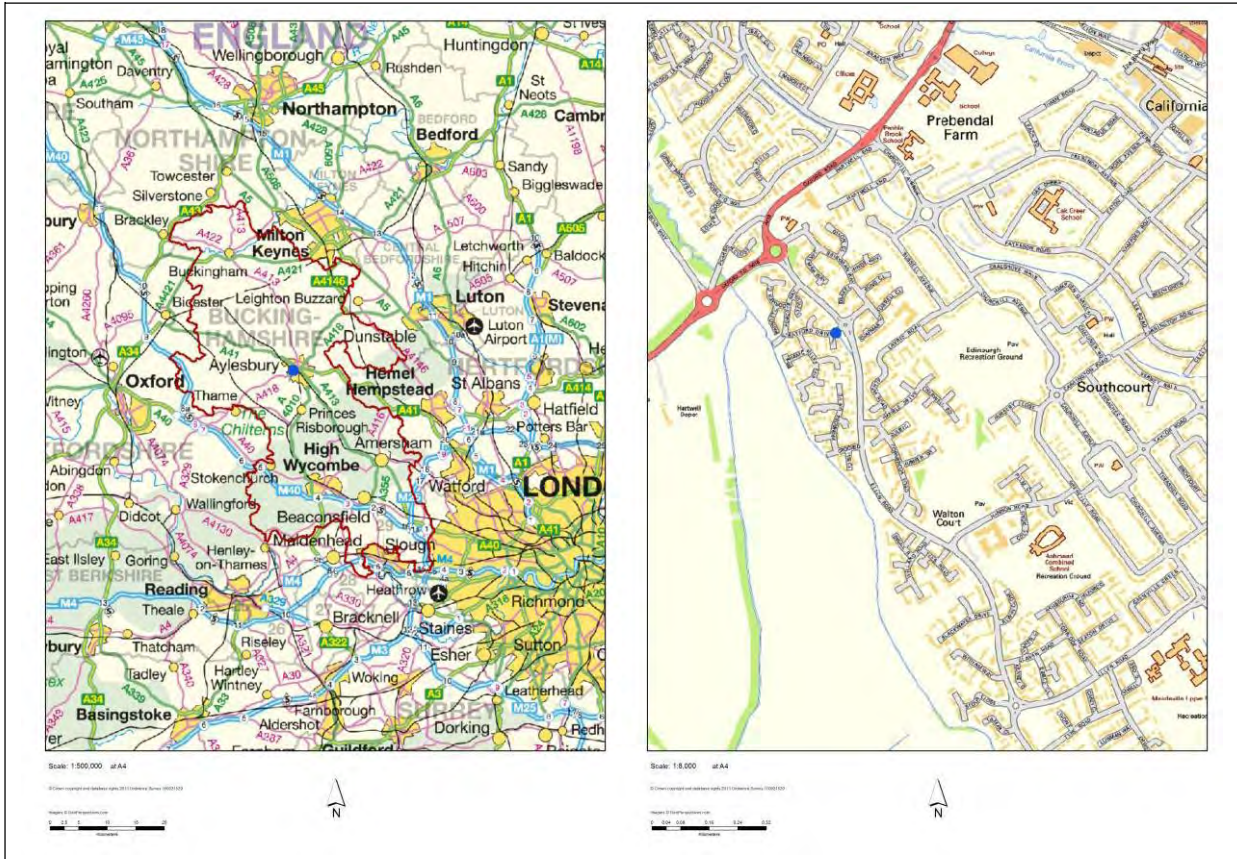


Figure 1 Location maps for the Willows estate at County and local level (Ordnance Survey License 100021529 2014)

1.3 Timeline of investigation

The area of the Willows was highlighted as requiring a flood investigation very soon after the event in discussions with the Risk Management Authorities (Bucks CC, AVDC, EA). Bucks CC have collected and collated information from a number of sources including other Risk Management Authorities (RMAs), local press reports and local residents.

David Lidington MP for Aylesbury convened a meeting with the organisations involved in the flood event on Friday 14th March 2014. Following this meeting the following meetings were undertaken to gather information for this investigation;

- 17/03/2014 Site visit of the Willows estate with Steven Lambert County Councillor for Aylesbury West and a Councillor for AVDC where contact was made with a number of local residents

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- 18/03/2014 Meeting with Ivan Crome Engineering Services at Aylesbury Vale District Council (AVDC)
- 07/04/2014 Meeting with Stuart Campbell, Local Area Technician for Transport for Buckinghamshire.
- 10/04/2014 Site visit with Gareth Simpson Environment Agency to explore possible reason for flooding and possible recommendations for future mitigation measures
- 11/04/2014 Meeting with Andy Gosling Buckinghamshire Fire and Rescue Service

1.4 Location

The Stoke Brook flows from west to east on the southern edge of the Willows housing estate. From the south east it is joined by the Sedrup Ditch just before going through two culverts under the A418 Oxford Road and Pearson Close. It then flows into Bear Brook, near Trenchard Street, Aylesbury and finally into the River Thame near the Thames Water sewage treatment works. The Stoke Brook and the Sedrup Ditch drain a catchment of 11km² (National Grid Reference SP 80865 12685).

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2. Background/ History of flooding

2.1 Catchment characteristics

The Stoke Brook and the Sedrup Ditch are both main Rivers which are defined as a watercourse marked as such on the main river map produced by the Environment Agency. The main river can include any assets such as structure, banks or appliances for controlling or regulating the flow of water in, into or out of a main river. Some characteristics of the Stoke Brook are that the channel is 3.6m bank full width and 1.7m deep opposite Bonham Close. Just upstream of the Oxford Road Culvert the channel is 2.6m wide at bank full and 0.9m deep on left bank and 0.4m deep on right bank.

Figure 3, 4 and 5 below show the fluvial and surface water flood maps respectively for the estate. The fluvial flood maps (Fig 3) show the flooding which would occur from the rivers in a 1 in 100 year (dark blue) 1 in 1000 year (light blue) event. The flood water in these situations would come from the river and flow out onto the impacted areas. The surface water flooding in different events shows the different depths of flooding in 1in 100 year (fig 4) and 1 in 1000 year (fig 5). The surface water flooding would occur when extreme rainfall falls on the ground and cannot flow into the rivers as the river is either full and/or the volumes of water are too great for the drainage pipes leading to the river.

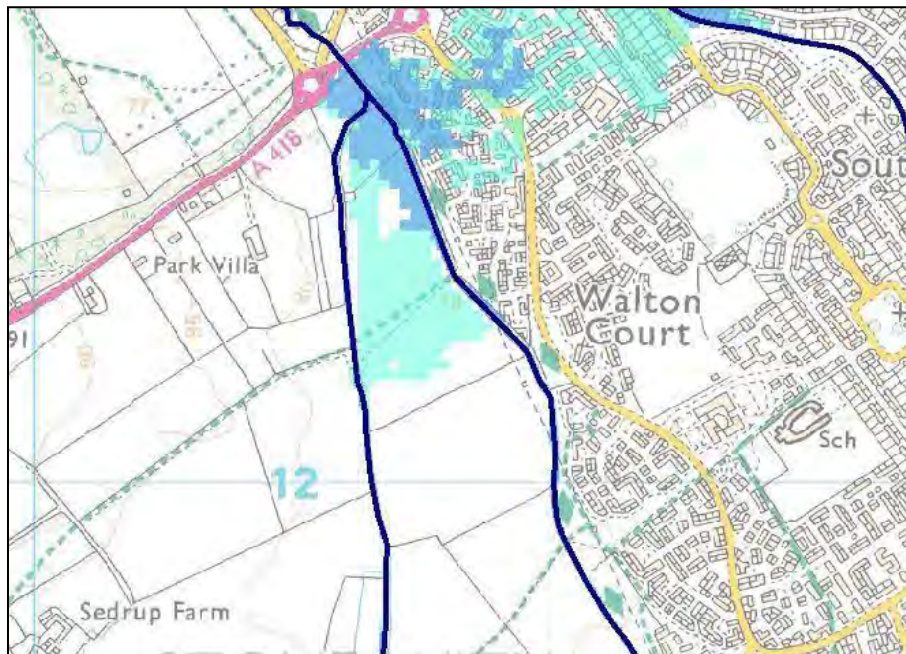


Figure 3 EA Flood map showing Stoke Brook and Sedrup Ditch 1:100 year event (flood zone 3) in dark blue and 1:1000 year (flood zone 2) in light blue (EA, 2014)

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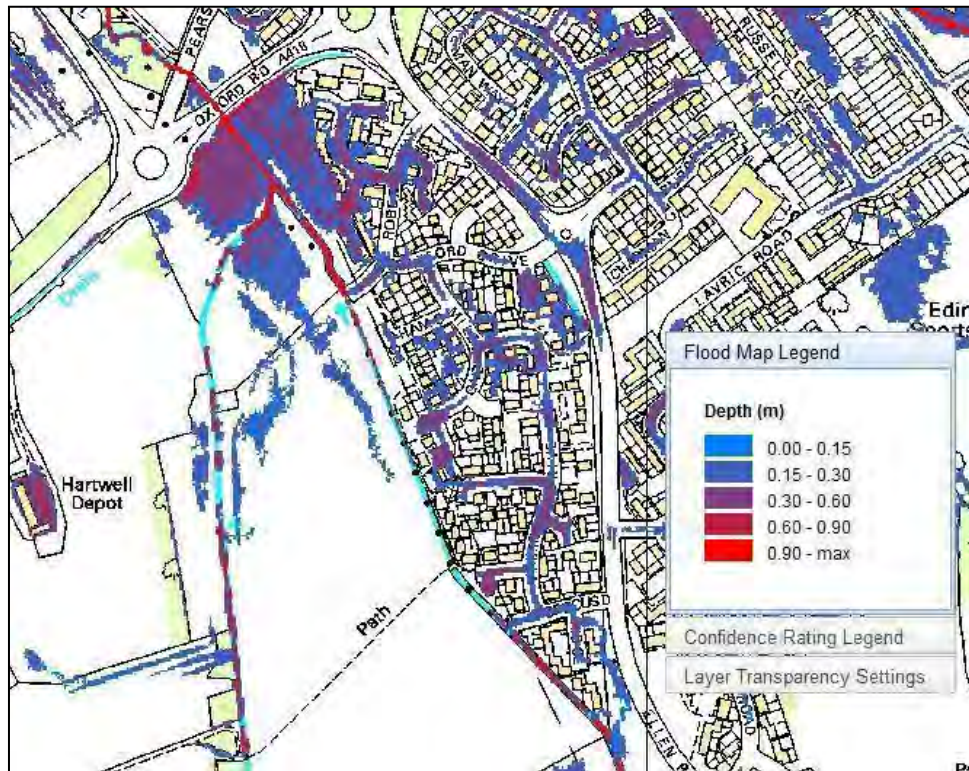


Figure 4 1:100 year Surface Water flood map showing predicted depth across the Willows estate (EA, 2013)

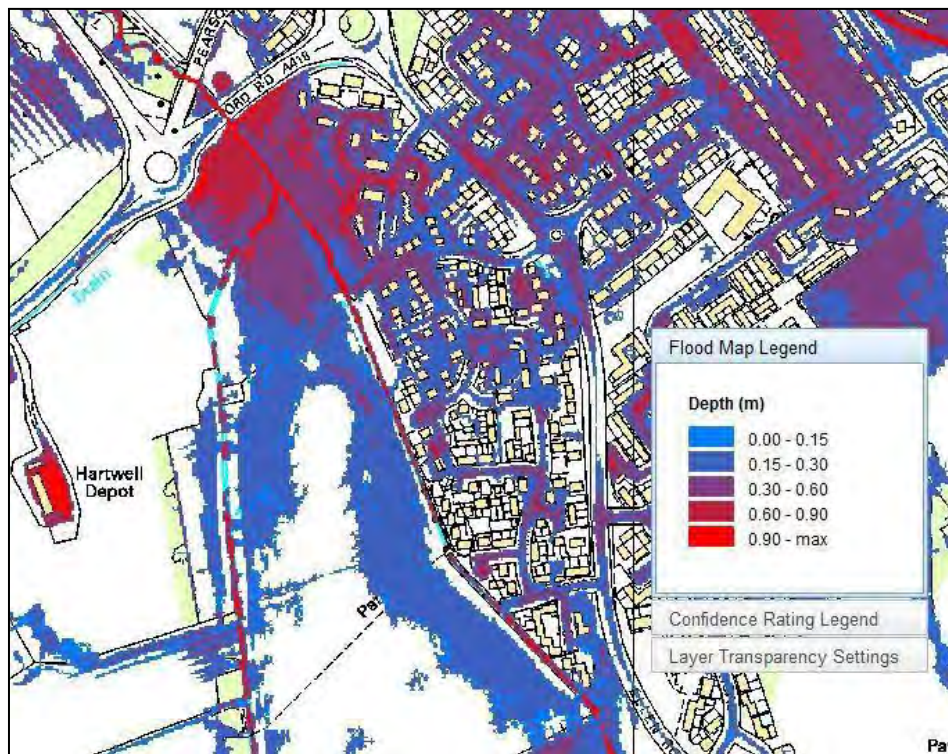


Figure 5 1:1000 year Surface Water flood map showing predicted depth across the Willows estate (EA, 2013)

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The geography of the catchment is described below looking specifically at; geology, hydrogeology and topography.

Geology:- The brook is situated on the superficial alluvium (clay, silt, sand and gravel) and the solid geology is mudstone (Kimmeridge Clay Formation).

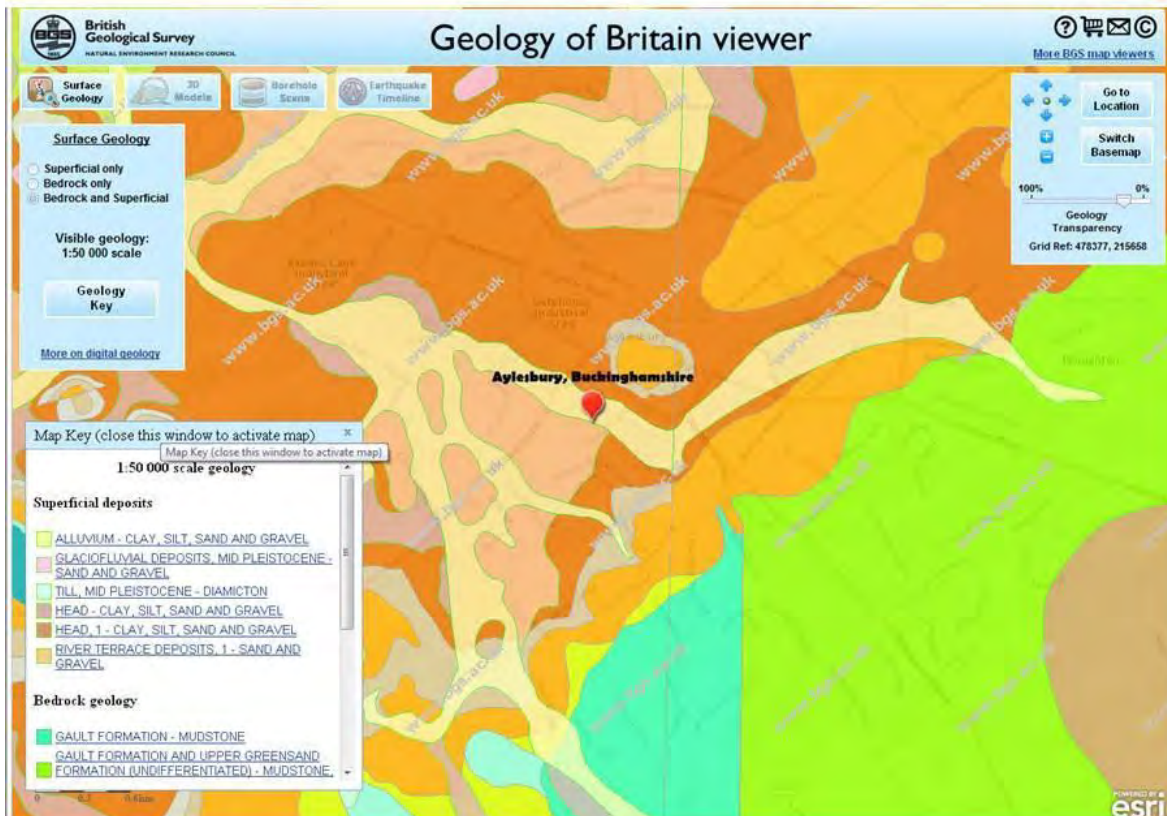


Figure 6 Geology of the Aylesbury area (BGS online Map, 2014)

Hydrogeology:- The Thames catchment has only a small component of groundwater flow from Chilterns scarp chalk springs and localised gravel aquifers. The Stoke brook has no groundwater components in its hydrology from geological mapping as explained above and shown in Figure 6.

Topography:- The valley of the Stoke Brook is fairly shallow sloping from 75mAOD to 80mAOD from the south east to the north west across the site over a distance of 650m. To the west of the Stoke Brook there is a slight hill that rises from 75mAOD to 91mAOD at Hartwell House, Park Hill over a distance of 2km.

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2.2 Previous flood events

The area is in a flood risk zone as described in section 2.1 above but there have only been a few small events in the past 5 years. Buckinghamshire Fire and Rescue Service attended flooding in 2011 in Bonham Close parking area and one to two gardens of residential properties were flooded and the cause of the flooding was deemed to be heavy rainfall too intense for the surface water drainage system. On 24th December 2013 some roads and parking areas on the estate flooded to a low level only causing minor disruption to the residents. This was thought to be a result of heavy rainfall overwhelming the surface water drainage system. One property on Dormer close flooded internally on 7th January 2014 along with several garages along the edge of the Stoke Brook in Parrot Close and Roberts Way. This was due to the Stoke Brook flooding into the estate via the road drainage system egressing out of the gullies.

2.3 Data

There are no EA flow or level gauging stations on the Stoke Brook. The flow gauges on the River Thames will not show the detail of the flood hydrograph that would be required for the analysis of this event in this area as it is too distant and on a different river. The nearest EA rain gauge is Aylesbury Sewage Treatment Works (STW) (TP261923) near the Aylesbury Vale Parkway station. Figure 7 below gives the daily rainfall totals from the Aylesbury STW for the six weeks from 1st January 2014. From this data it can be seen that there were high levels of rainfall in this six week period with peaks on 7th and 16th January and 7th February. There was rainfall almost daily in this six week period.

The rain gauge recorded 9mm of rainfall between 2am and 4am on 7th February 2014. A total of 14.2mm of rain fell in total on 7th February 2014 and the cumulative total from 1st January to 6th February was 136mm (Figure 7). The preceding conditions would have been saturated soil which is alluvium characterised by poor infiltration meaning that the rain that fell on 7th February will have runoff quickly into the Stoke Brook and the Sedrup Ditch.

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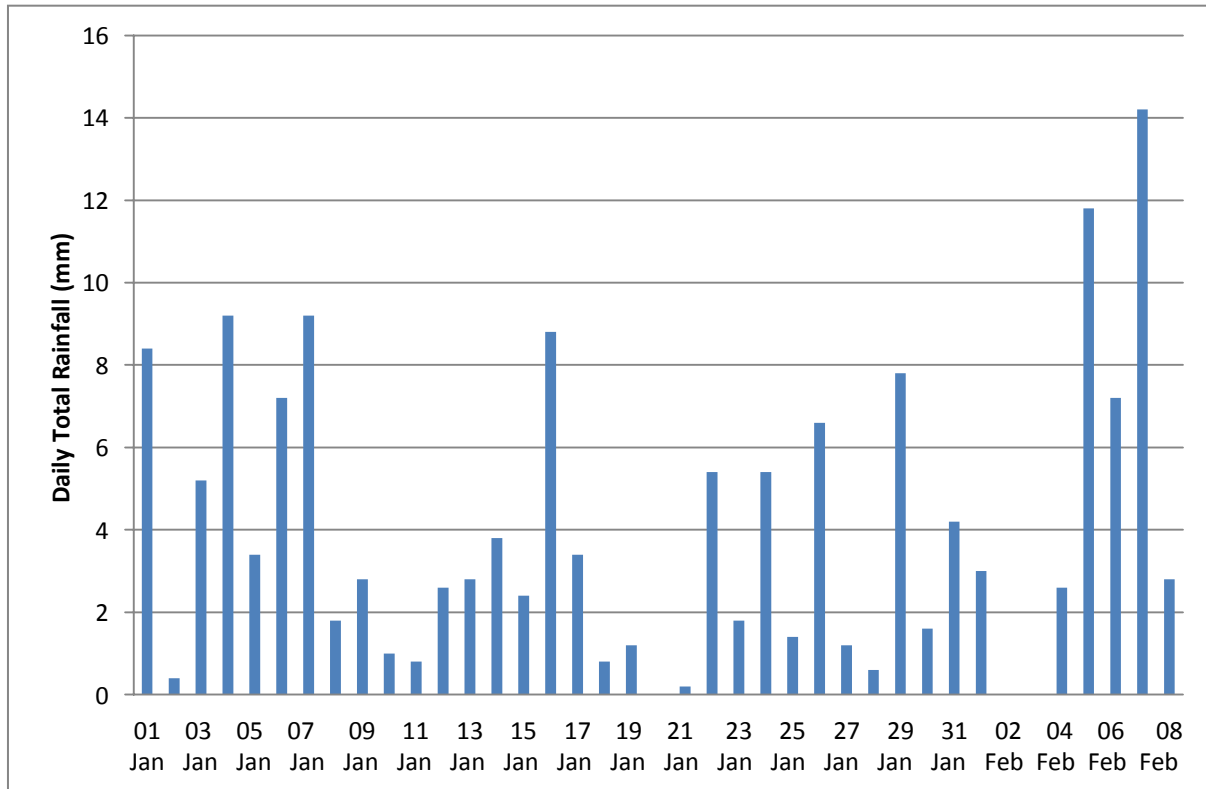


Figure 7 Daily total rainfall for EA Rain gauge at Aylesbury STW

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2.4 Drainage assets/ structures or features that affect flood risk

Figure 8 shows the gullies on the Willows housing estate these are all connected into the surface water drainage system. The drainage system then flows via gully outfalls into the Stoke Brook in seven locations as shown in figure 8. Thames Water own and maintain the surface water drains that take the water from the gullies and gully pipes (TfB) via the gully out falls into the Stoke Brook.

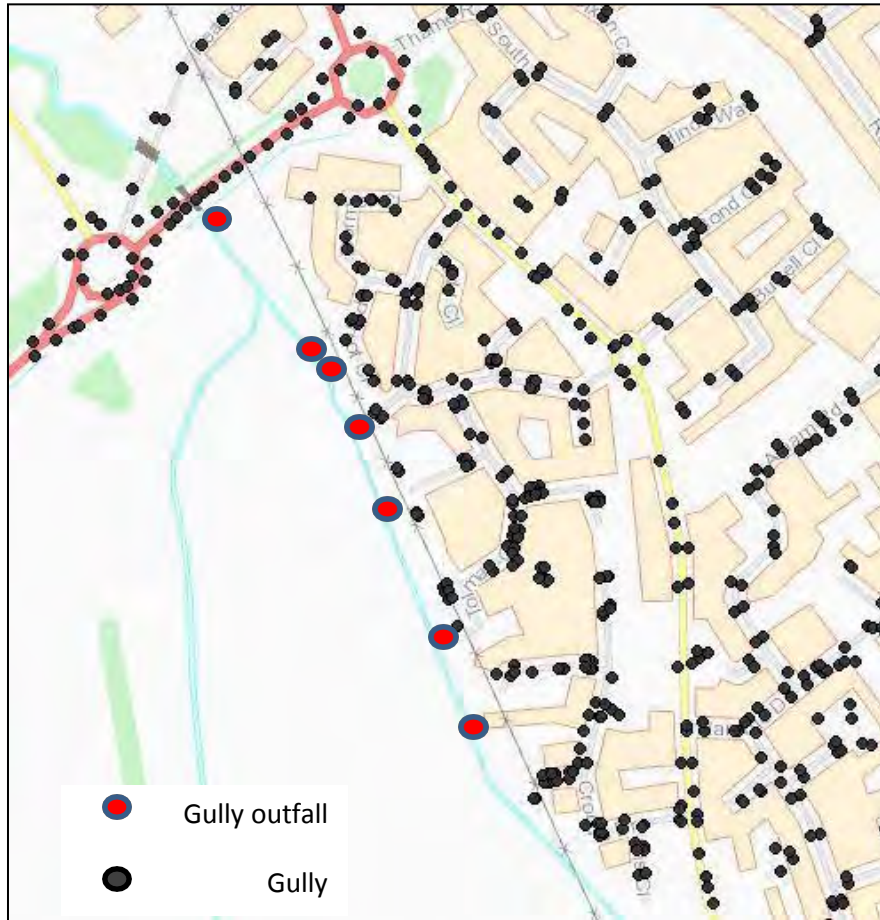


Figure 8 Map showing road gullies in the Willows, Aylesbury

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3. Analysis of 7th February 2014 flood event

3.1 Conditions at the time

Rainfall during December, January and early February meant that the whole catchment was saturated and both the Stoke Brook and the Sedrup Ditch would have been close to bank full. Therefore when the rain fell between 2 and 4am on 7th February (9mm in 2 hours) the water courses were already full.

3.2 Condition of features/ structures

The gully outfalls from the surface water drains on the Willows housing estate were silted up as they entered the Stoke Brook. Figure 9 shows one of the outfalls before de-silting and figure 10 shows one after de-silting.

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Figure 9 Silted up gully at Stratford Drive (Chris Spreadborough, Resident)



Figure 10 10/02/2014 16:31 Gully outfall - Councillor Steven Lambert

3.3 Condition of watercourse

The Stoke Brook was fairly over grown in places and had suffered from fly tipping. Figures 11, 12 and 13 below show some of the debris taken out of the brook after the flood event.

Figure 11 Debris taken out of Stoke Brook prior to flood event



Figure 12 10/02/2014 16:52 Silt removed from Stoke Brook and gully outfall at end of Fox Glove - Councillor Steven Lambert

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Figure 13 10/02/2014 Rubbish removed from Stoke Brook – Councillor Steven Lambert



3.4 What happened? (Flows paths, damage etc.)

The flood on 7th February 2014 occurred after a long period (over 6 weeks) of above average rainfall leading to a saturated catchment and the Stoke Brook and Sedrup Ditch close to capacity. The high rainfall in the early hours on 7th February 2014 created too much surface water runoff for the surface water drains and the water courses to convey downstream and away from the roads.

Having investigated the exact flow paths that the flood water took with all the stakeholders involved; AVDC, BFRS, EA, Bucks Resilience, TfB, residents and the County Councillor there are some differences in opinion as to what happened and why. The timeline of events and actions taken by the stakeholders is summarised in table 1 below. The main likely flow paths are shown in figure 14 but it is also known that the Stoke Brook flooded over the green area adjacent to Dormer Close and Parrot Close into the roads and subsequently into some properties. There were also several reports from stakeholders that water was bubbling out of the gullies which is likely to be a result of the surface water drainage system being overwhelmed by the high rainfall and not being able to flow away due to the water courses being at capacity.

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The flooding began during the early hours of the morning of 7th February 2014 and resulted in 80 properties flooding internally and these are shown in table 2. From the reports the flooding appears to have been from the river overtopping the banks at low spots along the banks at across the green area adjacent to Dormer Close and Parrot Close. Due to the high water levels in the river the surface water was not able to drain down gullies and connecting pipes and may have backed up through the gullies from the river. The debris and flytipping in the river would have increased levels in the river and therefore the flooding. Any blockage or constriction due to the culvert size at the A418 culvert would have increased water levels in the river and increased the flooding. When the debris was removed and the peak of the flood flow had passed then water levels began to subside in the early afternoon of 7th February 2014.

3.5 Incident Response

The response of all the different RMAs is given in Table 1. The summary of this response is given below:

- The County Councillor from Bucks CC responded to requests from local residents regarding flooding but was “alone on site until 10.30am” on 7th February
- The initial response from the Environment Agency as the RMA for the main river and AVDC and TfB/BCC was slow. There were many different issues which EA and TfB/BCC were dealing with in the early hours of 7th February 2014.
- AVDC opened a Rest Centre at 2:00pm on 7th February although only two residents utilised this service over night, other residents evacuated the area making arrangements to stay with friends and family.
- The TfB team responded well once they understood the County Councillor the seriousness of the situation
- Once the EA and TfB responded the action on the ground was good to provide 200 sand bags (TfB) and clearing of vegetation from Stoke Brook by the EA.
- AVDC delivered gel bags and BFRS delivered sand bags.
- Particular thanks goes to a local builders’ merchant and residents who donated and distributed sand and to the Kier construction team for their response and help following a tweet.
- Ellen Road ditch was cleared out by Aylesbury Vale District Council.
- Two resilience officers from BCC attended the incident on 7th February 2014.

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Table 1 Timeline of events and actions by key stakeholders

Date and Time	Text	Who?	Photo?
01/12/2013	Gully clearing and cleaning	TfB	
01/12/2013	Silted up gully outfalls Stratford Drive and Foxglove Close	Resident	Photos
01/12/2013	Over grown and rubbish in Ellen Road ditch	Resident	Photos
24/12/2013	Lupin Walk and part of Primrose Drive Roads flooded	TfB	
24/12/2013	Stoke Brook at capacity	Councillor Steven Lambert	Photos
01/01/2014	Gully clearing and cleaning	TfB	
01/01/2014	Stoke Brook flooded onto green behind Dormer Close	Councillor Steven Lambert	Photos
01/01/2014	Garages flooded in Parrot close, Roberts Way and Bonham Close	Councillor Steven Lambert	
07/01/2014	Sand bags delivered to Lupin Walk	TfB	
07/01/2014 18:00	David Thomas (AVDC EPO) & Ivan Crome (AVDC Eng Tech) visited site	AVDC	
07/01/2014 19:00	Flushed the sewer drains	Thames Water	
08/01/2014	Stuart Campbell, Local Area technician visited site and noted that flood was due to high water level in brook backing up through surface water drains and out of gullies into roads.	TfB	
06/02/2014	70mph gusts of wind reported - possible damage to trees and bushes over hanging Stoke Brook which might have added to the debris blocking the culvert under the A418	AVDC	
07/02/2014	Flooded again including internal flooding	TfB	
07/02/2014	200 sand bags delivered to site	TfB	
07/02/2014	Cleared debris and vegetation from Stoke Brook	EA	
07/02/2014 05:30	Flooding on Stratford Drive 15cm on flood water the whole house during the morning	Resident	Photos
07/02/2014 05:34	1st emergency call to residents in Miles End	BFRS	
07/02/2014 08:15	Flooding on Stratford Drive	Resident	Photos
07/02/2014 08:33	2nd emergency call to residents in Thomson Close	BFRS	
07/02/2014 08:40	Flooding on Stratford Drive and Miles End	Resident	Photos
07/02/2014 09:46	3rd emergency call to residents in Miles End and Stratford Drive	BFRS	
07/02/2014 10:00	Brotheridge Court Flooded	Resident	Photos
07/02/2014 10:27	4th emergency call to residents in Brotheridge Court	BFRS	
07/02/2014 10:30	50 to 60 properties on the Willows Estate have flooded	BCC Resilience	
07/02/2014 10:45	Sand bags distributed from his own van that he purchased with his own money	Local Resident	
07/02/2014 11:00	Evacuation commenced	Bucks Fire and Rescue Service	
07/02/2014 11:00	Andy Gosling made two inspections of the Stoke Brook and on both occasions it was flowing very fast	BFRS	
07/02/2014 11:00	2000 sand bags delivered	BFRS	
07/02/2014 11:30	BCC Leader arrived with a photographer	BCC	
07/02/2014 11:30	Delivery of a large quantity of sand and bags	Kier Construction Team	
07/02/2014 11:30	Water had been coming out of the drains and the road was flooding, this is about 200m from the Brook.	Resident	Photos
07/02/2014 13:26	EA operations message on BFRS radio "Culvert now open at both ends and unobstructed" to JC51 Station Manager Gruchy	BFRS	
07/02/2014 14:00	Rest centre opened	Aylesbury Vale District Council	
07/02/2014 14:00	Transport from Willows to rest centre arranged	BCC Resilience	
07/02/2014 14:00	Support rest centre operation	British Red Cross	
07/02/2014 14:00	Delivery of sand bags	AVDC/BCC	
07/02/2014 14:00	Permission granted to BFRS to pump water from Stoke Brook into field to lower levels and allow surface water drains to drain off.	EA	
07/02/2014 15:30	"The water started to retreat at a rate only possible, in my opinion, by clearing of a blockage."	Resident	
07/02/2014 20:30	Crews left the Willows estate, incident closed, all water had left the area	BFRS	
08/02/2014	50 sand bags delivered to site	TfB	
08/02/2014	Knocking on doors, talking to people and offering pastoral care.	Councillor Steven Lambert and Mike Smith	
08/02/2014 22:00	Rest centre closed	Aylesbury Vale District Council	
09/02/2014 09:00	Walked flood areas, swept faeces off the roads and kerbs, litter picked and swept the pavements.	Councillor Steven Lambert, Mike Smith and other councillors	
10/02/2014	Gully clearing and cleaning	TfB	
10/02/2014	Reports of flooding in Cannock Road on the Willows estate	AVDC and BCC Resilience	
10/02/2014	Branches from trees and bushes removed from Stoke Brook	AVDC	
10/02/2014 09:00	BFRS confirmed to resident that a blockage was cleared by the EA from the river.	Resident	
10/02/2014 14:00	On site with contractor to clear silt from gully outfalls	AVDC	
11/02/2014	Finished clearing gully outfalls	AVDC	
11/02/2014 13:00	Tree limbs removed from flow channel abutting Ernest Cook Trust Land. EA ops team arrived at same location 13.00pm to cut trees up for removal.	AVDC and EA	
12/02/2014	Flood Information Bus parked nearby for 2 days	AVDC, BCC and BFRS	
15/02/2014	Rubbish removed from Brook	Resident	Photos

From the EA operational log which was supplied there is no record of actions taken on Stoke Brook by their staff.

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Figure 14 Possible flow paths for flood event on 7th February 2014

30th April 2014**Table 2:** Internal property flooding on the Willows housing estate by street

Street	Number of Properties
Dormer Close	12
Parrot Close	8
Todd Close	4
Ayres Close	8
Stratford Drive	5
Brotheridge Court	12
Miles End	14
Bonham Close	2
Ellen Walk	6
Thomson Close	9
Total	80

3.6 Possible causes

Open watercourse conditions

The water levels in the Stoke Brook and Sedrup ditch were high due to high rainfall. These high water levels would have been the primary reason for the backing of water through the road drains and gullies. Some other reasons may have exacerbated the high water levels from rainfall and surface water runoff as listed below.

The Stoke Brook was overgrown with vegetation on the banks. There was debris from fly tipping and from fallen branches and twigs from the high winds in the previous weeks.

There was some siltation of the outfalls into Stoke Brook from the road drainage pipes. This siltation would have caused some backing up at lower flow levels but as the water levels in Stoke Brook would have been high these would have been the primary reason for backing up of water into the drainage pipes and gullies.

The ditch alongside Ellen Road (shown as a black line in Fig 14) was very silted and therefore did not appear to operate efficiently and water ponded around this area. The ditch was cleared and re-profiled by AVDC after the flood event to help with drainage in this area.

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Conditions of pipes, gullies and culverts

The road gullies had been cleared twice within the preceding three months so it assumed that they were clear. The pipe from the gullies to the Stoke Brook may have not been large enough capacity to cope with the amount of runoff caused by the extreme rainfall. The pipes were not able to convey the water into the Stoke Brook as this was running very full.

The culvert under the Oxford Road A418 appears to have been a “pinch point” with the flow backing up from this point back towards the Willows estate. This backing up may be because the culvert was blocked with debris or that the culvert is undersized for the volume of water required to flow through.

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4. Responsible Authorities and landowners

There are different responsibilities for flood management depending on the type of flooding. Organisations responsible for flooding are known as Risk Management Authorities (RMAs) and their responsibilities are detailed below. Riparian landowners also have responsibilities for watercourses across their land and these are also detailed below. These are summaries of the details included in the Bucks CC Local Flood Risk Management Strategy (2013-2018).

4.1 Lead Local Flood Authority

The Lead Local Flood Authority in this area is Buckinghamshire County Council. Bucks CC have a role as a Risk Management Authority in co-ordinating management of local flood risk from surface water, ground water and ordinary watercourses in the county. The Stoke Brook and Sedrup Ditch in this area are main river so therefore the responsibility for the flooding from rivers in this area comes under the Environment Agency. Any flooding from surface water comes under Buckinghamshire County Council as the LLFA.

4.2 Aylesbury Vale District Council

Aylesbury Vale District Council (AVDC) have responsibilities to inspect and maintain watercourses on District Council land, respond to requests for assistance during flood events and have the power to carry out flood risk management work which will benefit management of surface runoff, groundwater and ordinary water courses.

4.3 Environment Agency

The Environment Agency is one of the risk management authorities (RMAs) as defined by the Flood and Water Management Act (FWMA) 2010. Protecting the river environment and managing flood risk is part of their job. The Environment Agency is the RMA for flooding from main rivers.

The Stoke Brook and Sedrup Ditch are both main river and are therefore the EA are the RMA for fluvial flood risk in this area.

4.4 Highways Authority – Transport for Buckinghamshire

Any flooding from highways is managed by the Highways Authority which is Buckinghamshire County Council and the highways function is managed by Transport for Buckinghamshire.

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4.5 Water Utility Company – Thames Water

Thames Water are responsible for flooding from foul sewers and surface water sewers which they own. Whilst undertaking this they must manage flood risk from sewers.

4.6 Landowners and riparian owners

Landowners and riparian owners must maintain any culvert, or the bed and banks of any adjacent watercourse. They should clear away any debris from the watercourse or culvert even if it did not originate from their land.

A map of land ownership of the Willows area is shown below in figure 17. The land areas shown as hatched in the figure 17 are those owned by AVDC the blue areas are owned by the Ernest Cook Trust. Some of these areas border the Stoke Brook on the right bank and therefore AVDC have riparian owner responsibilities for these stretches. On the left bank and other sections of the right bank around the end of Miles End/Tolman Court the landowners whose properties or land border the river have riparian owner responsibilities.

Riparian owners can find further guidance on their responsibilities as landowners in the Environment Agency document “Living on the Edge” which can be found online at; <https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities>

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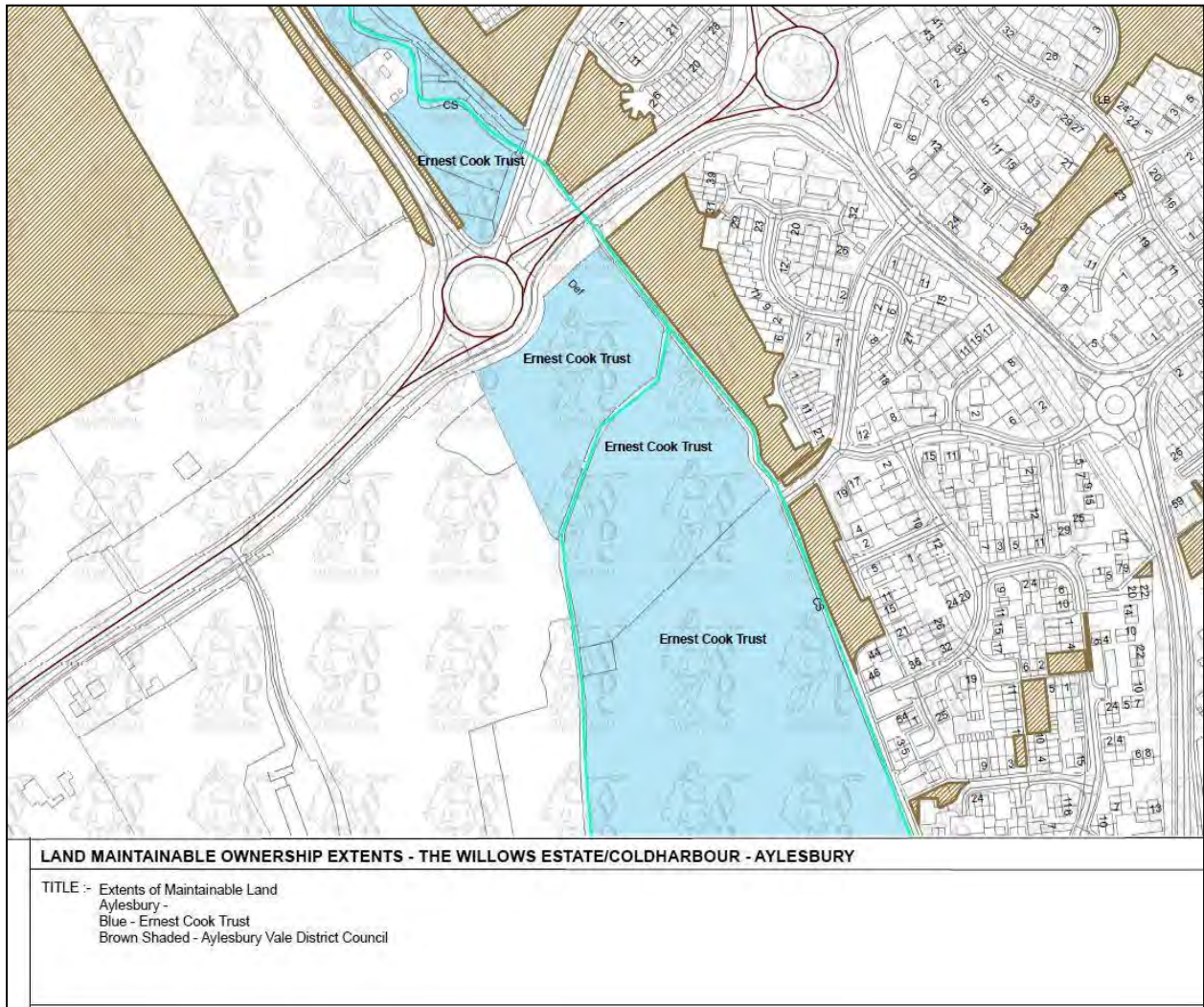


Figure 17 Landownership in the Willows estate area (AVDC, 2014)

4.7 Residents

Residents have a responsibility to take measures to protect themselves and their property when flooding is imminent.

4.8 Emergency Responsibilities

The emergency responsibilities are outlined in table 3 below.

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Table 3 Roles and responsibilities in an emergency, during and after a flood event

<p>Local (County and District) Authorities</p> <ul style="list-style-type: none"> • Coordinate emergency support within their own functions • Deal with emergencies on 'non main rivers' • Coordinate emergency support from the voluntary sector • Liaise with central and regional government departments • Liaise with essential service providers • Open rest centres • Manage the local transport and traffic networks • Mobilise trained emergency social workers • Provide emergency assistance • Deal with environmental health issues, such as contamination and pollution • Coordinate the recovery process • Manage public health issues • Provide advice and management of public health • Provide support and advice to individuals • Assist with business continuity 	
<p>Police Force</p> <ul style="list-style-type: none"> • Save life • Coordination and communication between emergency services and organisations providing support • Coordinate the preparation and dissemination <p>Fire and Rescue Service</p> <ul style="list-style-type: none"> • Save life rescuing people and animals • Carry out other specialist work, including flood rescue services • Where appropriate, assist people where the use of fire service personnel and equipment is relevant <p>Ambulance Service</p> <ul style="list-style-type: none"> • Save life • Provide treatment, stabilisation and care at the scene 	<p>Utility Providers</p> <ul style="list-style-type: none"> • Attend emergencies relating to their services putting life at risk • Assess and manage risk of service failure • Assist with recovery process, that is, water utilities manage public health considerations <p>Internal Drainage Board</p> <ul style="list-style-type: none"> • Operate strategic assets to reduce flood risk in partnership with RMAs and public <p>Town and Parish Councils</p> <ul style="list-style-type: none"> • Support emergency responders • Increase community resilience through support of community emergency plan development <p>Voluntary services</p> <ul style="list-style-type: none"> • Support rest centres • Provide practical and emotional support to those affected • Support transport and communications • Provide administration • Provide telephone helpline support
<p>Environment Agency</p> <ul style="list-style-type: none"> • Issue Flood Warnings and ensure systems display current flooding information • Provide information to the public on what they can do before, during and after a flood event • Monitor river levels and flows • Work with professional Partners and stakeholders and respond to requests for flooding information and updates • Receive and record details of flooding and related information • Operate water level control structures within its jurisdiction and in line with permissive powers • Flood event data collection • Arrange and take part in flood event exercises • Respond to pollution incidents and advise on disposal • Assist with the recovery process, for example, by advising on the disposal of silt, attending flood surgeries 	

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5. Conclusions and recommendations

5.1 Conclusions

- There was high rainfall on the night of 6th/7th Feb.
- Catchment was saturated due to wet conditions in preceding three months.
- Levels in Stoke Brook rose due to heavy rainfall and runoff from hard surfaces and already saturated areas. The levels may have been increased upstream of the A418 culvert which was reported to have been blocked by debris. The backing up from the A418 culvert and high water levels meant that the pipes from the road gullies were less able to convey the flood flows. Sediment at the outfall into the brook from the road gullies may have contributed in a small way to this restricted conveyance of flows from road to the Stoke Brook.
- The culvert under the A418 may not be of sufficient capacity to convey the required flood flows. This restricted capacity may have raised water levels upstream alongside the Willows estate.
- There was fly tipping in Stoke Brook which restricted the flow.
- There were branches, debris and vegetation in Stoke Brook which restricted the flow and caused the water level to rise higher. This debris was due to a combined impact of fallen branches as a result of high winds in the preceding few days and lack of maintenance of Stoke Brook.
- Environment Agency cleared debris and vegetation from Stoke Brook on 7th February.
- AVDC did further clearance of vegetation and silt on 10th/11th February.
- Transport for Bucks had cleared gullies twice within preceding 3 months.
- Fire service and the local County Councillor responded promptly to emergency calls.
- BFRS and TfB delivered sand bags to the area and AVDC delivered gel bags.
- Resources around the area were very stretched with different flood events. The operational response to this event was slow initially and the co-ordination between the different RMAs could be improved.
- Emergency response co-ordination could have been facilitated better if operational or tactical command had been established in combination with the Thames Valley LRF Flood Plan.

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5.2 Recommendations

- **Bucks CC** to ensure that owners of culverts, watercourses and drainage infrastructure are aware of their responsibilities.
- **Bucks CC, EA, AVDC and landowners** to discuss maintenance of watercourse and how to deal with fly-tipping issues and look at how maintenance can be improved.
- **Bucks CC** to facilitate sharing of information between RMAs and the community and to investigate establishing a residents' flood group.
- **Bucks CC** to keep in mind enforcement action under Section 25 of the LDA where landowners have failed to maintain watercourses.
- **EA and Bucks CC** to liaise and look at the catchment to consider options for flood management which could include:
 - flood attenuation upstream by adapting land use,
 - assessing the size, shape and slope of the Stoke Brook locally and along its length to check if flow can be slowed down
 - low embankment alongside the Willows residential area and
 - investigation of possible areas in the catchment where flood storage could be implemented.
- **EA, Bucks CC and TfB** to look at the design of the A418 culvert to check that it is sized correctly to take the required flow.
- **EA, Bucks CC and TfB** to investigate changing the Oxford Road culvert so that it is a more efficient shape to be able to convey storm flows during future flood events
- **EA, Bucks CC and TfB** to investigate installing a trash screen on the Oxford Road (A418) culvert and ensure that the trash screen is cleared regularly as part of ongoing maintenance program
- **EA** to distribute living on the edge leaflets to residents and land owners who own a section of the river bank.
- **EA** to complete a topographic survey to assess if the bank of the Stoke Brook is lower at the end of Foxglove Close.
- **EA** to investigate if flood warnings can be issued in this area.
- **AVDC and Ernest Cook Trust** to maintain the bushes and small trees on the bank of the Stoke Brook and Sedrup ditch, that they own, on a regular basis as part of their ongoing maintenance schedule.
- **AVDC** to advertise, encourage and enable residents to apply for the Repair and Renewal grant money which has been provided by Central Government.
- **TfB** to continue to clear and maintain the surface water drains and gullies on the

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Willows estate as part of their ongoing maintenance schedule.

- **Bucks CC, EA, AVDC, TfB and Thames Water** to discuss the best solution to keep the gully outfalls clear of silt using a sustainable solution.
- **Thames Water** to investigate whether installing flap valves on the outfalls would prevent water backing up through pipes and gullies when water levels in Stoke Brook are high.
- **Residents and land owners** who have riparian owner responsibilities to ensure that the Stoke Brook banks are maintained in a suitable manner.
- **Residents** to take measures to protect themselves and their property when flooding is imminent.
- **Residents** to document and photograph flood incidents where possible and report flooding to AVDC and/or Bucks CC and EA.
- **All RMAs** to make improvements to the emergency response and co-ordination from all organisations.
- **All RMAs** should fully understand the Thames Valley Local Resilience Forum Flood Plan and how Operational or Tactical Command Posts can aid the emergency response of all RMAs during an event.

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Explanation of Acronyms

Acronym	Definition
Bucks CC	Buckinghamshire County Council
BCC	Buckinghamshire County Council
AVDC	Aylesbury Vale District Council
EA	Environment Agency
TfB	Transport for Buckinghamshire
LLFA	Lead Local Flood Authority
RMA	Risk Management Authority
FWMA	Flood and Water Management Act 2010
IDB	Internal Drainage Board
BFRS	Buckinghamshire Fire and Rescue Service
NGR	National Grid Reference
BGS	British Geological Survey
STW	Sewage Treatment Works

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References

Reference in Document	Refers to
BGS online Map, 2014	http://mapapps.bgs.ac.uk/geologyofbritain/home.html
EA, 2013	https://www.gov.uk/government/publications/flood-maps-for-surface-water-how-they-were-produced
EA, 2014	EA flood map http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=en&topic=floodmap
AVDC, 2014	Supplied by Ivan Crome of AVDC Engineering Services

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Contacts

Lead Local Flood Authority



Flood Risk Management Team, Place Services, Buckinghamshire County Council, 9th Floor, County Hall, Walton Street, Aylesbury, HP20 1UY
email: floodmanagement@buckscc.gov.uk

Website: www.buckscc.gov.uk/flooding

Telephone: 0845 3708090 Monday to Friday 9am-5.30pm

Environment Agency



**Environment
Agency**

National Customer Contact Centre
PO Box 544
Rotherham
S60 1BY

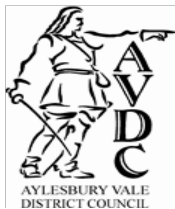
Email enquiries@environment-agency.gov.uk

Telephone 03708 506 506

Minicom (for the hard of hearing) 03702 422 549 Monday to Friday, 8am to 6pm

Website <https://www.gov.uk/government/organisations/environment-agency>

District Council



Aylesbury Vale District
Council
The Gateway
Gatehouse Road
Aylesbury
Bucks HP19 8FF

Opening times

Monday - Thursday
8.45am - 5:15pm

Friday
8.45am - 4.45pm*

Tel
01296585858

*Customer service centre closes at 4pm on
Friday.

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Highways Authority

Transport for Buckinghamshire

Transport and roads - 0845 2302882

Out of hours emergencies (Highways) - 01296 486630

E-mail: tfb@buckscc.gov.uk

Web: www.buckscc.gov.uk

Water Utility



Thames Water

PO Box 286

Swindon

SN38 2RA

Telephone: 0845 9200 800

Web: <http://www.thameswater.co.uk/help-and-advice/16739.htm>

Emergency Response

Buckinghamshire Fire and Rescue Service

Address: Buckinghamshire Fire & Rescue Service, Brigade HQ, Stocklake, Aylesbury, Bucks, HP20 1BD

Telephone: 01296 744400

Website: <http://bucksfire.gov.uk/>

Thames Valley Police

Telephone: 101 in non-emergency 999 in emergency

Website: <https://www.thamesvalley.police.uk/>

Buckinghamshire Ambulance Service

Telephone: 111 in non-emergency 999 in emergency

Website: <http://www.southcentralambulance.nhs.uk/content/press-release/buckinghamshire/flooding-advice.ashx>

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Appendices

Photo time line

Condition of Brook and gully outfalls prior to flood on 07/02/2014 Chris Spreadborough



Overgrown banks with huge amounts of silt & vegetation.



Choked up brook at foxglove.



Silted up gully at Stratford Drive



Overgrown ditch in Ellen Road.

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Pallets and rubbish in Ellen Road Brook Chris Spreadborough

07/02/2014 times unknown Photos of flooding – Resident Gary Wade



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07/02/2014 07:44 Flood – Councillor Steven Lambert

07/02/2014 08:15 From Stoke Brook looking up Stratford Drive Chris Spreadborough

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07/02/2014 08:15 Stoke Brook from the end of Stratford Drive Chris Spreadborough



07/02/2014 08:40 Junction of Stratford Drive/Miles End Chris Spreadborough



07/02/2014 08:20 Looking from the brook at Stratford Drive over towards Oxford Road (A418) Chris Spreadborough



07/02/2014 10:00 Brotheridge Court flooding Chris Spreadborough

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07/02/2014 11:30 Water had been coming up out of the drains and the road was flooding, this is about 200m from the brook Chris Spreadborough



07/02/2014 12:24 Internally flooded property - Councillor Steven Lambert



07/02/2014 12:15 Our back garden is starting to flood Chris Spreadborough

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07/02/2014 12:27 Internally flooded property -
Councillor Steven Lambert



07/02/2014 12:27 Internally flooded property -
Councillor Steven Lambert

07/02/2014 12:26 Internally flooded property -
Councillor Steven Lambert



07/02/2014 12:30 Getting closer to our back
door Chris Spreadborough

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07/02/2014 12:30 Just inches from the garage
Chris Spreadborough



07/02/2014 13:08 Numerous responding
agencies on site - Councillor Steven Lambert



07/02/2014 12:30 The damp patch shows where
it got close to the front door and garage before
we could stop it Chris Spreadborough



07/02/2014 14:35 Local builders merchants
provides sand for sand bags - Councillor Steven
Lambert

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09/02/2014 11:24 Ellen Road ditch prior to clearance - Councillor Steven Lambert



10/02/2014 16:47 Gully outfall - Councillor Steven Lambert



10/02/2014 16:31 Gully outfall - Councillor Steven Lambert



10/02/2014 16:52 Silt removed from Stoke Brook and gully outfall at end of Fox Glove - Councillor Steven Lambert

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11/02/2014 16:36 Ellen Road ditch post flooding - Councillor Steven Lambert



11/02/2014 16:37 Ellen Road ditch post flooding - Councillor Steven Lambert



11/02/2014 16:37 Ellen Road ditch post flooding - Councillor Steven Lambert



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19/02/2014 Ellen Road ditch post clean up -
Councillor Steven Lambert



25/02/2014 17:30 Two photos (above) of the
Oxford Road Culvert post the flood event



Bucks Herald Photographs – 07/02/2014

30th April 2014



30th April 2014



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Photos of rubbish removed from Stoke Brook after the flood on 07/02/2014 Chris Spreadborough



Gully outlet at the end of Stratford Drive. This was before the silt was removed, if viewed today the bottom can be seen which shows it would have been about 60cm deep to the bed of the brook.

10/02/2014 Rubbish removed from Stoke Brook
– Councillor Steven Lambert

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Photos taken by Flood Officer on 10th April 2014
post flood and structures



A418 Oxford Road culvert



Stoke Brook



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Stoke Brook



Gully outfall



Ellen Road ditch after clearance

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Section 19 Flood Investigation Criteria

A section 19 flood investigation is carried out if significant flooding has occurred within the county the definition of this is shown below.

Definition of Significant Flooding in Buckinghamshire

- Caused internal¹ flooding to five or more residential properties² per 1km²; or
- Internal flooding of two or more business premises³ per 1km²; or
- one or more items of critical infrastructure⁴; or
- caused a transport link to be totally impassable:
 - Motorways, trunk roads and major rail links – 2 hours or more
 - Class A and B highways and other railway links – 4 hours or more
 - Class C⁵ highways – 10 hours or more
 - Class U⁶ highways – 24 hours or more.

¹ Internal including basement flooding

² Residential property (Class C3 (a,b))

³ Business premises (Class A1-3, B1-8, C1, D1(d-e), D2)

⁴ Critical infrastructure are (Class D1 (a, b, c), C2) - hospitals, health centres, clinics, surgeries, colleges, schools, day nurseries, nursing homes, emergency services (police, fire, ambulance) stations, utilities, substations

⁵ Unless the route is the only means of access, or is primary route for critical infrastructure then reduce to 4 hours

⁶ Unless the route is the only means of access, or is primary route for critical infrastructure then reduce to 4 hours