Preliminary Rainfall Analysis

2016 MAFSM Annual Conference

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Research

- MAFSM October 2013
- 40 years of rainfall in Maryland and Virginia
- Looking for possible increases over time; 24 hour storm
- The next step was to add significance testing & look at extreme maxima
- Started to look at number of events per year
- Fairfax County Rainfall Gauges

Virginia & Maryland

➢A substantial record is required

    ➢minimum 20+ years

➢We wanted the flexibility to look at a range of storm durations

    ➢minimum of 15 minute increments

➢To identify recent trends

    ➢need recent years of data

    ➢continuous years of data

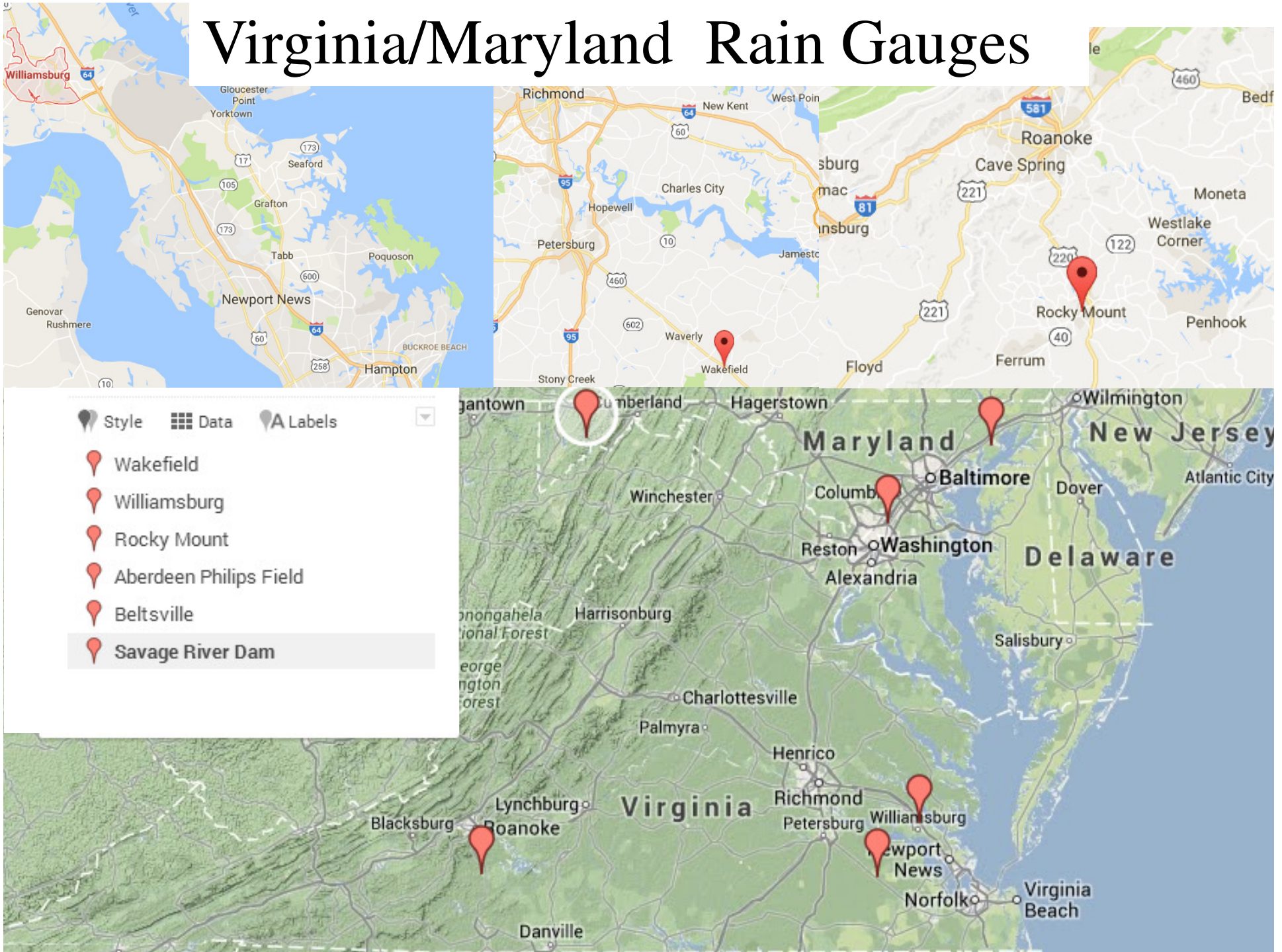➢Focused on: the 24 hour storm duration and number of storms >2", and 1 hour storm duration and number of storms > 0.5"

Virginia: Of all the NWS stations in VA only 4 met our criteria despite some missing records; which we will discuss.

Maryland: Of all the NWS stations in Maryland only 4 stations met our criteria.

Virginia/Maryland Rain Gauges

Significance Tests

➢ **R²** > 0.25 good correlation

  measure of the fit for a regression

➢ **Kendall TAU** > 1.96 (the 95% confidence limit) indicates a trend

  It is a measure of 'disarray' in the data

$$\tau = \frac{(\text{number of concordant pairs}) - (\text{number of discordant pairs})}{\frac{1}{2}n(n-1)}.$$

➢ **Mann-Kendal** > 1.96 indicates a trend

  Variation of Kendall TAU

➢ **Theil-Sen slope of trend**

  < 0.05 indicates a trend

  < 0.1 possible trend

  a method for robust linear regression that chooses the median slope among
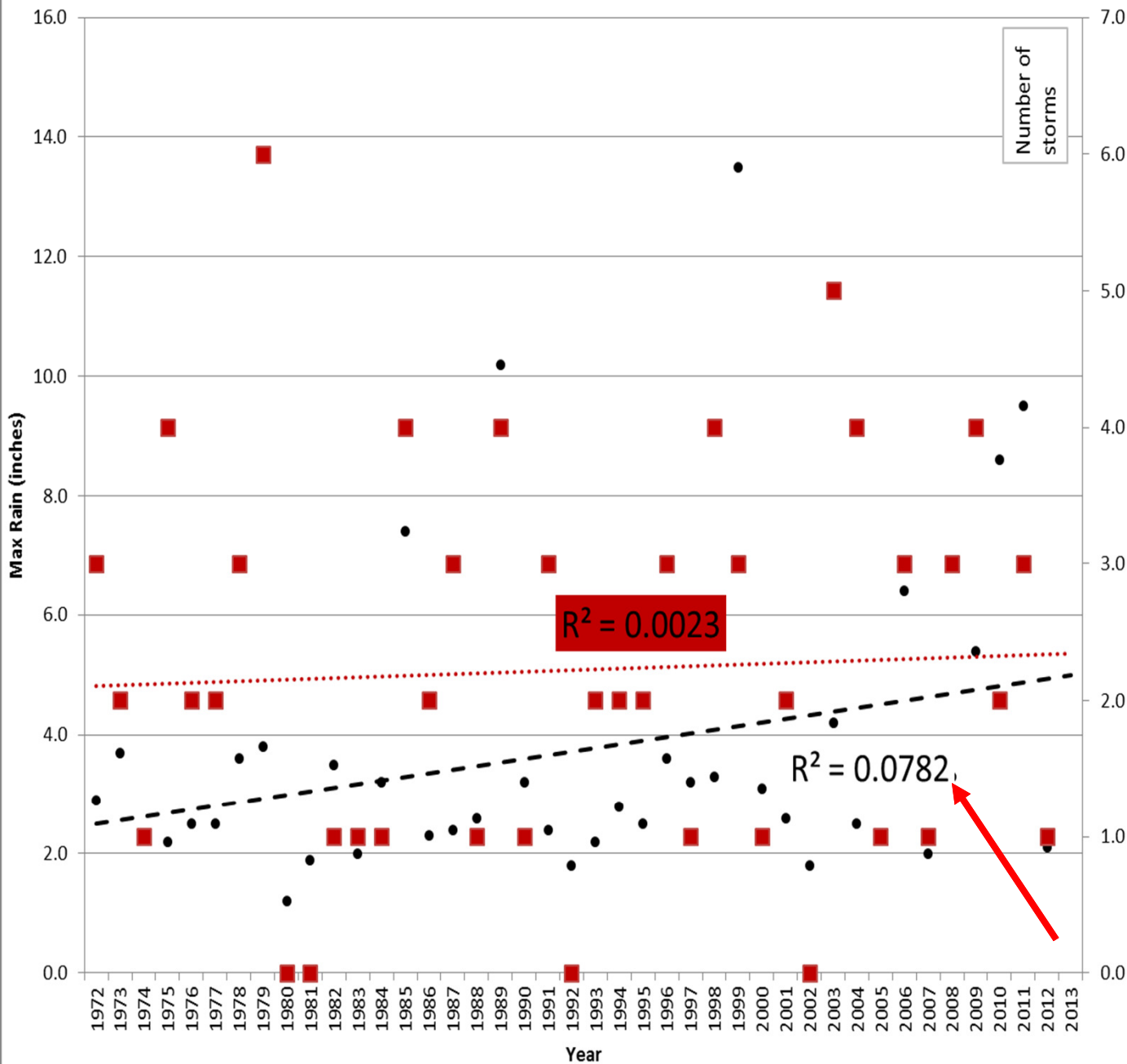 all lines through pairs of two-dimensional sample points

Extreme maxima

➢Gumbel

Used to estimate the 100 year event from a small dataset

➢Log Pearson

Frequently used to determine stream flows from a smaller dataset. We modified it to estimate a 100 year rainfall
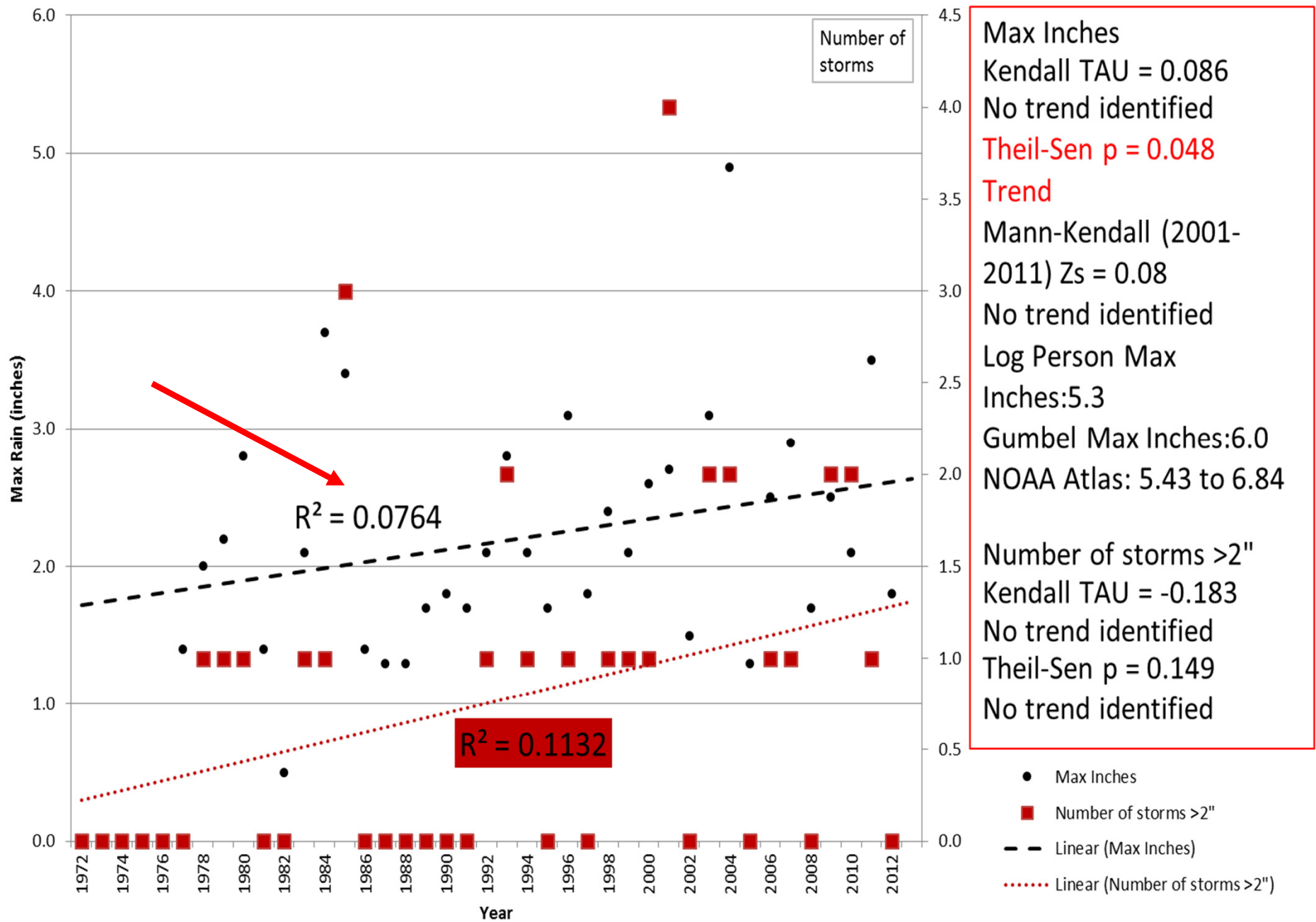
24 hours rain (inches), Station WILLIAMSBURG 2 N VA US
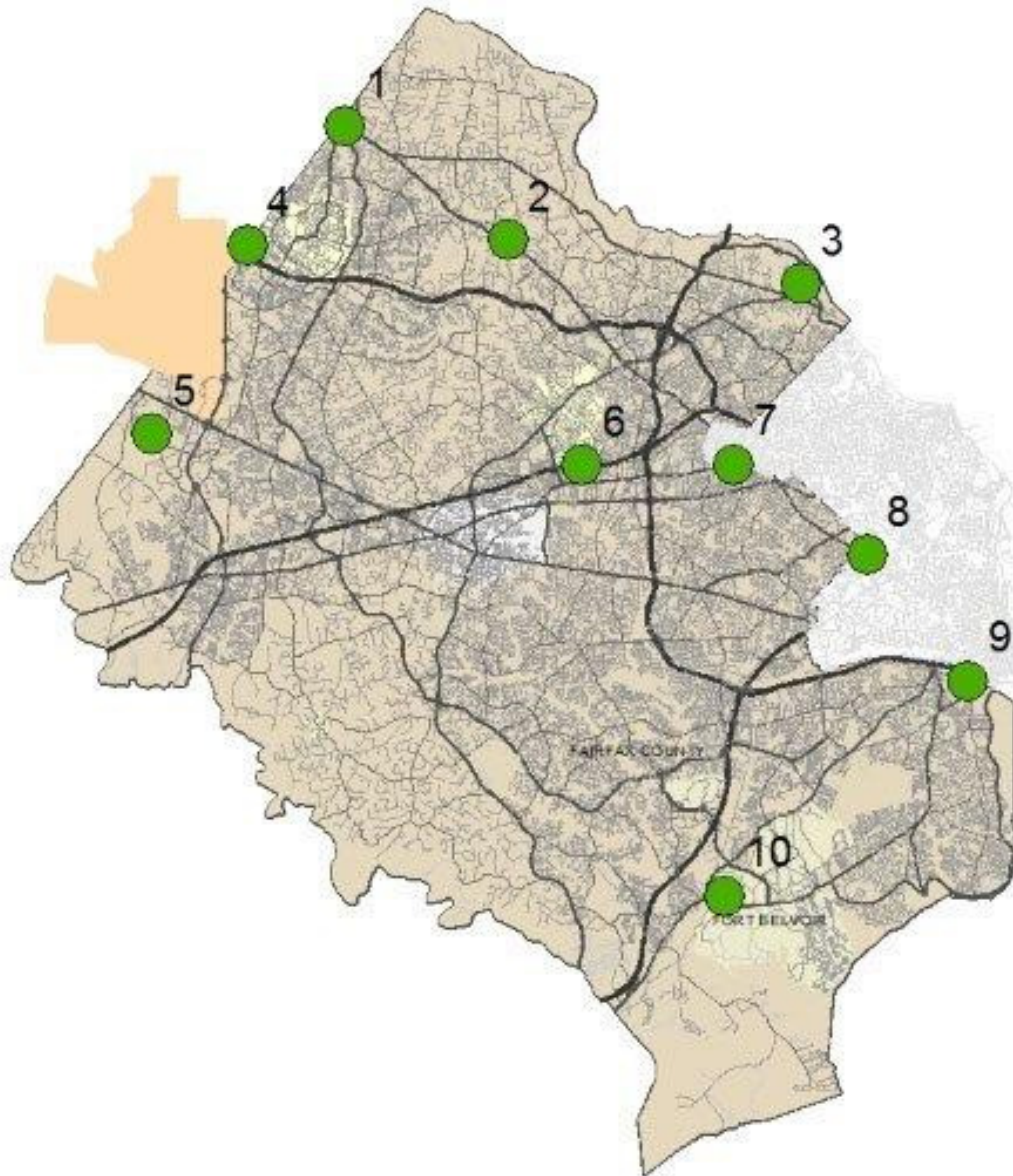
24 hours rain (inches), Station SAVAGE RIVER DAM MD US

Fairfax County Rainfall Data

- 10 gauges

- 15 minute intervals

- 9 or 10 years of data for each gauge
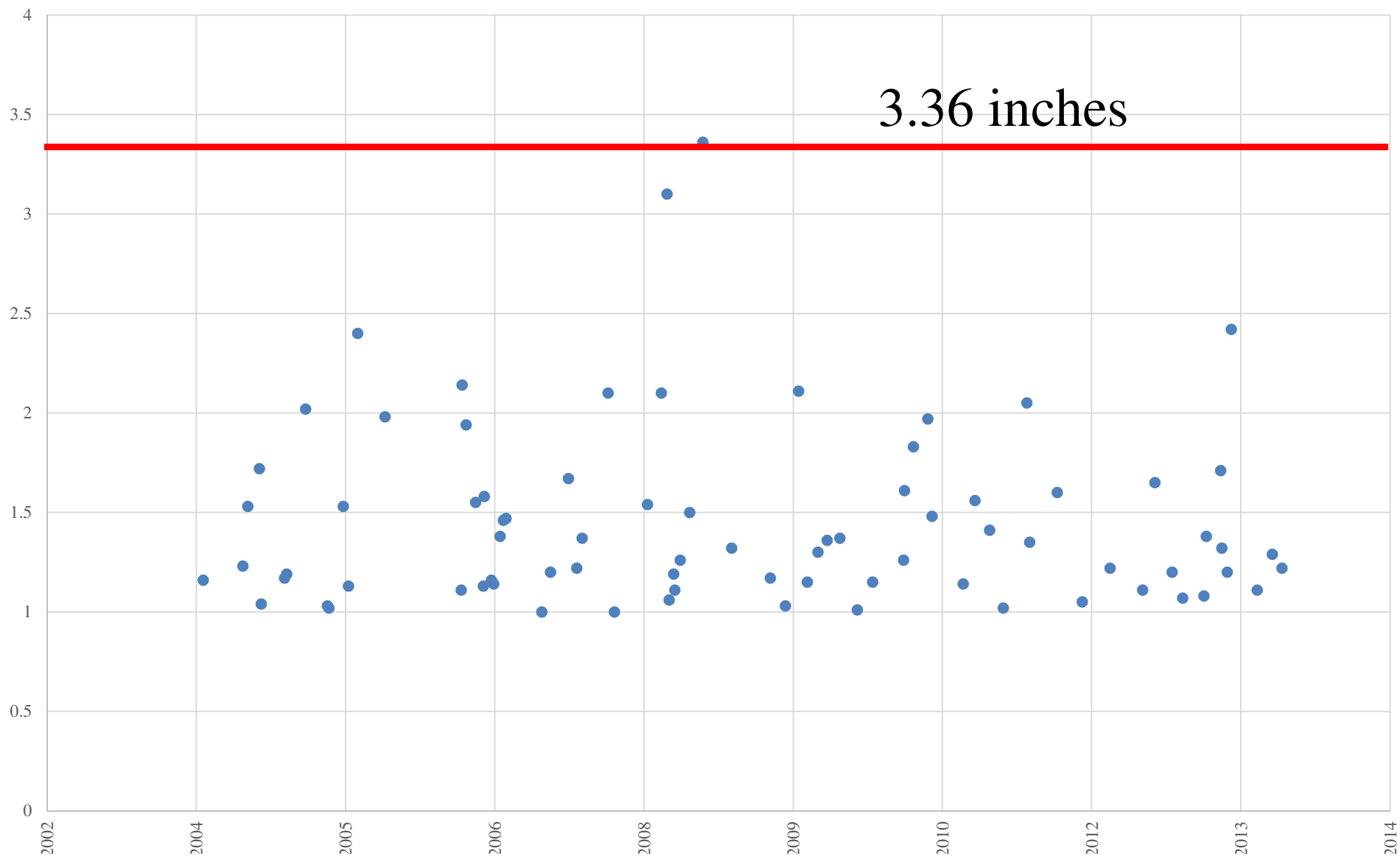
Search for rainfall events

- Software that searches through the rainfall records

- Duration 6 hour and 24 hour

- Events > 1 inch

- Discrete events; 72 hours apart

M8057
Events with a 24 hour duration; > 1 inch

4.87 inches
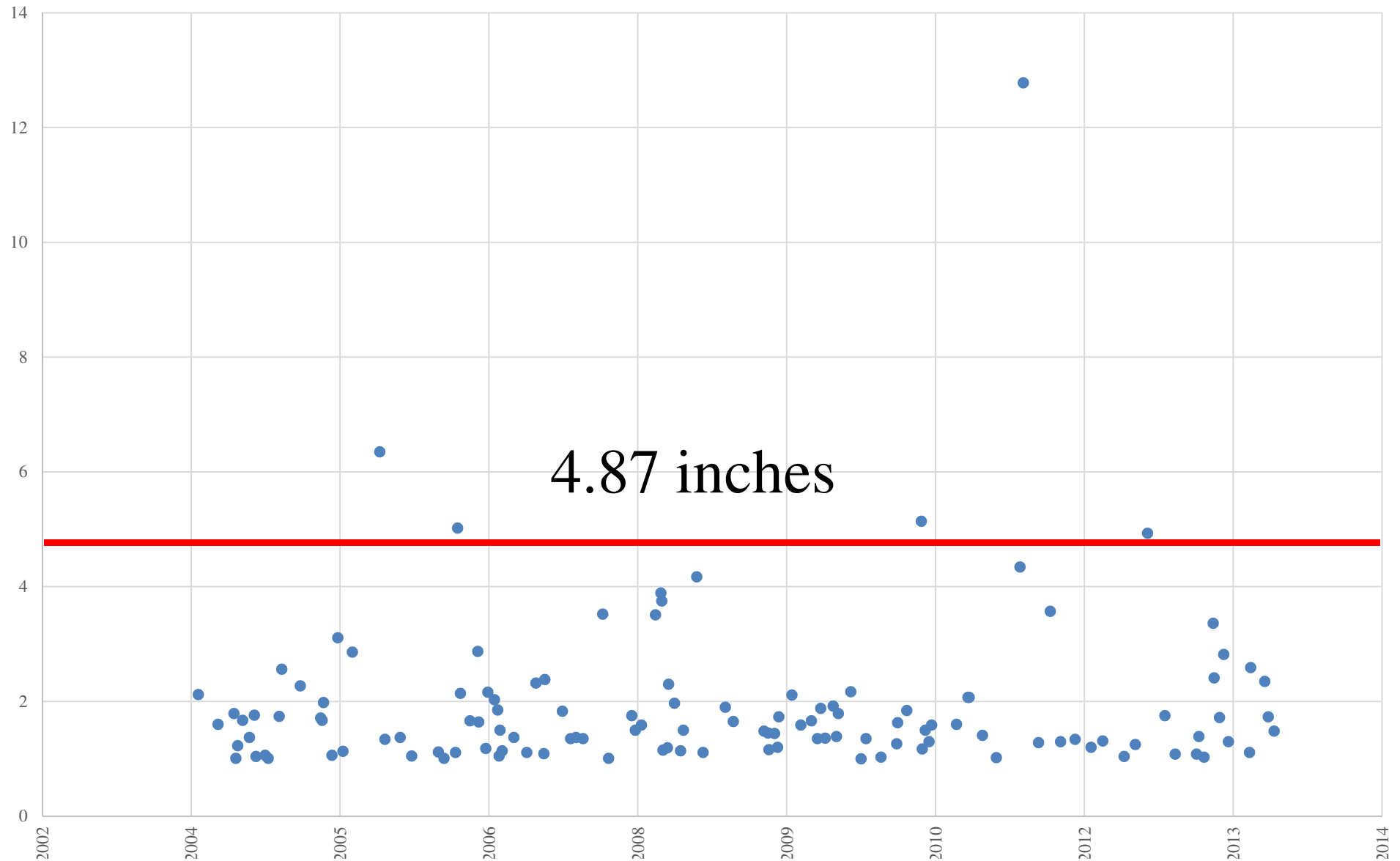
Current design standards

Table 6.19 Storm Volume in Inches of Rainfall* (122-16-PFM)

Frequency	Duration of Storm									
	5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1 Yr	0.355	0.567	0.708	0.971	1.21	1.42	1.52	1.87	2.28	2.62
2 Yr	0.426	0.681	0.856	1.18	1.48	1.74	1.85	2.27	2.75	3.17
5 Yr	0.506	0.810	1.02	1.46	1.87	2.20	2.35	2.87	3.49	4.07
10 Yr	0.565	0.904	1.14	1.66	2.16	2.56	2.75	3.36	4.12	4.87
25 Yr	0.641	1.02	1.30	1.92	2.56	3.08	3.32	4.08	5.08	6.09
50 Yr	0.698	1.11	1.41	2.12	2.87	3.50	3.79	4.70	5.92	7.18
100 Yr	0.754	1.20	1.52	2.32	3.20	3.95	4.29	5.37	6.85	8.41
Max Prob								27.0		

* Storm Volumes from NOAA Atlas 14 for the Vienna Tysons Corner Station (Station ID:44-8737) except for the maximum probable storm which is from NWS Hydrometeorological Report No. 51.

Number of events exceeding the 10 year 6 hour storm

Gauge	Number of events exceeding
FAIR_D2010	1
FAIR_B2006	1
FAIR_A3003	3
UOSA_T1080	1
FAIR_M8057	1
FAIR_G3063	3
FAIR_M2028	1
FAIR_I3020	1
FAIR_I1803	2
FAIR_H2022	1

Thy fate is the common fate of all;
Into each life some rain must fall.

Henry Wadsworth Longfellow

fiveminutevacations.com

Number of events exceeding the 10 year 24 storm

Gauge	Number of events exceeding
FAIR_G3063	5
UOSA_T1080	3
FAIR_M8057	5
FAIR_M2028	3
FAIR_I3020	2
FAIR_I1803	4
FAIR_H2022	2
FAIR_D2010	4
FAIR_B2006	5
FAIR_A3003	3

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Has the UK truly 'stocked up' on rainwater?

By Tom de Castella
BBC News Magazine

GETTY IMAGES

Hard as it is to believe now, two years ago the UK was seriously preparing for drought. Since then there's been a lot of rain, so does it mean there won't be hosepipe bans for many years?

In today's
Magazine

British Politicians Blame One Another for Regional Flooding

By KATRIN BENNHOLD

LONDON — As flood warnings move down the River Thames, and closer to the capital, the political tide is rising, too.

Severe-flood alerts, meaning there is real danger to life, are in place for stretches of the Thames that are within 17 miles of London. The marines have been called in, and vulnerable homes were still being evacuated on Monday.

Disaster stories abound: A 7-year-old boy died over the weekend after falling ill in a flooded home in nearby Surrey, a kayaker drowned on a swollen Welsh river, a coastal railroad was ripped up by waves in Cornwall, and scores of additional homes were flooded across the hard-hit Somerset Levels, a coastal plain and wetlands area in southwest England. Around 5,000 houses in Britain have been damaged since December in what has most likely been the rainiest season in at least 248 years.

But the tempest of charges and countercharges about who is to blame for Britain's lack of preparedness for the crisis has been almost as fierce as the rainstorms battering the country again this week.

Eric Pickles, the secretary of state for communities and local government, who is leading Prime Minister David Cameron's emergency response, put the blame squarely on the Environment Agency, accusing it of giving the government poor advice on flood management.

"We thought we were dealing with experts," Mr. Pickles said Sunday. He stopped short of calling for the resignation of the agency's chairman, Chris Smith of the Labour Party — but only just. "I don't see myself becoming an advocate of the 'Save Chris Smith' campaign," he said.

Clearly unable to resist a water metaphor, the Conservative lawmaker Ian Liddell-Grainger was less polite, calling Mr. Smith a "little git" and threatening to "stick his head down the loo and flush."

Mr. Smith hit back on Monday, saying that his staff knew "100 times more" than politicians and that he was "not going to take any lessons" on flood management from Mr. Pickles. Instead, Mr.

OLI SCARFF/GETTY IMAGES

Rescue workers evacuated residents from homes near the River Thames on Monday. About 5,000 houses have been damaged in a heavy rain season.

Source: Environment Agency, United Kingdom

THE NEW YORK TIMES
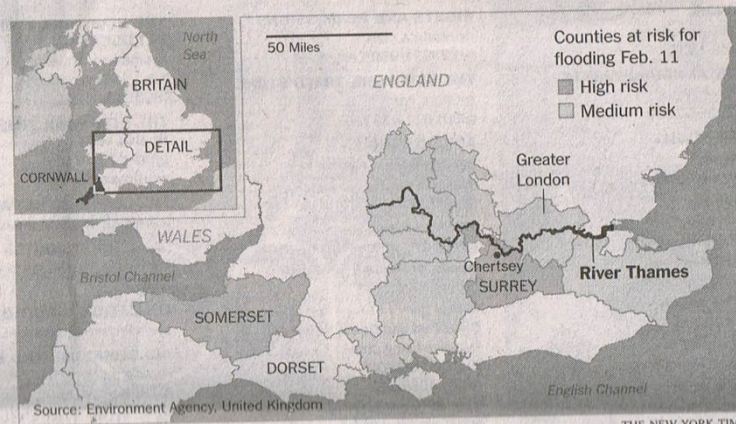
Smith blamed austerity and accused the government of starving his agency of the necessary funds to pay for decent flood defenses and measures, like river dredging.

Even Mr. Cameron, who has urged for a stop to the infighting and refused to be drawn into the debate over the Environment Agency during a visit of flood-hit Dorset on Monday, has blamed the Labour Party for abandoning dredging in the late 1990s.

As those in charge were busy pointing fingers, the leader of the populist United Kingdom Independence Party, Nigel Farage, toured a submerged village in waders, calling for overseas aid to be redirected to Somerset.

Mr. Farage did not, however, blame the government's policy on same-sex marriage for the floods, as one of his party's representatives did three weeks ago. That politician, David Silvester, who has since been suspended, had said that the floods were Mr. Cameron's fault because by legalizing same-sex marriage he had brought the wrath of God onto his country.

Others thought it more likely that climate change was a culprit for the exceptional weather. Julia Slingo, chief scientist of the Met Office, Britain's national weather service, said all the evidence pointed to a link.

For the 8.2 million people living in London, what was once a somewhat distant news event has certainly become uncomfortably close. Residents briefly got a taste of some of the disruption other areas have been living with for more than a month when the M25, the ring road running around greater London, was flooded on Friday. Three of its four lanes running in one direction were temporarily closed.

The Thames Barrier — one of the world's strongest flood defense installations, designed to protect London from a surge in the North Sea — was shut on Sunday at high tide and was expected to close again to protect properties along the river.

West of London, sections of the Thames have already flooded. Zane Gbangbola, 7, died after his family's home was flooded in the town of Chertsey, news reports said. It had not been established whether carbon monoxide poisoning from a generator pumping floodwaters from the home was to blame, the reports said. But a waterborne disease was apparently ruled out after a sample from the family's basement had been analyzed.

Thousands of other homes in the Thames valley are under threat from rising waters in the coming days, Mr. Pickles warned on Monday. As residents braced for winds expected to reach 80 miles per hour and an additional 40 millimeters (1.6 inches) of rain by Thursday, he signaled a possible cease-fire in the partisan sniping.

Challenged in a special session in Parliament on Monday, Mr. Pickles said it was time to end the "pathetic game of who is to blame."

Summary

The analysis is for a very small dataset and we are not in a position to draw final conclusions.

6 hr events exceeding

Gauge	Date	Inches
FAIR_M2028		
	09/06/2008 14:45	6.44
FAIR_I3020		
	05/09/2008 04:15	3.71
FAIR_I1803		
	09/06/2008 14:45	5.34
	09/08/2011 18:00	3.86
FAIR_H2022		
	09/06/2008 14:45	3.54

Gauge	Date	Inches
FAIR_D2010		
	09/06/2008 15:30	7.1
FAIR_B2006		
	09/06/2008 15:45	5.91
FAIR_A3003		
	06/25/2006 22:45	3.52
	09/06/2008 15:30	5.03
	07/12/2013 04:15	4.21
UOSA_T1080		
	09/06/2008 14:45	3.72
FAIR_M8057		
	09/06/2008 15:30	3.36
FAIR_G3063		
	07/28/2004 00:30	4.36
	09/06/2008 15:30	5.6
	08/18/2010 11:00	3.72

1 to 3 storms exceeding the 6 hour regulated design value

24 hr events exceeding

Gauge	Date	Inches
FAIR_M2028		
	10/08/2005 09:45	6.88
	09/06/2008 16:45	7.4
	09/08/2011 20:15	5.98
FAIR_I3020		
	10/08/2005 15:00	5.71
	06/26/2006 21:15	5.4
FAIR_I1803		
	10/08/2005 15:00	5.76
	06/26/2006 20:15	6.3
	09/06/2008 16:45	6.19
	09/08/2011 20:30	7.09

Gauge	Date	Inches
FAIR_G3063		
	10/08/2005 16:30	6.81
	06/26/2006 20:30	5.59
	09/06/2008 17:00	6.35
	09/08/2011 20:45	5.18
	10/30/2012 04:15	5.31
UOSA_T1080		
	10/08/2005 07:30	5.59
	06/26/2006 15:30	5.78
	10/30/2012 06:45	5.28
FAIR_M8057		
	10/08/2005 15:30	6.35
	06/26/2006 20:30	5.02
	09/30/2010 23:15	5.14
	09/08/2011 20:45	12.78
	10/30/2012 04:45	4.93

24 hr events exceeding

Gauge	Date	Inches
FAIR_M2028		
	10/08/2005 09:45	6.88
	09/06/2008 16:45	7.4
	09/08/2011 20:15	5.98
FAIR_I3020		
	10/08/2005 15:00	5.71
	06/26/2006 21:15	5.4
FAIR_I1803		
	10/08/2005 15:00	5.76
	06/26/2006 20:15	6.3
	09/06/2008 16:45	6.19
	09/08/2011 20:30	7.09

Gauge	Date	Inches
FAIR_G3063		
	10/08/2005 16:30	6.81
	06/26/2006 20:30	5.59
	09/06/2008 17:00	6.35
	09/08/2011 20:45	5.18
	10/30/2012 04:15	5.31
UOSA_T1080		
	10/08/2005 07:30	5.59
	06/26/2006 15:30	5.78
	10/30/2012 06:45	5.28
FAIR_M8057		
	10/08/2005 15:30	6.35
	06/26/2006 20:30	5.02
	09/30/2010 23:15	5.14
	09/08/2011 20:45	12.78
	10/30/2012 04:45	4.93

Gauge	Date	Inches
FAIR_H2022		
	10/08/2005 14:45	6.24
	06/26/2006 20:45	7.86
FAIR_D2010		
	10/08/2005 09:45	5.48
	06/26/2006 07:15	7.22
	09/06/2008 17:00	8
	09/08/2011 20:30	8.45
FAIR_B2006		
	06/26/2006 17:30	4.99
	09/06/2008 16:30	7.04
	10/01/2010 00:00	5.24
	09/08/2011 19:45	6.59
	10/30/2012 04:00	5.05
FAIR_A3003		
	06/26/2006 03:45	5.12
	09/06/2008 16:15	5.98
	10/30/2012 04:00	4.91

2 to 5 events exceeding the regulated 24 hour design value