



# Emergence of an ephemeral chalk stream at Assendon, Oxfordshire, in 2014

**November 2016**

**W15-1389**

## Authors

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## Acknowledgements

The JBA Trust is very grateful to Magdalena Grabowiecka of the Environment Agency for provision of data, David Baldwin of Monson and Gordon Hunt of Oxfordshire County Council for sharing details of their response, and Stephen Verge for sharing his local knowledge and personal research.

The assistance of Maxine Zaidman, James Malloy, Nick Hardcastle and Duncan Faulkner of JBA Consulting is also appreciated.

Front cover photograph: Assendon Spring source © JBA Consulting

## Purpose

This document has been prepared as a resource to help inform further research.

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## Executive Summary

Assendon Stream is an ephemeral watercourse that is normally dry, even during wet winters, but occasionally flows through the villages of Middle and Lower Assendon and alongside the Fairmile, near to Henley-on-Thames in Oxfordshire. It emerges and flows when groundwater levels in the underlying chalk are high.

The source of the stream is a spring which rises near the village of Stonor and only flows into the channel when groundwater levels are extremely high. The stream is ungauged.

Rainfall recorded by the Met Office from 1 December 2013 to 28 February 2014 made this one of the wettest winters since records began in 1766, and following exceptional rainfall during January 2014, the Environment Agency identified the possibility that rising ground water levels may begin to drive flows in Assendon Stream.

JBA Trust monitored and documented the emergence and flow of the Assendon Stream in 2014 to provide a resource for researchers and practitioners interested in understanding more about this type of rare groundwater flooding event.

This report summarises the data and evidence collected as part of the study including detailed documentation of the emergence pattern, groundwater records, monitored stream flows, levels and photographic evidence.

## Dissemination and further updates

The report is available on the JBA Trust website ([www.jbatrust.org](http://www.jbatrust.org)).

For further information about this study and supporting data please contact the JBA Trust via the "Contact Us" page ([www.jbatrust.org/contact-us/](http://www.jbatrust.org/contact-us/)).

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# 1 Introduction

## 1.1 Background

Assendon Stream near Henley-on-Thames is an extremely ephemeral watercourse that is normally completely dry, even during a wet winter. Prior to the winter of 2013-14, it rose briefly in 2003 and last experienced sustained flow in 2001, when there was prolonged flooding to roads and property. Before that it had flowed in the 1960s and 1981.

In February 2014 the spring started to flow following the extreme wet weather of the previous few months. This presented a very rare opportunity to monitor the emergence of the stream, and gather first hand data in relation to the its response to groundwater levels and the mechanisms of flooding.

JBA Trust carried out a study to monitor and document this event and use the information collected to produce a resource for researchers and practitioners with the aim of helping those interested in understanding the mechanisms for flow and flooding on ephemeral watercourses of this type.

## 1.2 Flood event study

The main objective of the study was to carry out monitoring of Assendon Stream as the 2014 event progressed, and to collect data about the stream's response to groundwater levels and the mechanisms of flooding.

The activities were:

1. Regular weekly field monitoring to collect the following:
  - Date and location of emergence of surface flows
  - Length and location of flowing reaches
  - Areas flooded
  - Photographs
  - Spot measurements of depth and velocity of the flow at key locations
  - Reconstruction of flow rates
  - Note of any remedial action taken by authorities (Environment Agency, Local Authority) and community response.
2. Liaison with the Environment Agency, South Oxfordshire District Council, Oxfordshire County Council and a local resident who has been studying the catchment for the last 10 years.
3. Compilation of a digital dataset including flow/level data and photographs.
4. Summary of historical accounts of stream emergence and/or flooding.

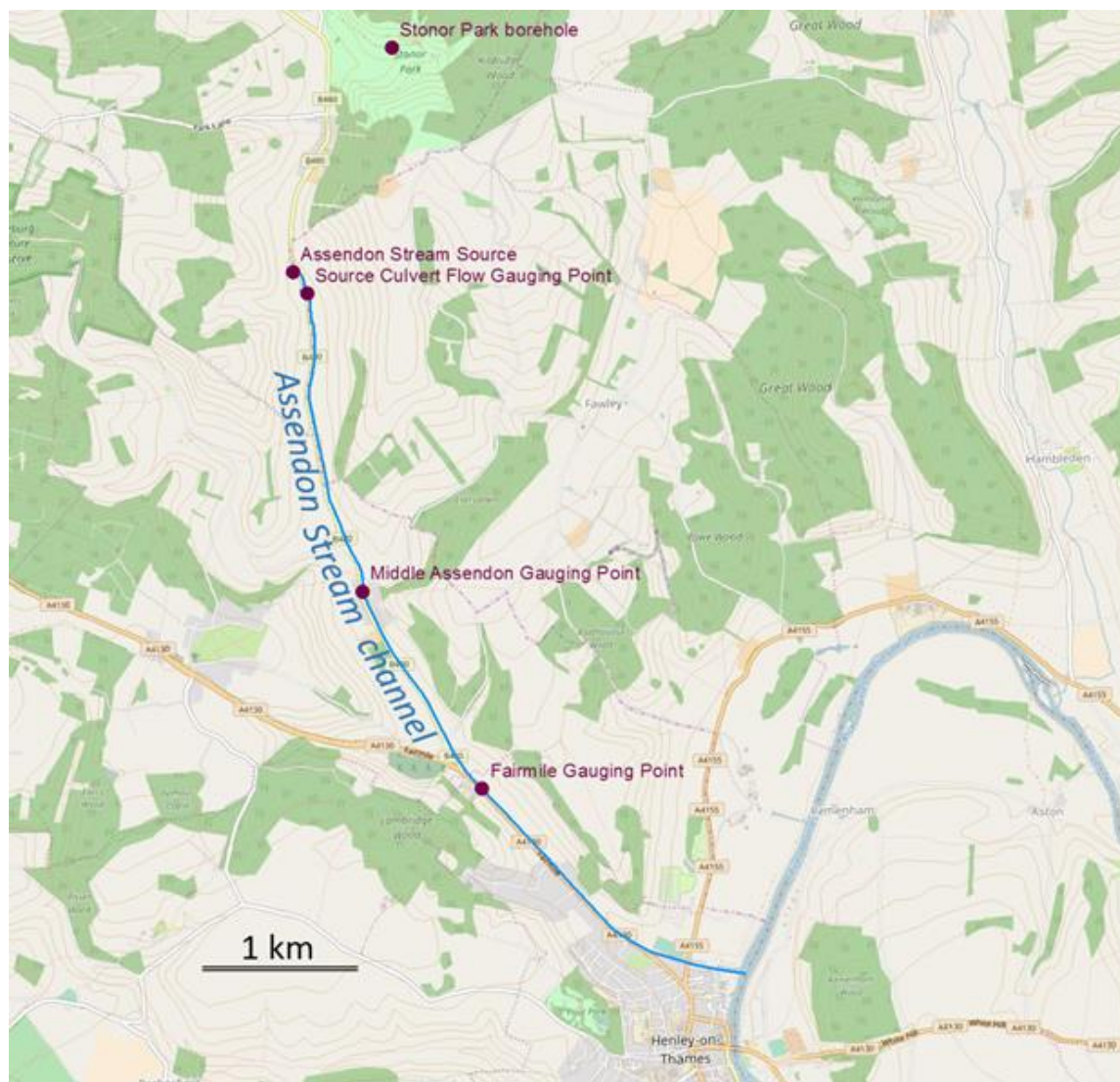


## 2 Study Area

### 2.1 Overview

The Assendon Stream, a tributary of the River Thames, is an ephemeral groundwater fed watercourse which rises in the Stonor Park Valley on the dip slope of the Chiltern Hills.

The underlying geology of the region is mostly porous chalk deposits characterised by dry valleys and acid stony soils. When groundwater level are high they can drive stream flows down through Henley-on-Thames (South Oxfordshire) to join the river Thames.



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**Figure 1:** Assendon Stream location map

The location of Assendon Stream is shown in **Figure 1**. Most of the catchment is underlain by the Lewes Nodular Chalk Formation, while the Holywell Nodular Chalk Formation underlies the valley bottoms, a few isolated patches of Lambeth Group (clay, silt and sand) lie in the local area.

Superficial deposits of clay, silt, sand and gravel also lie in the valley bottoms and on higher ground. Very porous valley gravels overlying the chalk start 1km upstream of Middle Assendon where there are periglacial deposits and gravel.

## 2.2 Hydrogeology

The catchment receives a Standard Average Annual Rainfall (SAAR) of 747mm. The main source of the Assendon Stream is a fixed spring rising at Stonor which only flows when groundwater levels are extremely high.

The groundwater levels in the Berkshire Downs Chalk above Henley-on-Thames are monitored by several boreholes. Stonor Park, drilled to a depth of 147.5 meters into the Lewes Nodular Chalk (an unconfined aquifer), has the longest uninterrupted data record (weekly data records since 1963, and daily records since 1991) and is used by the Environment Agency for quarterly hydrometric reporting.

The groundwater displays a regular annual sinusoidal pattern and captures the aquifer's full range of fluctuation. The aquifer block monitored at Stonor is one of the larger chalk blocks without surface drainage, and as a result of this its response to individual recharge events is damped compared with other boreholes in the area.

## 2.3 Flooding

The Assendon Stream has been known to rise and cause flooding in the past. An overview of previous historical events is given in Chapter 5.

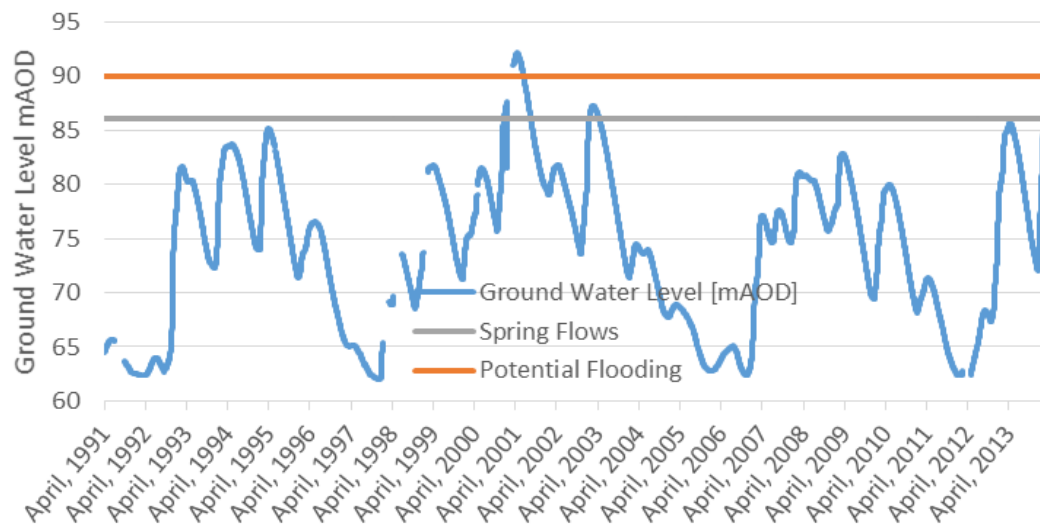
A flood modelling and mapping study carried out for the Environment Agency in 2013 identified threshold levels in the Stonor Park borehole associated with the observed flooding and stream flows that were recorded during the 2001 event (Table 1).

**Table 1:** Observed surface water flows and property flooding with associated groundwater levels

Level at Stonor Park OBH (m AOD)	Surface water flows and property flooding in 2001
85.65	Assendon Stream spring emerges at source
86.00	Spring starts to flow from source
86.20	Groundwater flooding starts to occur in cellars in Middle Assendon
87.05	Stream rises in ditch opposite Rainbow Inn, Middle Assendon
87.20	Stream reaches Warmcombe Lane (approximately 700m u/s of Middle Assendon)
88.00	Streams link and flow through Middle Assendon when groundwater level reaches the surface and emerges in the valley floor preventing flow percolating back into the gravel here. Tributary rises at Bix Bottom (250m north of Bix Bottom Lane at a 'kink in the contours', near Middle Assendon)
89.00	Tributary starts to flow, stream increases very rapidly in flow volume.
89.50	Stream reaches Lower Assendon when groundwater reaches surface in the gravels here, and north Fairmile. Groundwater comes to the surface in the gravels. Flow is in-bank.
90.00	Stream reaches the end of the Fairmile at Henley and enters the Thames. Flooding occurs in the Assendons.
92.00	Flooding as observed in 2001.



These threshold levels help to link hydrological conditions and extent of the emergence of Assendon Stream to the ground water levels recorded by the Stonor Park borehole (Figure 2).



**Figure 2:** Stonor Park borehole ground water levels 1991 - 2013

Further details about the Stonor borehole and full groundwater records up to recent dates can be found at the website of the British Geological Survey at the following link:

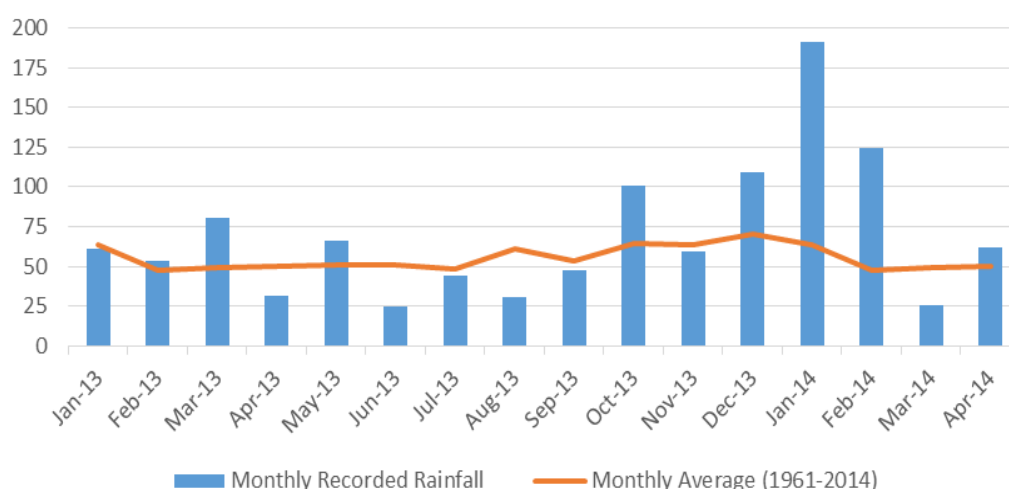
<http://www.bgs.ac.uk/research/groundwater/datainfo/levels/sites/StonorPark.html>

## 3 Monitoring of the 2014 event

### 3.1 Observations of the event

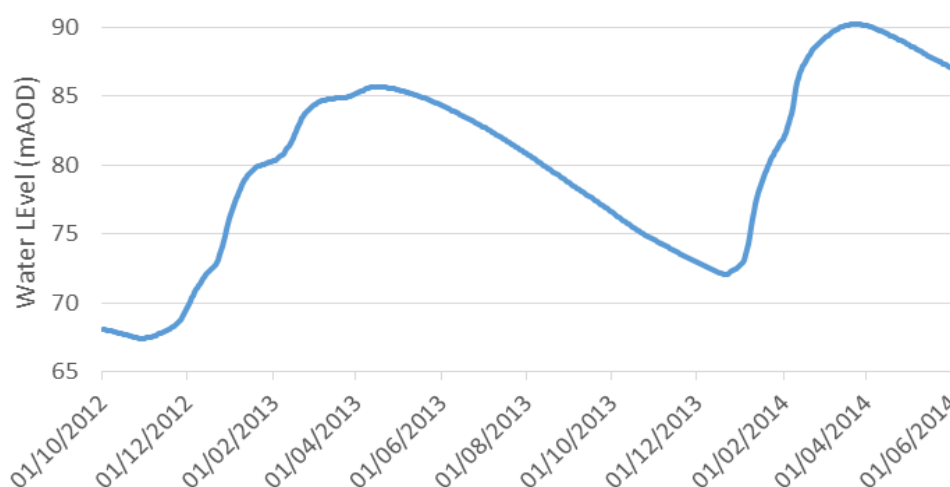
The winter of 2014 as recorded by the Met Office from 1 December 2013 to 28 February 2014 was the wettest winter since records began in 1766, with areas in southern and central England receiving over double the expected amount of rainfall<sup>1</sup>.

**Figure 3** compares the monthly rainfall totals recorded at the nearby Hambleden Lock rain gauge against the long term monthly average. The winter rainfall figures reflect the national trend of an extremely wet winter with January and February receiving over double their recorded long term average rainfall.



**Figure 3:** Rainfall totals (mm) recorded at Hambleden Lock (January 2013 to April 2014)

Following the exceptionally wet start to the year ground water levels at Stonor Park began to rise rapidly to high levels (**Figure 4**). This suggested a strong possibility that the Assendon Spring may flow during early 2014.



**Figure 4:** Stonor Park Borehole water levels (October 2012 to June 2014)

<sup>1</sup> <http://www.metoffice.gov.uk/news/releases/archive/2014/early-winter-stats>

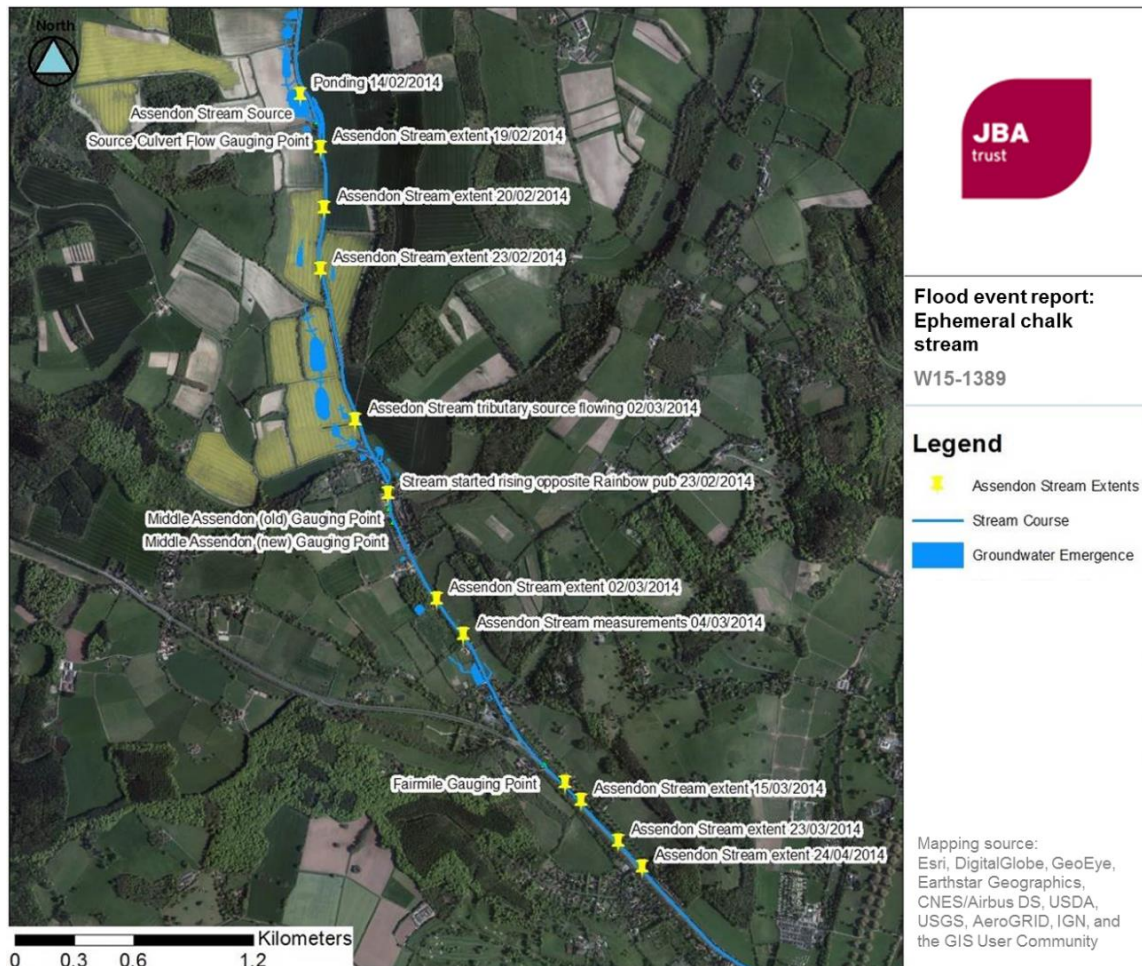
Regular monitoring of the ground conditions commenced on 13 February 2014 to document the emergence of the spring's source from the fields between the villages of Stonor and Middle Assendon and to track its progress in relation to ground water levels. A summary of the site visits, hydrological conditions and observations is provided in [Table 2](#).

**Table 2:** Assendon Stream site visit observations

Date	Stonor Park Borehole Level	Description
13/02/2014	87.19	Assendon stream source visited 8am, no flow although ponding occurring in the fields by the source to the west of the road. Channel followed upstream from point where field culvert joins no sign of any other connectivity from field
14/02/2014	87.37	Assendon stream source visited 8am no flow, no visible change from 13th. Environment Agency issued a Groundwater Flood Alert.
17/02/2014	87.88	Assendon started to flow out of its source for approximately 250m before draining back to ground. The ground water fed pond has substantially increased in size and is spilling into the culvert under the road. The Stream is also rising in the channel on the eastern side of the road upstream of the culvert.
20/02/2014	88.39	Stream flow has progressed an extra 200m and is now approximately 450m downstream of pipe outfall from field. No sign of stream rising in ditch opposite Rainbow Inn or upstream of culvert.
23/02/2014	88.74	Stream has progressed another 300m down channel 750m from source, farmer has cleared channel from field and culvert entrance so flows increased also appears to have undertaken clearance of road gulley's into channel. Stream has started to rise outside Rainbow Inn although not flowing here yet
25/02/2014	88.90	The stream extent is about 1 mile north of Middle Assendon and also rising in Middle Assendon. Groundwater levels still rising but rate of rise is slowing. Increased levels outside Rainbow Inn, water now in several channel sections although not sufficient to flow yet. Presumed dewatering of one property from basement in middle Assendon.
28/02/2014	89.16	Heavy rainfall overnight continued during visit. Significant flow through Middle Assendon although not connected to flow from source yet as stream checked above White Lane and channel dry. Flow now reaching approximately 100m down the Fairmile (unsure whether is additional flow is as a result of direct surface runoff or not).
02/03/2014	89.36	Fairmile ditch now dry previous flows on 28/02/2014 assumed to be as a result of heavy rainfall rather than groundwater driven flow. Streams connected above Middle Assendon and flow is entering the main channel from the tributary which has risen to the North of Bix Bottom Lane. Water spilling onto the road between the spring and Warmscombe Lane. Flow now continues downstream of Middle Assendon to a point approximately 800m north of the Fairmile (approximately 2.5km in total length).
04/03/2014	89.46	Steady flow from 'tributary'. Stream has reached Lower Assendon but still dry at the Fairmile. Water is spilling out of bank at Middle Assendon when pipes under a driveway are blocked, and onto the road, before entering the channel further downstream.
07/03/2014	89.72	Flows have now reached the Fairmile however have only progressed a short way before returning to ground.
16/03/2014	90.16	Flow from culvert onto Fairmile has increase, flow has progressed a short way further down the Fairmile. Flows and levels in the stream further up the Assendon valley have increased.
01/04/2014	90.13	Fairmile culvert still flowing flow had progressed slightly down the Fairmile
08/04/2014	89.89	Flow almost to Bainbridge House driveway (just past Lambridge Wood Rd junction). Leaves in ditch at driveway culvert and approx. 10m past look wet as if flow has previously got further and has since gone down.
14/04/2014	89.62	Flows / depths and extent down Fairmile almost identical to visit on 08/04/2014.
24/04/2014	89.13	Flows and depths of water in channel noticeably lower. Extent of flow downstream onto Fairmile no different to 14/4/2014. Flow to about 5m before driveway culvert to Bainbridge House.
25/04/2014	89.09	Visited following heavy rainfall on the morning of 25/04/2014 approximately 1-2 hours after storm peak levels had increased by 2-4cm in stream from previous day no significant problems in Middle Assendon

The area of ground water emergence at the stream's source observed on 13 February 2014 began to increase with the rising groundwater levels until the stream started to flow from its source through the culvert under the main road and into the maintained channel beside the road on 17 February 2014.

Regular monitoring then continued to track the emergence of the spring as it moved down the Stonor Park valley. The progress of the stream is illustrated in Figure 5.



**Figure 5:** Assendon Spring pattern of emergence, February to April, 2014

3.2

3.3



### 3.4 Photographic record

The photographs in [Figure 6](#) and [Figure 7](#) show the progress of the event at key locations and represent a small selection of the complete photographic record of this event.

See [Table 7](#) for details of further data and information available on request from JBA Trust.



**Figure 6:** The Assendon Spring Source rising on 19 February 2014



**Figure 7:** The Assendon Spring ground water rising on 3 March 2014

### 3.5 Hydrological measurements

Velocity and water depth monitoring commenced on 4 March 2014. The equipment used for recording the flow velocity was a Valeport Model 801 electromagnetic velocity meter with a flat type sensor suitable for shallow flows. Eighteen field visits were made during the period February to April 2014, eight of which included flow gauging. Flow gauging measurements were carried out weekly.

#### 3.5.1 Flow Gauging Locations

Flow gauging measurements were taken at three locations along Assendon stream course as the stream progressed down the valley. The locations of the gauging points are described below and in Table 3.

Initial monitoring took place downstream of the culvert that carries the spring from its source under the B480 road into the stream channel which travels alongside the road. A second monitoring point was introduced further downstream in the village of Middle Assendon. Later on, as the spring progressed further down the valley, a third flow gauging point was introduced where the stream emerges onto Fairmile and flows towards Henley.

**Table 3:** Assendon Stream flow gauging locations

Monitor Point	Grid Reference	Description
Stonor spring	SU 73469 88171	Downstream of culvert near source
Middle Assendon	SU 73911 85652	Downstream of Fawley Bottom Lane culvert
Fairmile	SU 74690 84364	Downstream of Fairmile culvert

#### 3.5.2 Cross section survey

The channel was surveyed at each cross section. Field observations suggest that the cross sections remained stable during the monitoring period. Cross section data are available in the accompanying spreadsheet (Table 7).

#### 3.5.3 Flow estimation

Stream flow has been estimated by velocity-area calculation. The resources available for field work allowed for depth and velocity measurement, but not continuous water level monitoring. On each field visit, three manual “spot” velocity and depth measurements were made at approximately the same locations within the channel at each cross section. Flow velocity was read out twice during each measurement, with the average of the two readings being used in the flow calculations.

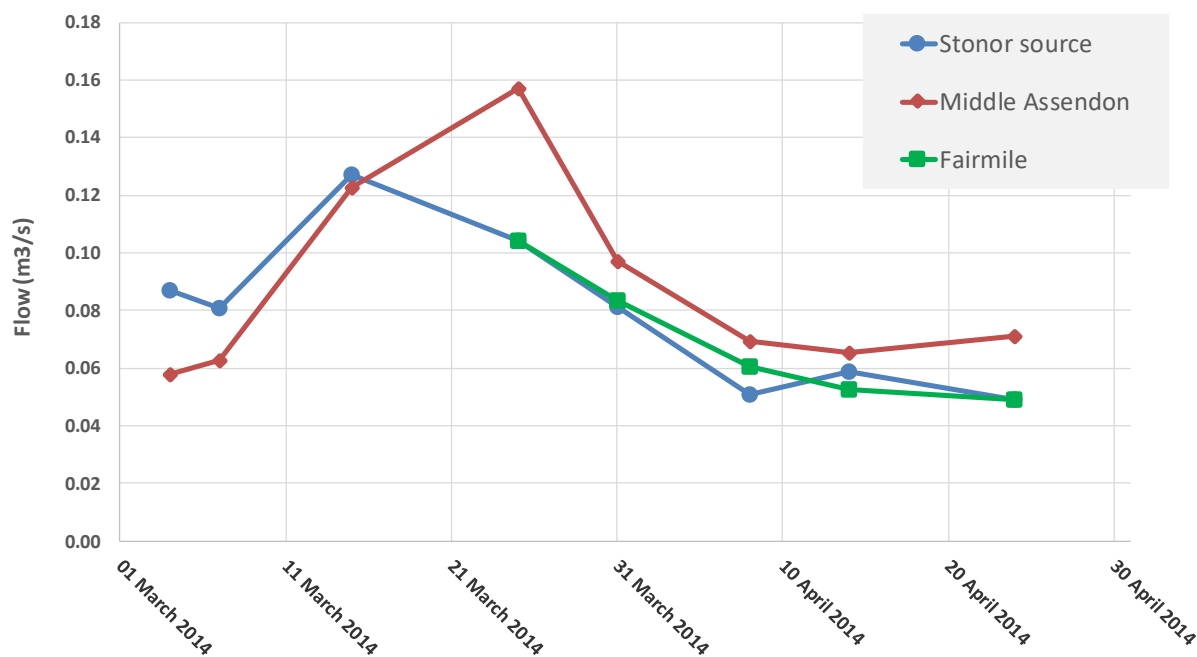
In the absence of water level monitoring, the spot gauge flow depths have been combined with the cross section survey data to reconstruct a water level for each velocity/depth measurement. The average of three such water level estimates has been used in order to compute the cross sectional flow area for each of the observations.

The velocity area calculation can be found in the accompanying spreadsheet (Table 7). At each monitoring location, the relationship between depth of flow and the corresponding cross sectional area has been computed and tabulated.

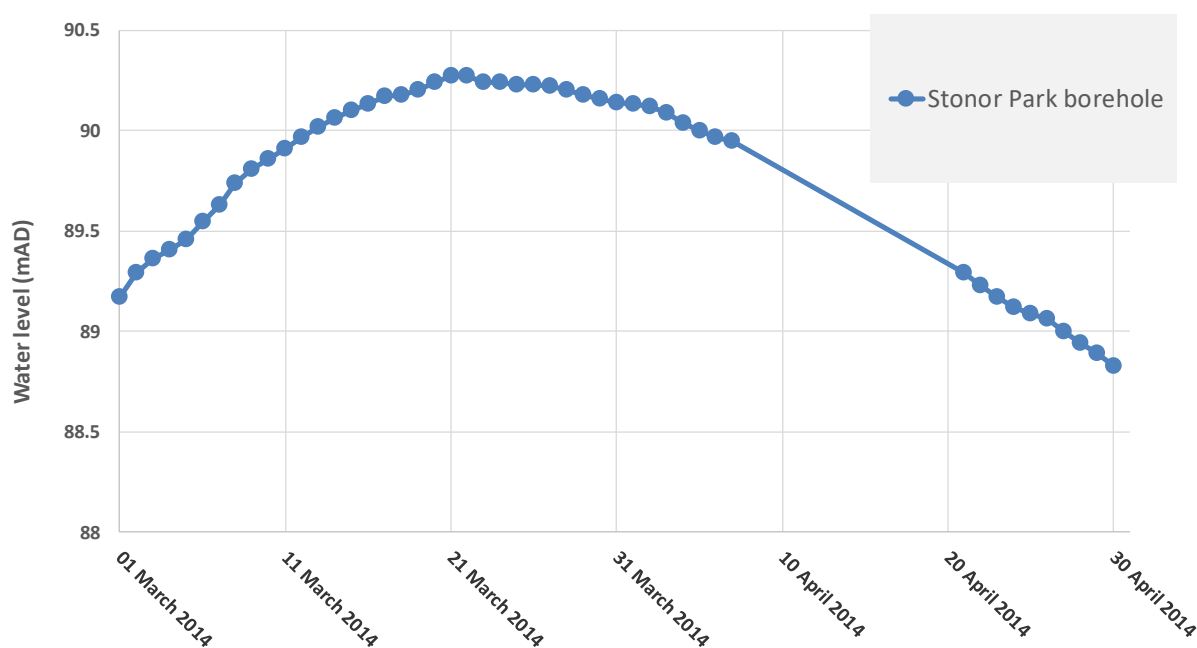
The estimates of water level and cross sectional flow area have both been carried out using simple lookup tables in the accompanying spreadsheet, and are therefore best regarded as initial approximations that include some discretisation error. More precise estimates could be obtained by the use of interpolation algorithms. There is some uncertainty about the measurements taken on 31 March at the stream source and Middle Assendon sites (see annotation in the spreadsheet).

The peak flows recorded between 15 and 31 March 2014 appear to coincide with the peak ground water levels of over 90 metres AOD.





**Figure 8:** Assendon Stream flow gauging measurements



**Figure 9:** Stonor Park borehole levels for the period during which flows in Assendon Stream were measured

Monitoring of the spring ceased once it became clear that the groundwater levels were receding and that recharge to levels seen in 2001 was unlikely given the below average rainfall during March.

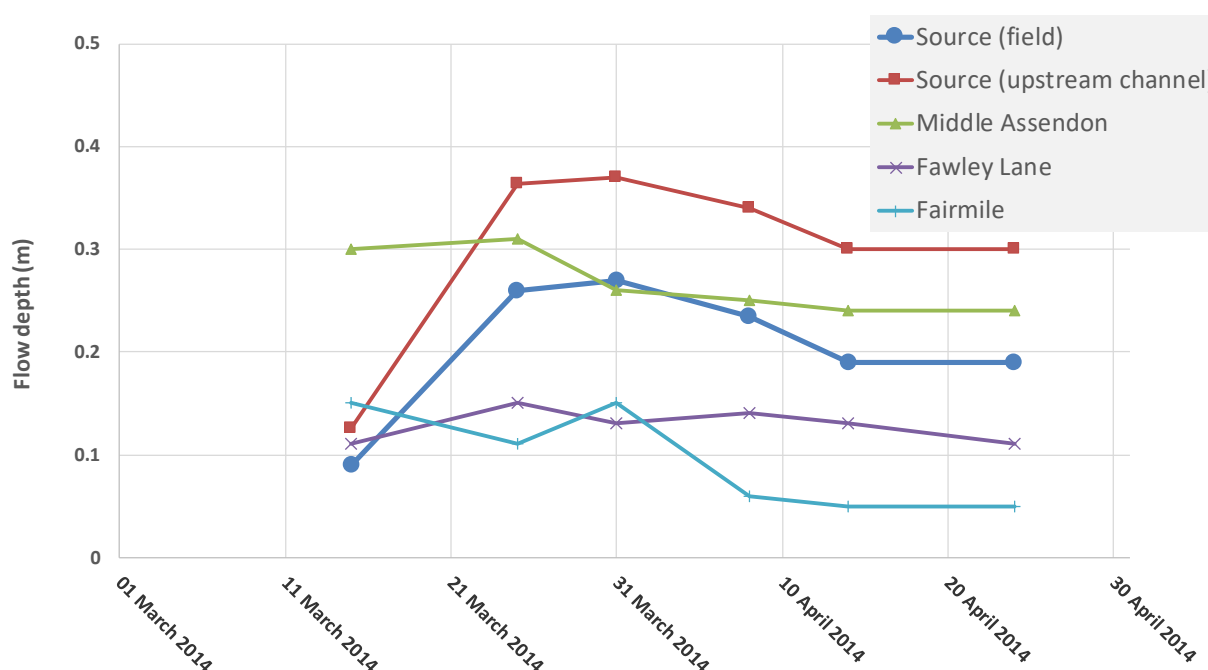
### 3.5.4 Levels at culverts

In addition to flow monitoring, the flow depths at fixed structures were also recorded during the event in order to track relative water levels over time. Channel depths at the downstream end of several culverts were measured with the culvert soffit levels providing fixed reference points. The locations of the gauging points are described in Table 4.

**Table 4:** Assendon Stream culvert depth monitoring locations

Monitor Point	Grid Reference	Description
Source Culvert – field	SU 73547 87603	Culvert under the B480
Source Culvert – upstream	SU 73547 87603	Culvert from upstream channel
Middle Assendon Culvert	SU 73911 85681	Culver under Fawley Bottom Lane
Fawley Lane Culvert upstream	SU 74449 84698	Culvert under unnamed minor road to Fawley
Fairmile Culvert	SU 74578 84481	Flowing onto Fairmile from B480

The results of the culvert depth monitoring are shown below in Figure 10. The results mirror those of the flow monitoring in terms of the rise and fall in stream levels.



**Figure 10:** Assendon Stream flow depths measured at culverts

## 4 Flood risk management responses

During the flooding in 2014, various agencies involved in the management of the watercourse and highways (including local residents) took action to reduce the risk of flooding. These actions are recorded below in [Table 5](#).

**Table 5:** Flood response actions

Date	Organisation	Actions Taken
15 January 2015	Environment Agency	Flood Alert issued River Thames for Henley, Remenham, Medmenham and its tributaries.
19 January 2015	Environment Agency	Flood Alert removed
14 February 2015	Environment Agency	Flood Alert issued for ground water flooding for the Henley and Assendon area.
25 February 2015	OCC	Highway grips dug by OCC, sandbags delivered, jetting of pipes.
25 February 2015	Residents	Residents dewatering at Middle Assendon.
4 March 2015	OCC	SODC maintenance contractors on site clearing vegetation from the channel just d/s of Lower Assendon
1 April 2015	OCC	Email from Gordon Hunt at OCC confirmed that OCC had cleared highway culverts and major blockages prior to the event. The District Council and Henley Town Council had also done some clearing. Discussion between OCC and Parish councils have also taken place over riparian responsibilities.
9 May 2014	Environment Agency	Flood Alert removed

## 5 Comparison with past events

### 5.1 Historic Records

A detailed flood history search going back to 1674 identified when the stream has flowed on previous occasions. Sources of information included records held by the Parish Council, South Oxfordshire District Council (SODC) and Oxfordshire County Council (OCC). The findings of this search are summarised in [Table 6](#) below.

The search found evidence of 26 events occurring over a 340-year period, suggesting the stream has flowed on average around once every 13 years, and that the lack of flows between the 1960s and 2000 is relatively unusual.

Most of these events appear to have been relatively minor, with no flooding. Some descriptions suggest that the stream flowed for several months over the winter period, whilst others indicated that it flowed for only a short distance before disappearing back into the ground. Several descriptions (particularly 1694 and 1774) suggest flooding that created a hazard for people. Blockage or a lack of maintenance of the ditch has been cited as a contributory factor to flooding in some more recent events.

**Table 6:** Assendon Stream Historic Flow record

Date	Evidence	Source
1674	Dr Robert Plot, 1677, Natural History of Oxfordshire, pp 29-30: "That Land-springs and such as run but once perhaps in many years, have their rise and continuance from plentiful showers, ... whereof that of Assenton [Assendon], near Henly [Henley] upon Thames is one of the most eminent that I know of in England; In 1674, with that violence that several mills might have been driven with the Current; and had not the town of Henly made some diversion for them, their Fair Mile must have been drowned for a considerable time."	BHS Hydrochronology
1774	Assendon Spring, a bourne that flows rarely and irregularly from the Stonor valley to the Thames at Henley: "Local history books relate that in 1774 a child fell into it and was rescued at the outflow... "The Assendon Spring is also recorded in 1853 by J.S.Burn (History of Henley). His account states that some years before a small girl who had been playing beside the stream in a Henley street fell in and was swept away by the strong current."	BHS Hydrochronology  Assendon e- Museum
Dec 1841- 1842	"In 1841, the last year when it is known the [Assenden, Lambourn, and Bourne End] bourn[s] ran at the same season of the year..." [i.e. written as in 1852]	BHS Hydrochronology
Dec 1852 - 1853	"At Assenden, the stream is as from one source; so at Lambourn; at Bourn End it rises in numerous depressions on the line of the brook ... The brooks commenced running ... on the first week of December 1852."	BHS Hydrochronology
	Mr Clare Sewell Read, Farming in Oxfordshire, in Journal of the Royal Agriculture Society, vol XV (1854): "Some springs at the foot of the hills burst out in wet seasons and flow with great rapidity for months and are not seen again for years. The spring at Assenden [Assendon, near Henley on Thames], after having been dry since 1842, sent forth a very considerable stream during the chief part of last year" [1853]	BHS Hydrochronology
1872	Assendon Spring, a bourne that flows rarely and irregularly from the Stonor valley to the Thames at Henley: "...In 1872, it flowed strongly for a year "	BHS Hydrochronology
1875	"the stream suddenly burst forth with great force, a volume of crystal clear water . The dyke had become choked with disuse, and had to be cleared and embanked, as the stream else would have flooded the whole road"	Henley Standard (provided by Stephen Verge)

Date	Evidence	Source
1881	"now the snow and ice have been cleared out of the watercourse, the water from this spring is coming into the town"	Henley Advertiser (provided by Stephen Verge)
1883	"Assendon Spring is now running in full vigour" "the velocity of the stream through the Fairmile was 2½ miles per hour and the discharge of the stream was 142,000 gallons per hour" (2nd February 1883) "the stream of water has greatly increased in bulk" (10 March 1883)	Henley Advertiser (provided by Stephen Verge)
1890's	"Old photographs also show the spring in flow in the 1890s and 1916."	Assendon e-Museum
1904	[the stream] "passed the old Travellers Rest pub before soaking into the ground"	Stephen Verge
1916	"Old photographs also show the spring in flow in the 1890s and 1916."	Assendon e-Museum
	History of Bix, Oxfordshire, UK: Assendon Spring "This rises into the Spring Pit which is a small area in the last field on the left before entering Stonor from Middle Assendon. Local children have bathed in it in the past. Over the years it has been piped along certain sections of its length including the final stretch before it discharges into the Thames by Phyllis Court.... Photographs of 1916 and 1920 show it to have had a substantial flow when it lightly flooded an entire section of the road uphill of Northfield End."	<a href="http://www.frewin.com/archive/bix_history.htm">http://www.frewin.com/archive/bix_history.htm</a>
1920	History of Bix, Oxfordshire, UK: Assendon Spring "Photographs of 1916 and 1920 show it to have had a substantial flow when it lightly flooded an entire section of the road uphill of Northfield End."	<a href="http://www.frewin.com/archive/bix_history.htm">http://www.frewin.com/archive/bix_history.htm</a>
1920's	The stream is recorded as flowing in 1925, 1926, 1927, and 1928: [the stream] "is now flowing 50 yards on the Henley side of Assendon Cottage" (1926) "the spring is flowing higher and stronger at the present time than it has for 60 years". [It is] "maintaining an abnormal flow of water and difficulty is being experienced in dealing with the abnormal volume" (1928)	Henley Advertiser and Henley Standard (provided by Stephen Verge)
1937	The last time that the flow in Assendon Stream reached the Thames before 2001. "Flooding to a depth of 9 inches in the ditch along the Fairmile."	Stephen Verge
April 1951	"The continued heavy rains have brought the River Thames up again and many parts of the Thames Valley are flooded. It is many years since Thames Valley flooding has continued so long as it has this winter--the river is almost as high today [13/4/1951] as it has been at any time during the season. The Assendon Spring, which rises in a pit on the left hand side of the road a short distance from the Henley side of Stonor, started to run last week. It is steadily making progress and has nearly reached as far as Crabtree Farm. There is every indication that it will keep running until it reaches the Fair Mile and flows on to Northfield End. Since it last ran, improvements have been made to cope with the running water and it is hoped it will not cause the inconvenience it has on some previous occasions."	BHS Hydrochronology
1960	"In the 1960s a council worker who travelled by bicycle regularly dug out the ditch. The field in which the spring rose contained a wide trench about two metres deep. This was later filled in. The spring's ditch had also not been properly maintained in the late 20th century and so the roads along the Assendon valley quickly flooded. On several occasions this flooding froze over and at least one car travelling near Stonor skidded and ended	Assendon e-Museum <a href="http://www.assendonmuseum.co.uk/The_Assendon_Spring.pdf">http://www.assendonmuseum.co.uk/The_Assendon_Spring.pdf</a>

Date	Evidence	Source
	<p>upside down in the ditch. Emergency work was carried out to deepen the ditch and install underground pipes for the spring in Assendon and in Northfield End, Henley."</p> <p>"the Assendon Spring flowed in 1960. It took several weeks for the water to reach Henley and the River Thames and the flow was fully contained in the trench and ditch, with no flooding."</p>	
1969	<p>Oxfordshire County Council, Preliminary Flood Risk Assessment, April 2011</p> <p>"4.4 Groundwater</p> <p>4.4.1 ...Prior to 2001, the stream had last flowed in 1969."</p>	Oxfordshire PFRA, Stephen Verge
1981	<p>News Review of the Year - 2001</p> <p>"A forgotten stream caused chaos in Middle Assendon. The Assendon spring rose after being dry for the previous 20 years, and the cold weather caused the water to freeze, creating hazardous conditions for cars. But many believed the stream could have an even more sinister meaning. According to locals it only flows when Britain is likely to be at war. The last time it rose was during the Falklands War in 1981 and the Korean War before that. [1950-1953]"</p>	<p>The Henley Standard</p> <p><a href="http://www.henleystandard.co.uk/news/archive.php?id=1195169382">http://www.henleystandard.co.uk/news/archive.php?id=1195169382</a></p>
Winter 2000-2001	<p>The prolonged event of 2000/1 saw some of the highest groundwater levels recorded within the chalk and oolitic limestone aquifers in the county, causing flooding in watercourses including Assendon Spring, Stert Brook (Thame) and Ewelme Brook. According to the Parish Flooding Survey, 22 properties are estimated to have flooded on the Assendon Spring.</p>	Oxfordshire PFRA Oxfordshire County Council records
	<p>"The Assendon Spring last flowed in great volume in the winter of 2000-2001. This caused road closures in Lower Assendon and along the Fair Mile."</p>	Assendon e-Museum
	<p>News Review of the Year – 2001</p> <p>"January: A forgotten stream caused chaos in Middle Assendon. The Assendon spring rose after being dry for the previous 20 years, and the cold weather caused the water to freeze, creating hazardous conditions for cars. But many believed the stream could have an even more sinister meaning. According to locals it only flows when Britain is likely to be at war. The last time it rose was during the Falklands War in 1981 and the Korean War before that.</p> <p>February: The flooding caused by the rising of the Assendon Spring wreaked havoc from Assendon down into the town centre — and residents were told by engineering experts that the problem could exist for the next 12 months. Homes in the villages, the Fair Mile, Northfield End and New Street were also affected.</p> <p>April: Henley was reported to be 'rotting from the foundations up' due to the highest water table levels for 200 years. Numerous shops, businesses and houses were flooded including the Kenton Theatre and Asquiths teddy bear shop. The unusually wet weather and the rising of the Assendon Spring were blamed for the situation.</p> <p>June: The horrendous flooding caused by the Assendon Spring could happen again, residents were warned. Due to the high water table, even average rainfall during the winter could cause more floods. Geoff Bell, of the Environment Agency, described the amount of rain in graphic detail. He said: "Eight million cubic litres of water fell from the sky. That would fill an area the size of a football pitch, 800 metres high."</p> <p>A number of photos were also published on this website, showing flooding of roads and properties.</p>	<p>The Henley Standard</p> <p><a href="http://www.henleystandard.co.uk/news/archive.php?id=1195169382">http://www.henleystandard.co.uk/news/archive.php?id=1195169382</a></p>



Date	Evidence	Source
	<p>Hidden Henley, Published 27/02/12</p> <p>Image of footbridge.</p> <p>"This footbridge is just off the Fair Mile, Henley, and marks the running of the Assendon spring back in 2001. In fact, it went on for several weeks and flooded down the valley from beyond Stonor and along the main road into town before some of it found its way underground in the New Street area and eventually out into the Thames. The plate states that the bridge was constructed by the residents of Lower Assendon to commemorate this event."</p>	<a href="http://www.henleystandard.co.uk/news/news.php?id=1061654">http://www.henleystandard.co.uk/news/news.php?id=1061654</a>
Winter 2003	The spring rose and flowed approximately 1km down the valley.	Stephen Verge
Feb/ Mar 2014	<p>The stream began to flow on 17th February 2014 after an extremely wet winter. By 4 March 2014 the stream was flowing continuously from its source as far as Lower Assendon before disappearing back underground. The stream had reached its capacity at some small culverts in Middle Assendon and was starting to spill out onto the road. By 21 March the stream had reached the Fairmile, but no major flooding had occurred.</p>	Observations by JBA Consulting

## 6 Data resources

### 6.1 JBA Trust monitoring data

A summary of the monitoring data collected in the field during the weekly site visits in 2014 is listed below in [Table 7](#). The full dataset collected is available on request from JBA Trust as a spreadsheet.

**Table 7:** Field monitoring data available from JBA Trust

Information Record	Description
Field notes	Weekly of visual observations, borehole level data, and local updates about the 'on the ground' situation
Photograph Record and Photo Location Reference	Log of photographs taken and photo locations
Flow Measurement Record	Channel flow calculations including velocity and depth measurements taken in the field
Culvert Depths	Flow depths measured at culverts
Cross sections	Cross section survey data at the three flow monitoring points

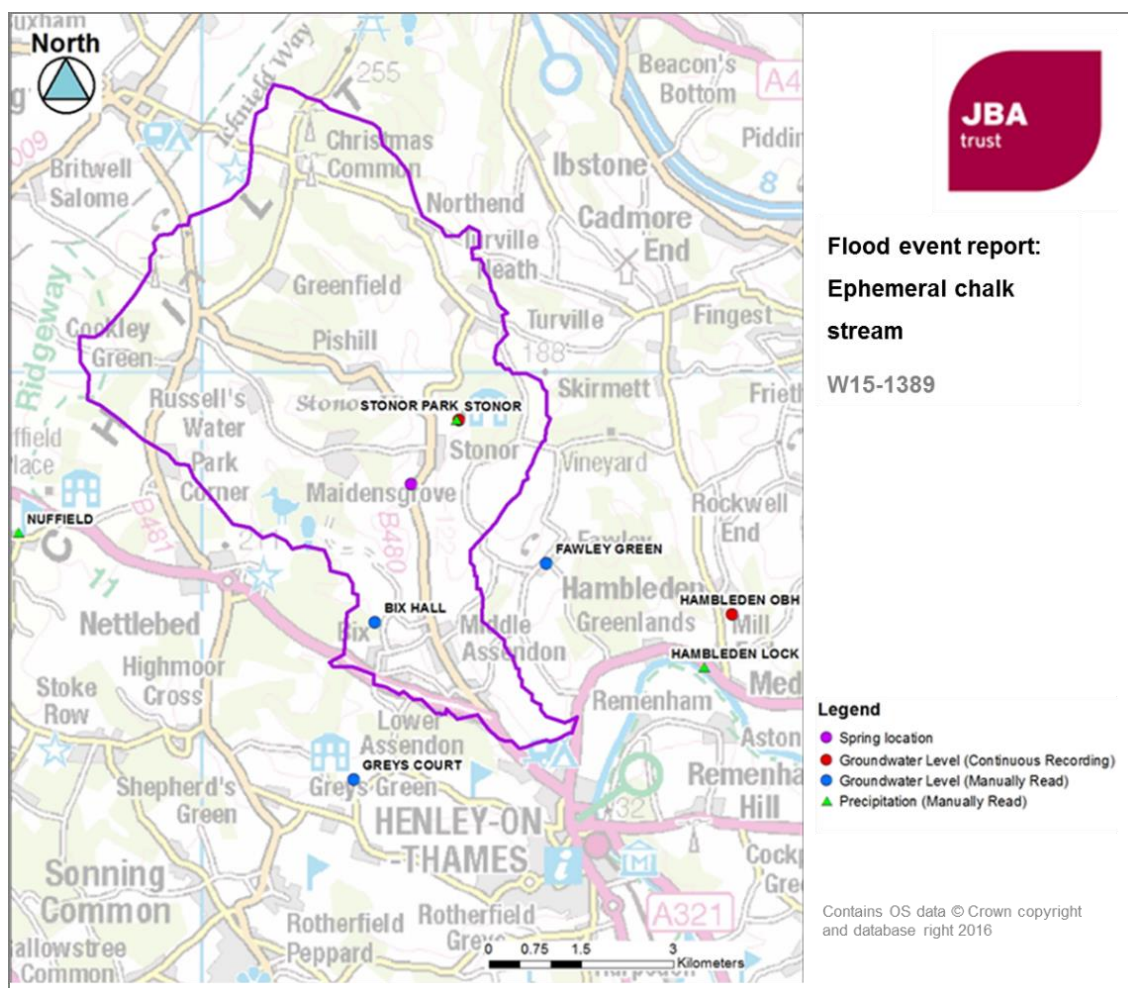
### 6.2 Third party hydrometric data

Further interpretation of the factors driving the emergence of Assendon Stream would require analysis of (as a minimum) rainfall and soil moisture data for the surrounding area. Data may be available from the Environment Agency, the Met Office and the British Geological Survey.

[Table 8](#) lists relevant sources to assist those requesting further information from data providers. [Figure 11](#) shows the locations of the data sources in [Table 8](#).

**Table 8:** Nearby groundwater and hydrometric data sources

Dataset	Data Type	Record Length	Gauge Location
Bix Hall Borehole	Continuous Borehole Water Level Record	May 1972 – Date	SU 728859
Fawley Green Borehole	Manually Recorded Borehole Water Level Record	April 1955 - Date	SU 756869
Greys Court OBH	Manually Recorded Borehole Water Level Record	Oct 1971 - Date	SU 724834
Stonor Park OBH	Manually Recorded Borehole Water Level Record	May 1961 - Date	SU 741892
Hambleden Lock Rainfall	Storage Rain Gauge	Jan 1961 - Date	SU 781185
Nuffield Rainfall	Storage Rain Gauge	Jan 1995 - Date	SU670874
Stonor Rainfall	Storage Rain Gauge	01/01/1997 – 01/10/2013	Square 160
MORECS	Soil Moisture Deficit (SMD)	1999 - Date	Square 160



**Figure 11:** Location of rainfall gauges and boreholes in the vicinity of Assendon Stream.



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