Initial Meeting for the
Stream, Rainfall, and Water Quality Gauging Analysis
Rappahannock River Basin, VA

Germanna Riverside Center, Fredericksburg, VA
August 2, 2012

9:30 am **Introduction**
-Overview of Study Purpose
-Background Information
-Chowan River Basin Gauging Study
Holly Carpenter, USACE Norfolk District
Eldon James, RRBC Staff

10:00 am **USGS Gauging Options for the Rappahannock River Basin**
Shaun Wicklein, Virginia Water Science Center, USGS

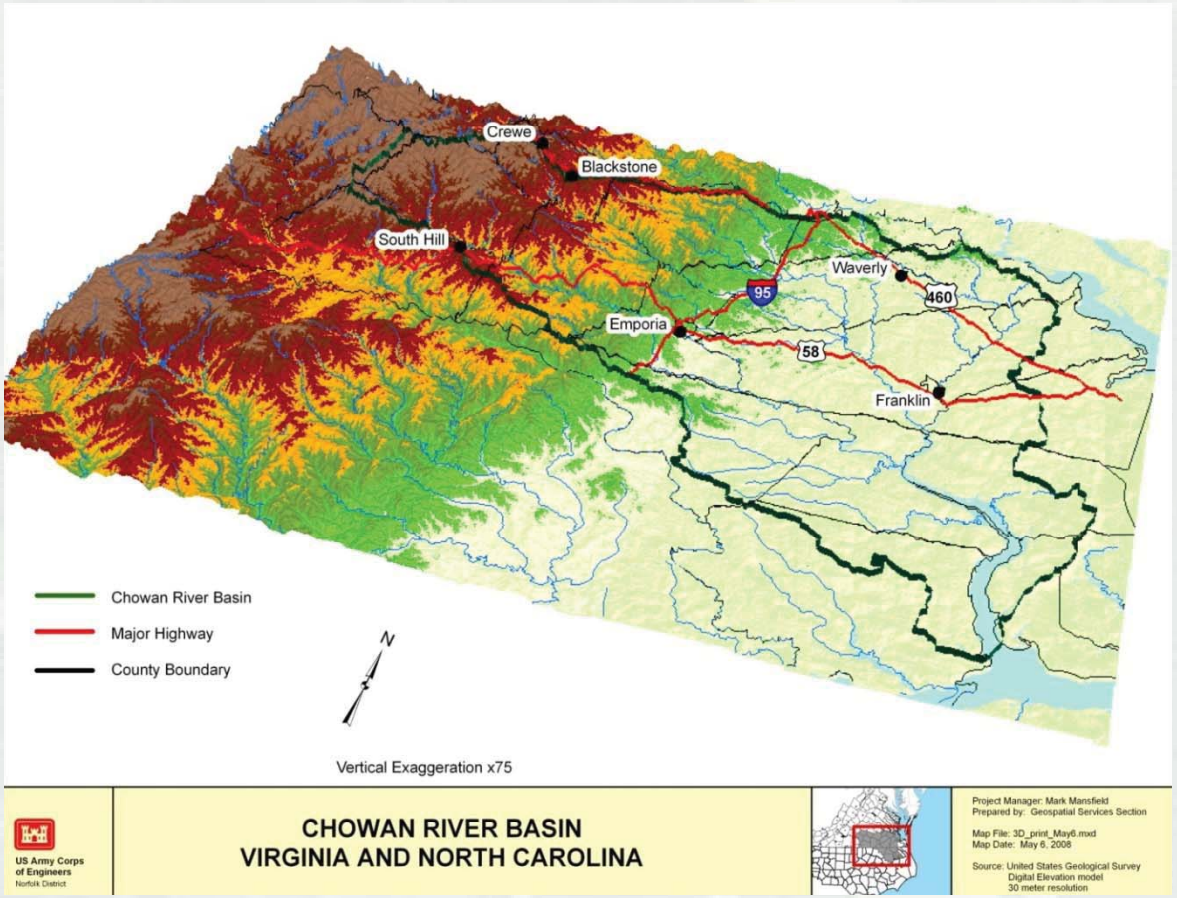
10:20 am **Rappahannock Basin and Gauging Overview**
Jason Elliott, Weather Forecast Office Baltimore/Washington, NWS

10:50 am **Discussion of Gauging Needs in the Basin**

11:20 am **Meeting Closing Comments, Schedule of Next Meeting**

Rappahannock River Basin Gaging Analysis
2 August 2012

Chowan River Basin



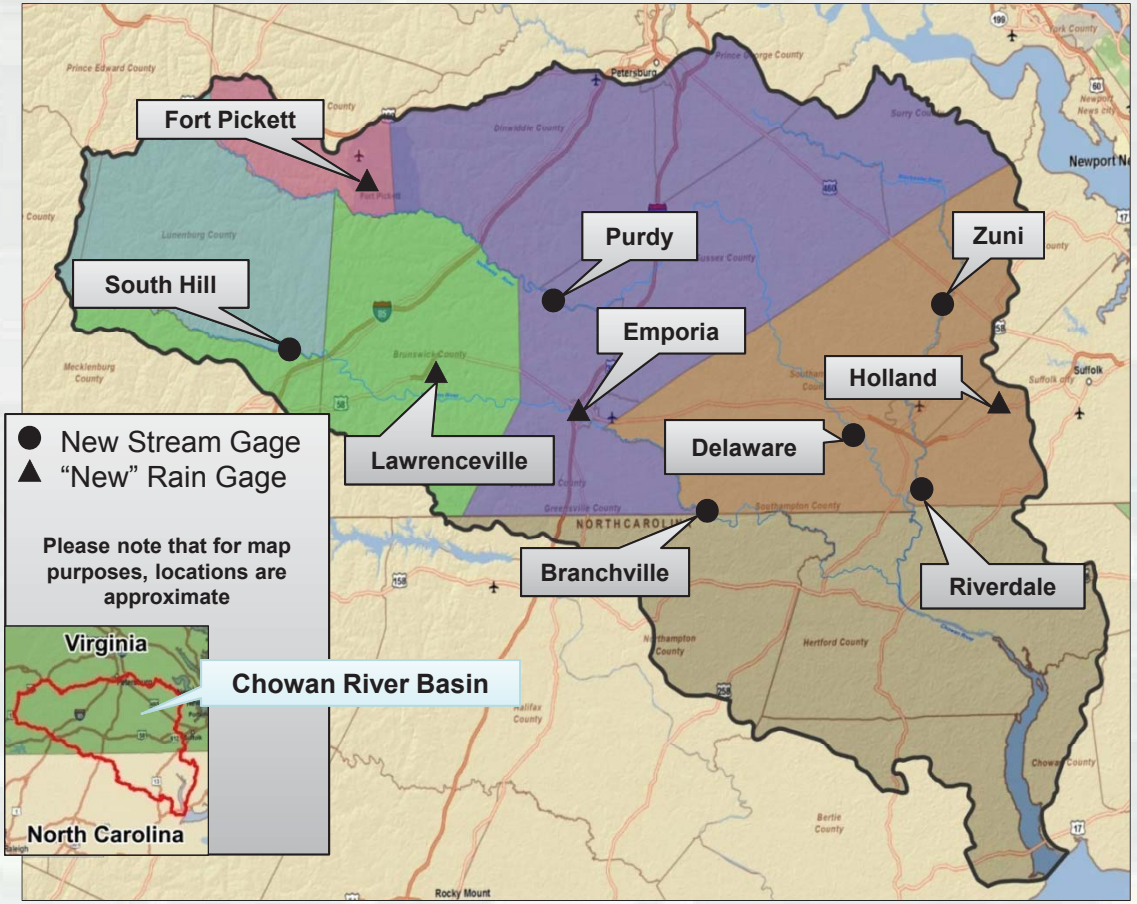
Technical Advisory Committee*

- City of Emporia
- City of Franklin
- Greensville County
- Isle of Wight County
- Southampton County
- Surry County
- Sussex County

- VDEM
- VDEQ
- VDGIF
- VDOF
- NWS
- USGS
- ACOE
- FEMA

Chowan River Basin
Rainfall/Stream Integrated Gaging Network

- Significant flooding has occurred with recurring frequency
- Hurricane Floyd was the flood of record in 1999
- Six new stream gages are recommended for installation: South Hill, Branchville, Purdy, Delaware, Zuni, and Riverdale
- Four existing rain gages are recommended for upgrading: Fort Pickett, Lawrenceville, Emporia, and Holland
- The new gages would much improve the system and allow forecasting of flooding in a more effective way
- The impact would be that citizens can be evacuated and property rearranged before floodwaters become an issue



Network System Cost Estimates

Implementation Costs:

- ✓ Stream Gages ($160K)
  - Real time
  - Actual & Forecast
  - Stage Discharge
  - Index Velocity
- ✓ Rainfall Gages ($75K)
  - Rainfall
  - Wind
  - Barometric pressure
  - Temperature

Operations and Maintenance Costs:

- ✓ Stream Gages ($96.8K)
- ✓ Rainfall Gages (Minimal)

USGS
science for a changing world

U.S. Geological Survey Monitoring for the Rappahannock River Basin

Shaun Wicklein
Hydrologist
U.S. Geological Survey

U.S. Department of the Interior
U.S. Geological Survey

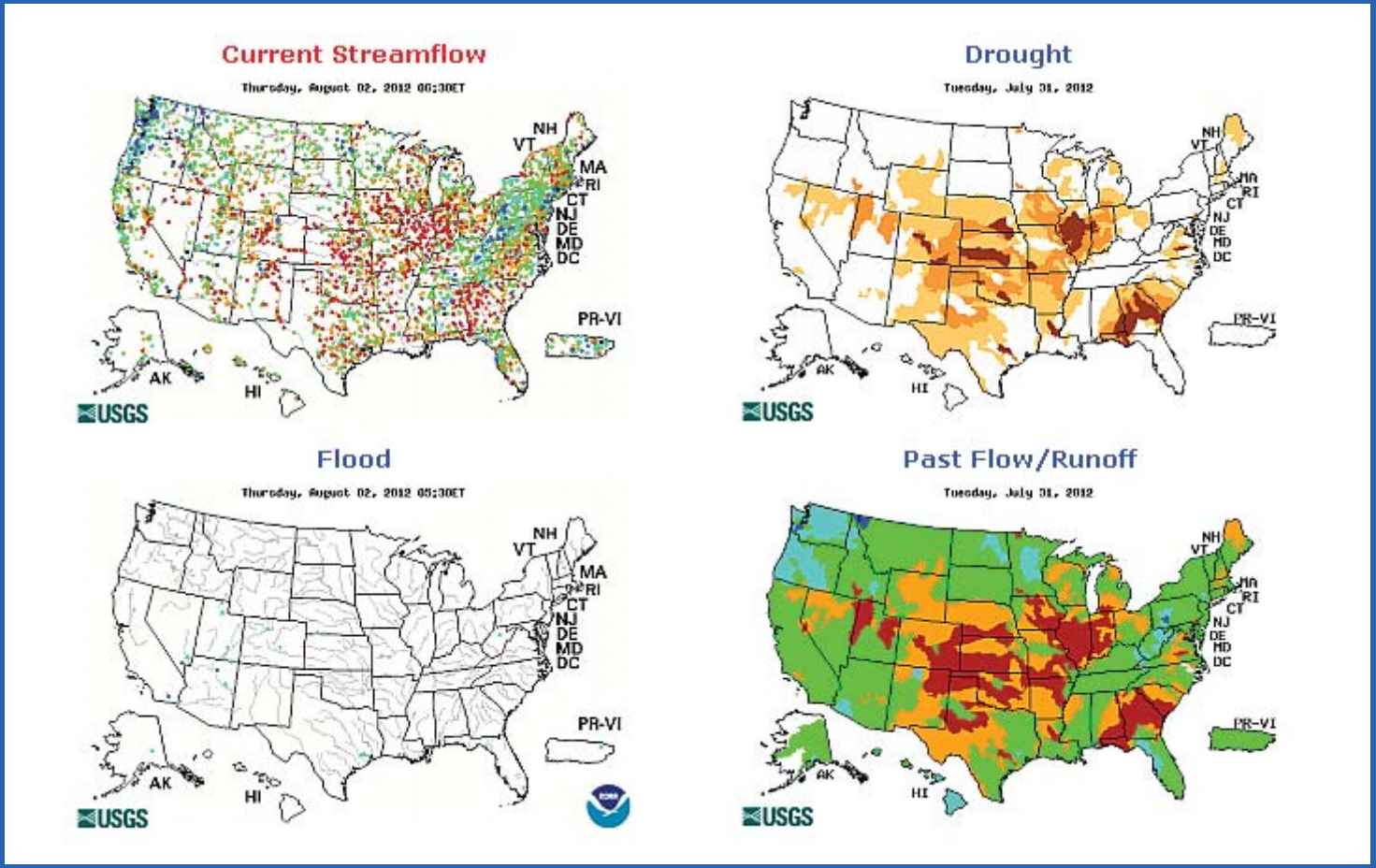
USGS Mission and Roles

The USGS is a science organization that provides impartial information on:

- **Health of the nations ecosystems and environment**
- **Natural hazards**
- **Natural resources**
- **Climate and land-use change**
- **Core Science**

USGS

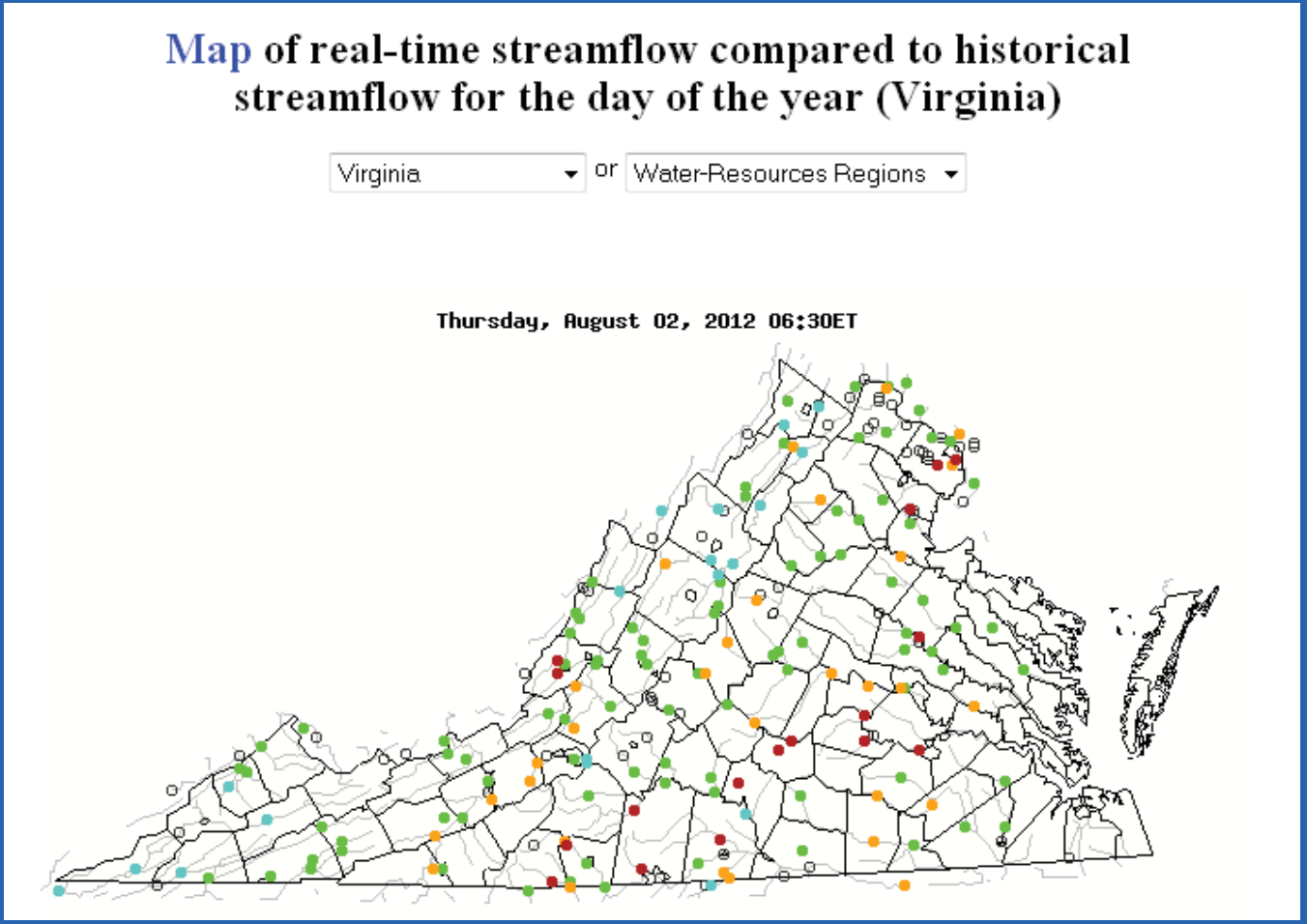
Monitoring and analysis tools



USGS

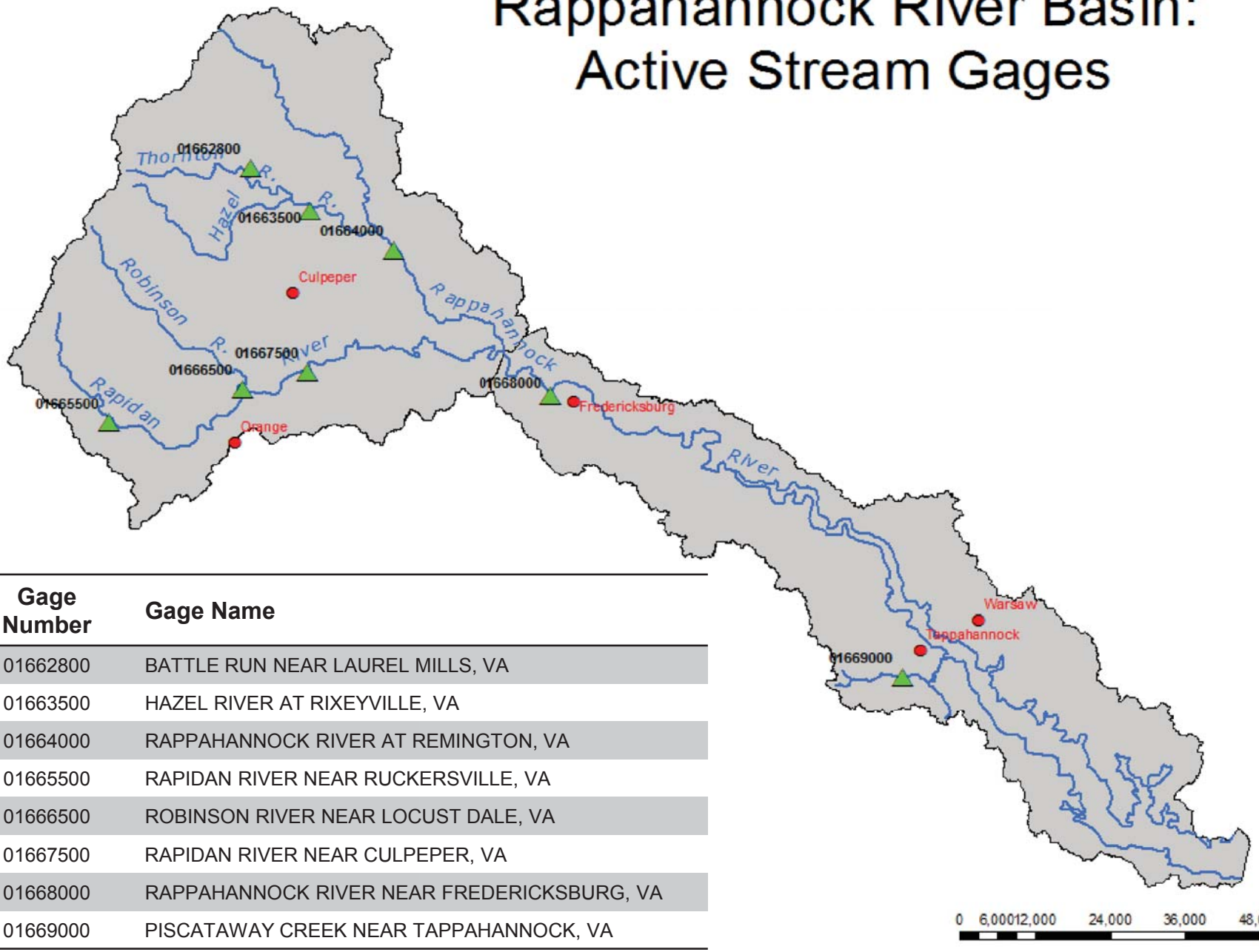
Streamflow monitoring for Virgina

Network Co-operated with VA Dept. of Environmental Quality

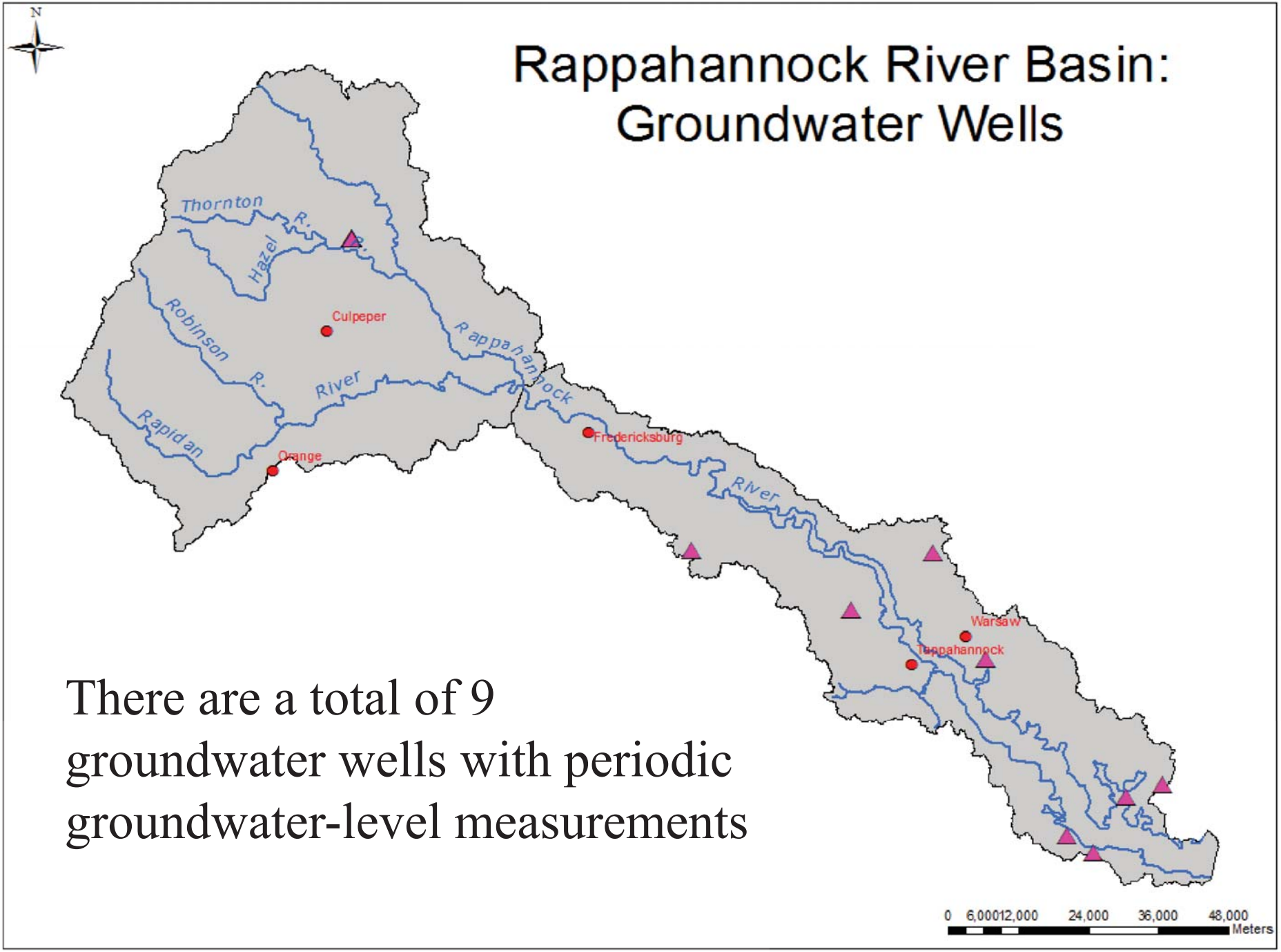


USGS

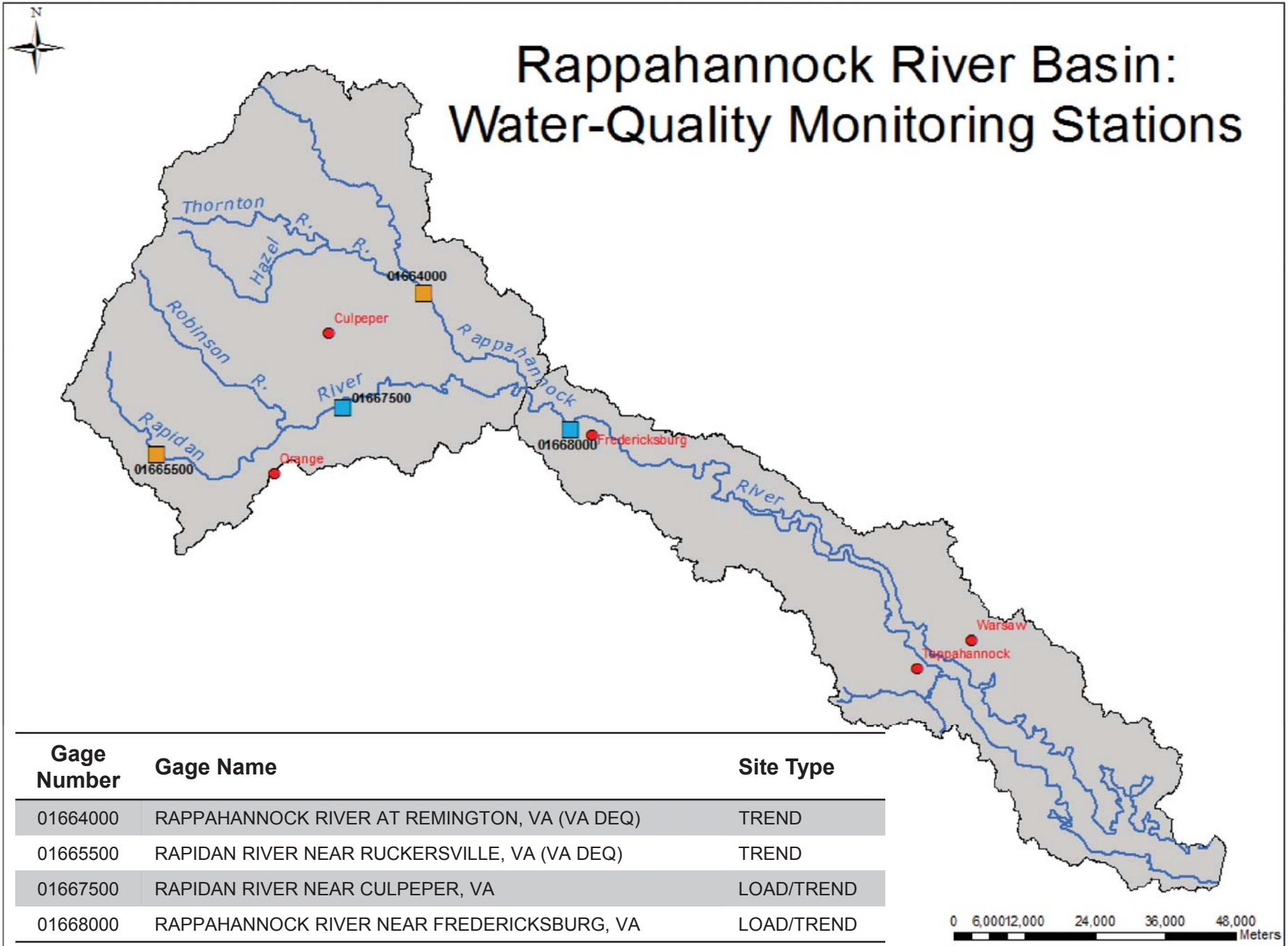
Rappahannock River Basin: Active Stream Gages



Gage Number	Gage Name
01662800	BATTLE RUN NEAR LAUREL MILLS, VA
01663500	HAZEL RIVER AT RIXEYVILLE, VA
01664000	RAPPAHANNOCK RIVER AT REMINGTON, VA
01665500	RAPIDAN RIVER NEAR RUCKERSVILLE, VA
01666500	ROBINSON RIVER NEAR LOCUST DALE, VA
01667500	RAPIDAN RIVER NEAR CULPEPER, VA
01668000	RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA
01669000	PISCATAWAY CREEK NEAR TAPPAHANNOCK, VA


N
Rappahannock River Basin:
Groundwater Wells
Thornton R.
Hazel R.
Robinson R.
Rapidan River
Rappahannock River
Culpeper
Orange
Fredericksburg
Warsaw
Tappahannock
There are a total of 9 groundwater wells with periodic groundwater-level measurements
0 6,000 12,000 24,000 36,000 48,000
Meters

Rappahannock River Basin: Water-Quality Monitoring Stations



Gage Number	Gage Name	Site Type
01664000	RAPPAHANNOCK RIVER AT REMINGTON, VA (VA DEQ)	TREND
01665500	RAPIDAN RIVER NEAR RUCKERSVILLE, VA (VA DEQ)	TREND
01667500	RAPIDAN RIVER NEAR CULPEPER, VA	LOAD/TREND
01668000	RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	LOAD/TREND

Chesapeake Bay Program

- Much of the Chesapeake Bay is listed as impared waters due to
  - Low dissolved oxygen
  - Poor water clarity
  - Algal blooms
- Impairments are related to elevated levels of sediment and nutrients
- Key program goals
  - Reduce sediment input to improve water clarity
  - Reduce nutrient delivery
  - Removal from the impaired water list

USGS

USGS Role in the Chesapeake Bay

- USGS serves as the principal technical agency by providing watershed science to support the Chesapeake Bay Program
- In Virginia, the USGS, in partnership with VA DEQ, performs nutrient and sediment water-quality monitoring, load/trend computation, as well as data analysis/interpretation for the entire nontidal water-quality monitoring network

USGS

Chesapeake Bay Nontidal Network:

Monitoring: (85-sites)

- Maryland
- Virginia
- West Virginia
- Pennsylvania
- West Virginia
- New York
- Delaware
- SRBC
- USGS

Approach:

- Consistent sampling and analytical methods

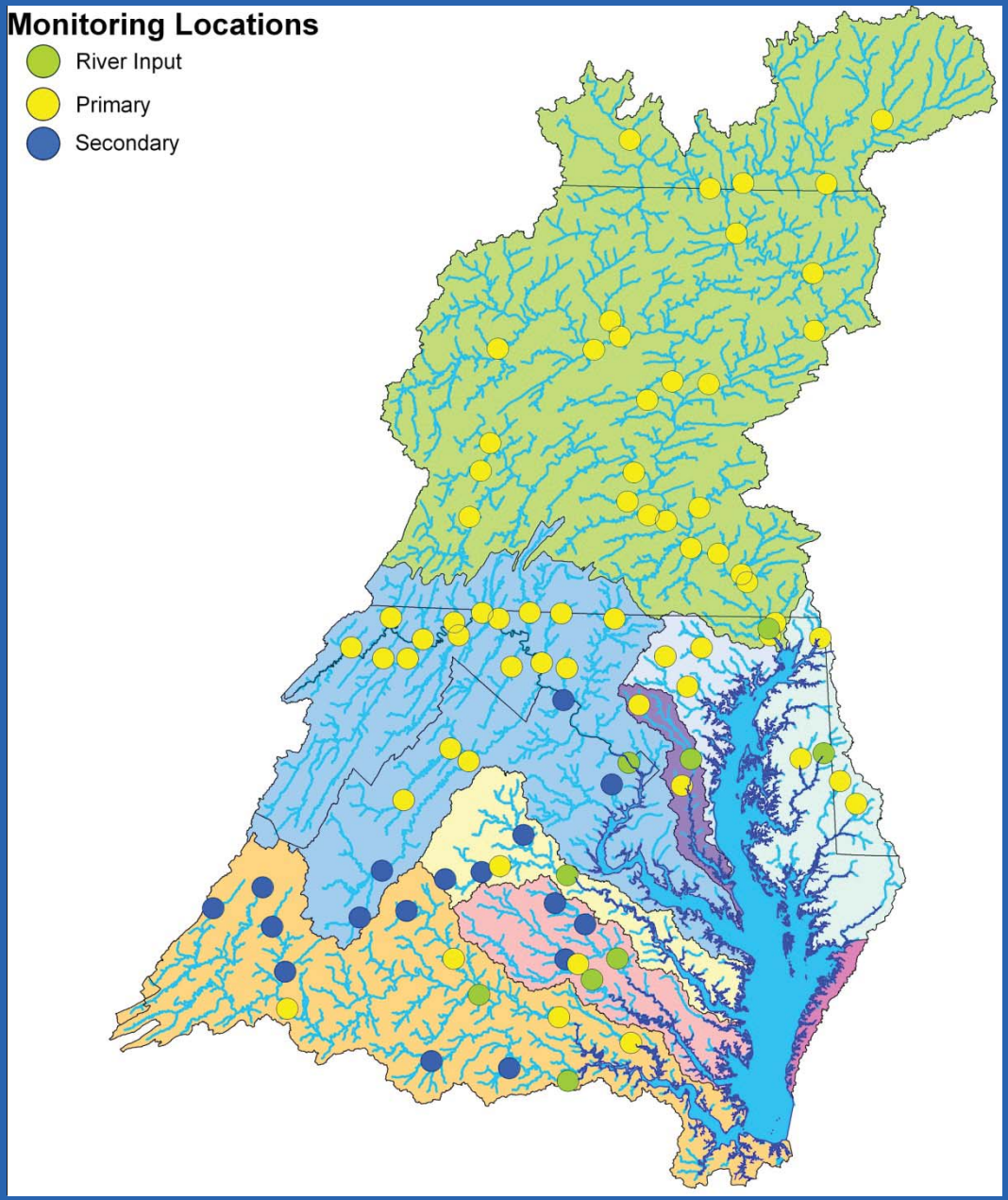
Analysis and Reporting

- Trends
- Loads
- Streamflow

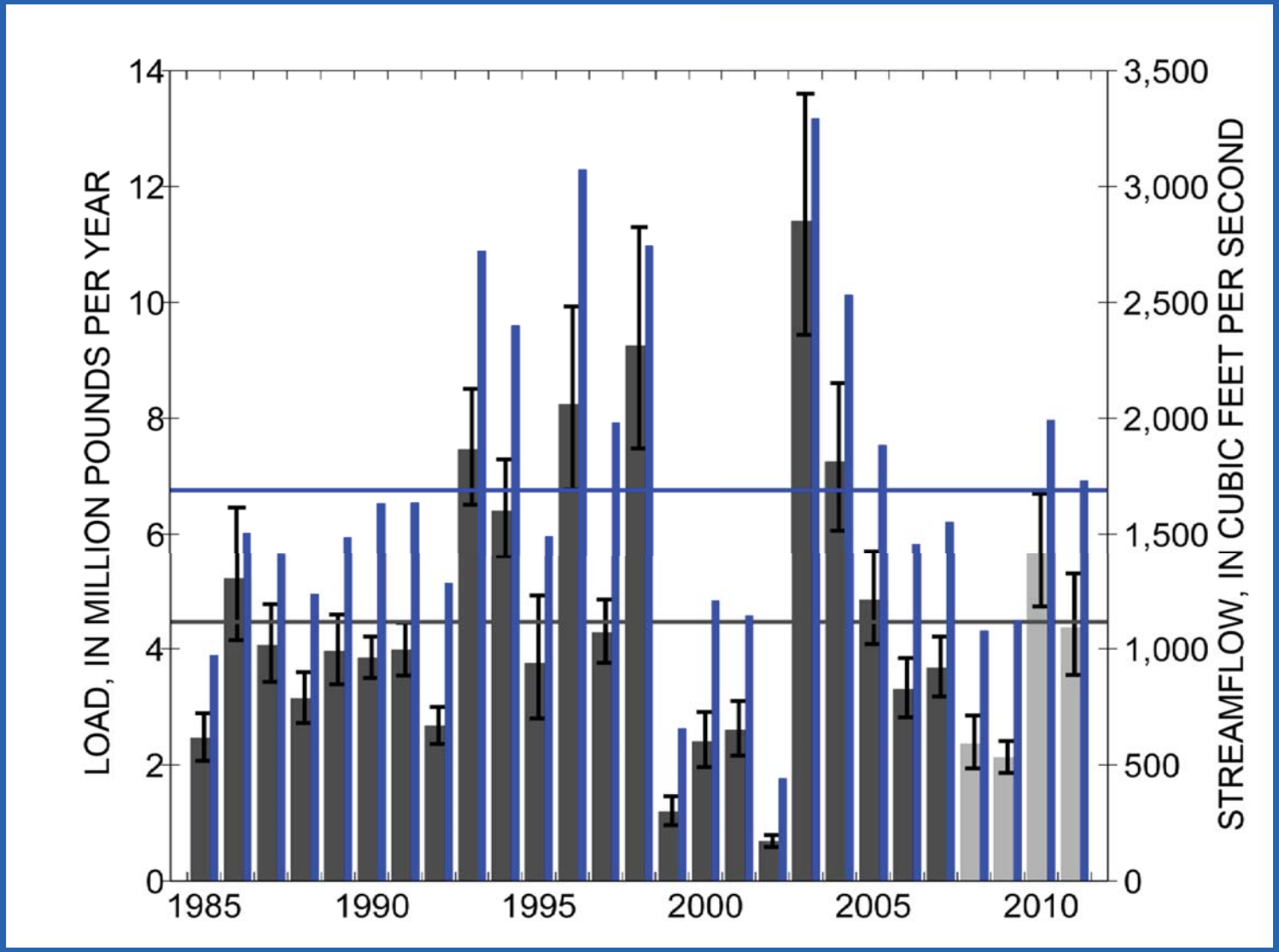
Annual communication:

- Science Community
- Management Community
- Public

USGS



Rappahannock River total nitrogen load



USGS

Loads also computed for: Nitrate, Total Phosphorus, Orthophosphorus, and Suspended Sediment

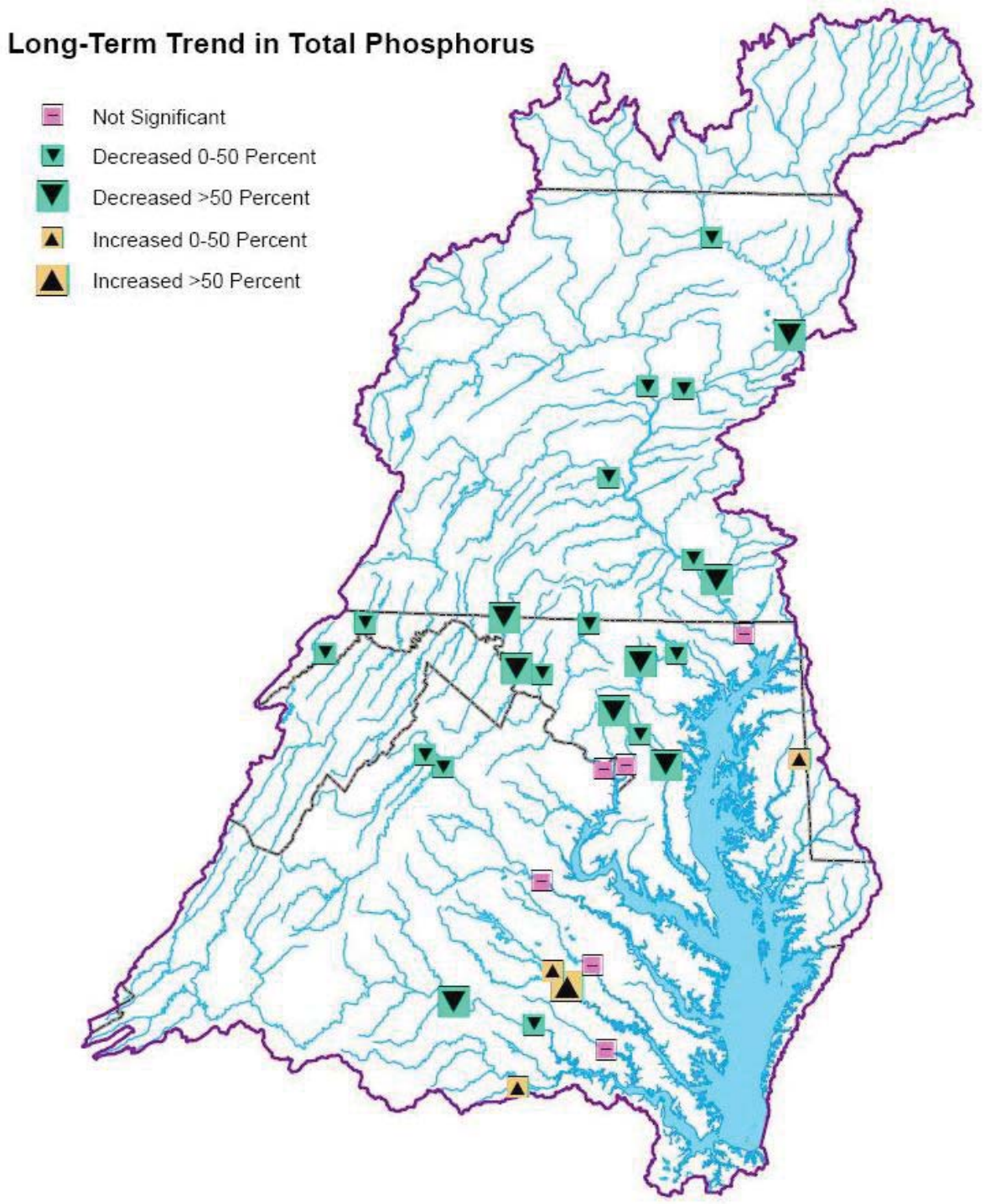
Long-term Trends: Total Phosphorus 1985-2009

- Flow-adjusted concentration trend

Notes:

- = Improving water quality/decreasing nitrogen levels
- = No trend detected in either the up or down direction
- = Degrading water quality/increasing nitrogen levels

USGS



USGS Publication

Report is available on the Web at:
http://pubs.usgs.gov
Key word: 2012-5093

Authors:
Mike Langland
Joel Blomquist
Doug Moyer
Ken Hyer

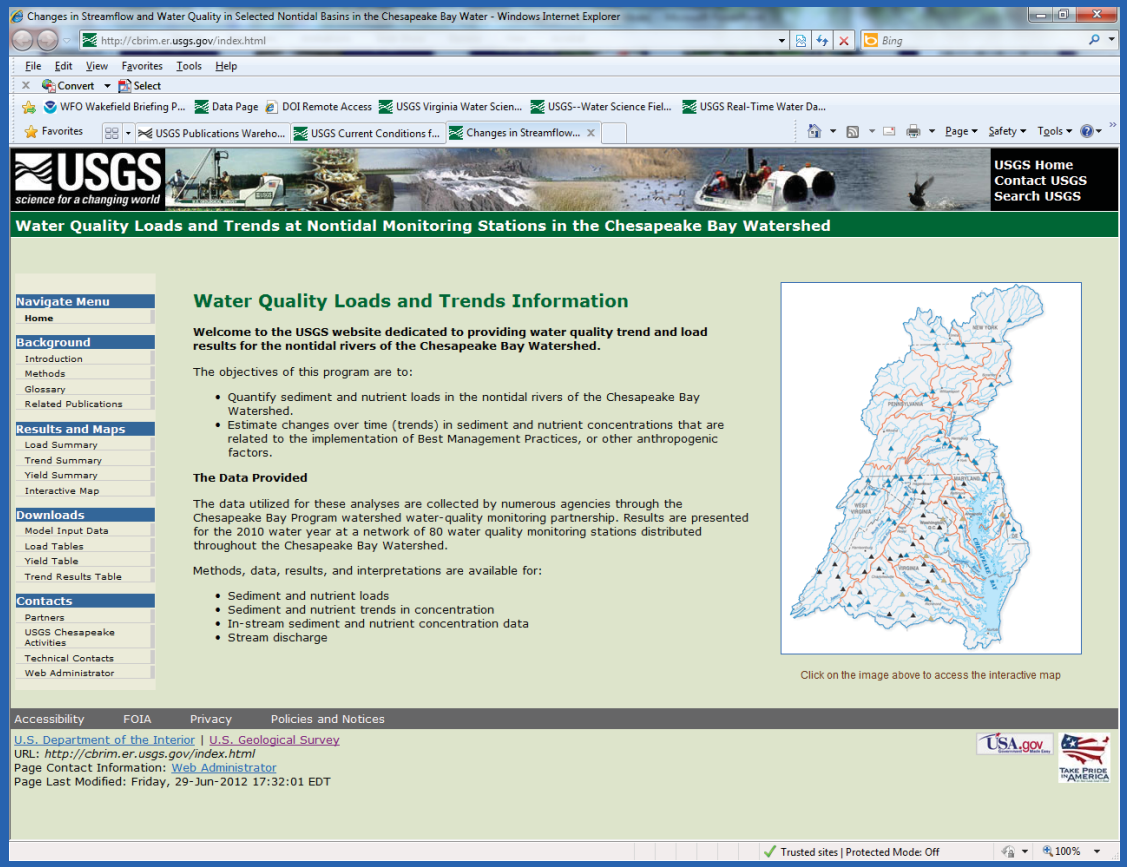
USGS
science for a changing world

Nutrient and Suspended-Sediment Trends, Loads, and Yields and Development of an Indicator of Streamwater Quality at Nontidal Sites in the Chesapeake Bay Watershed, 1985–2010

Scientific Investigations Report 2012–5093

U.S. Department of the Interior
U.S. Geological Survey

New USGS Web page for Water-Quality Loads and Trends in the Chesapeake Bay Watershed



USGS

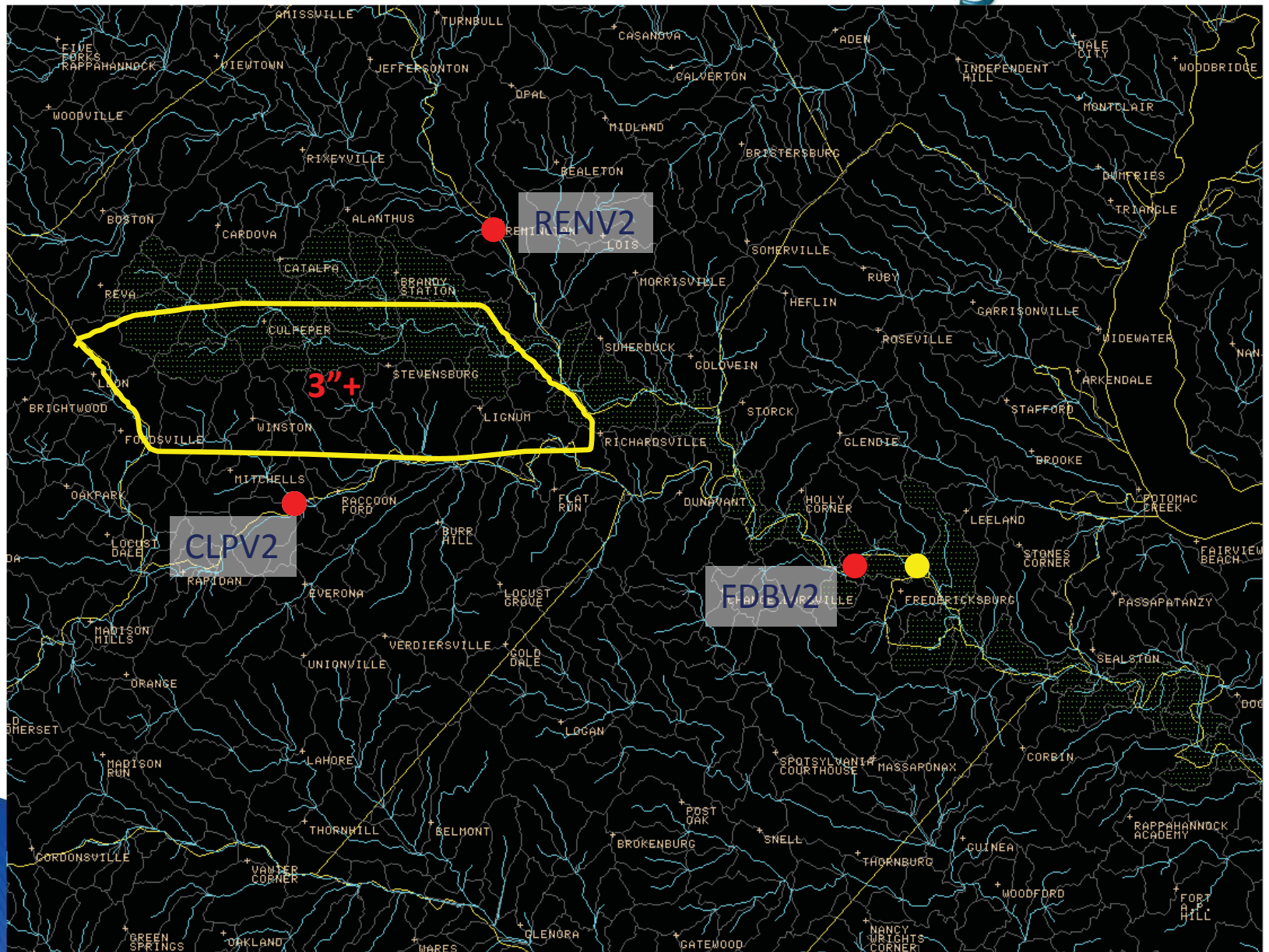
http://cbrim.er.usgs.gov/index.html

Rappahannock Basin & Gauging Overview

Jason Elliott

August 2, 2012

This all started last August…



Culpeper (Rapidan River)

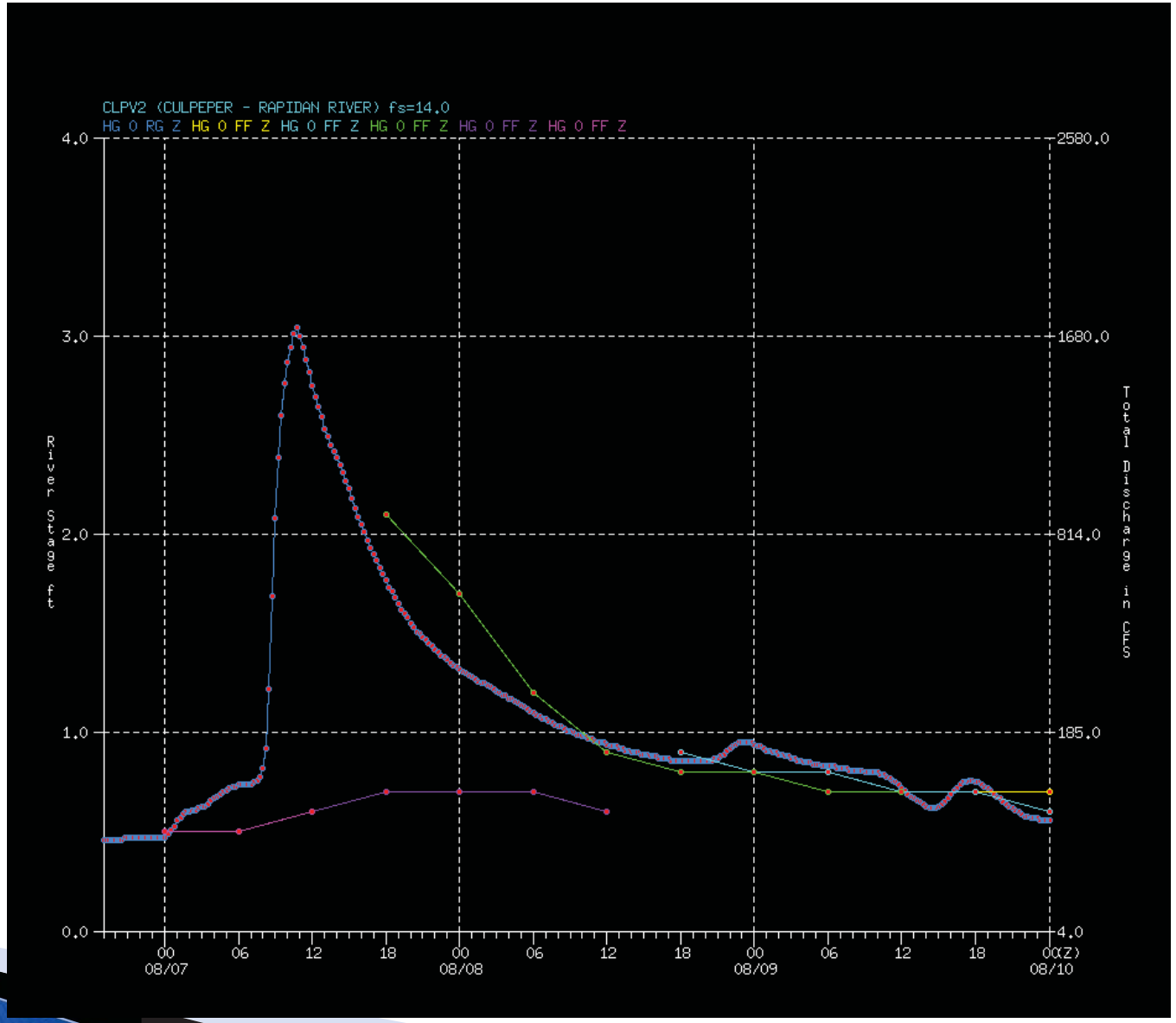
Peak flow:

1716 cfs

1045 UTC

08/07

(3.04 feet)



Remington (Rappahannock River)

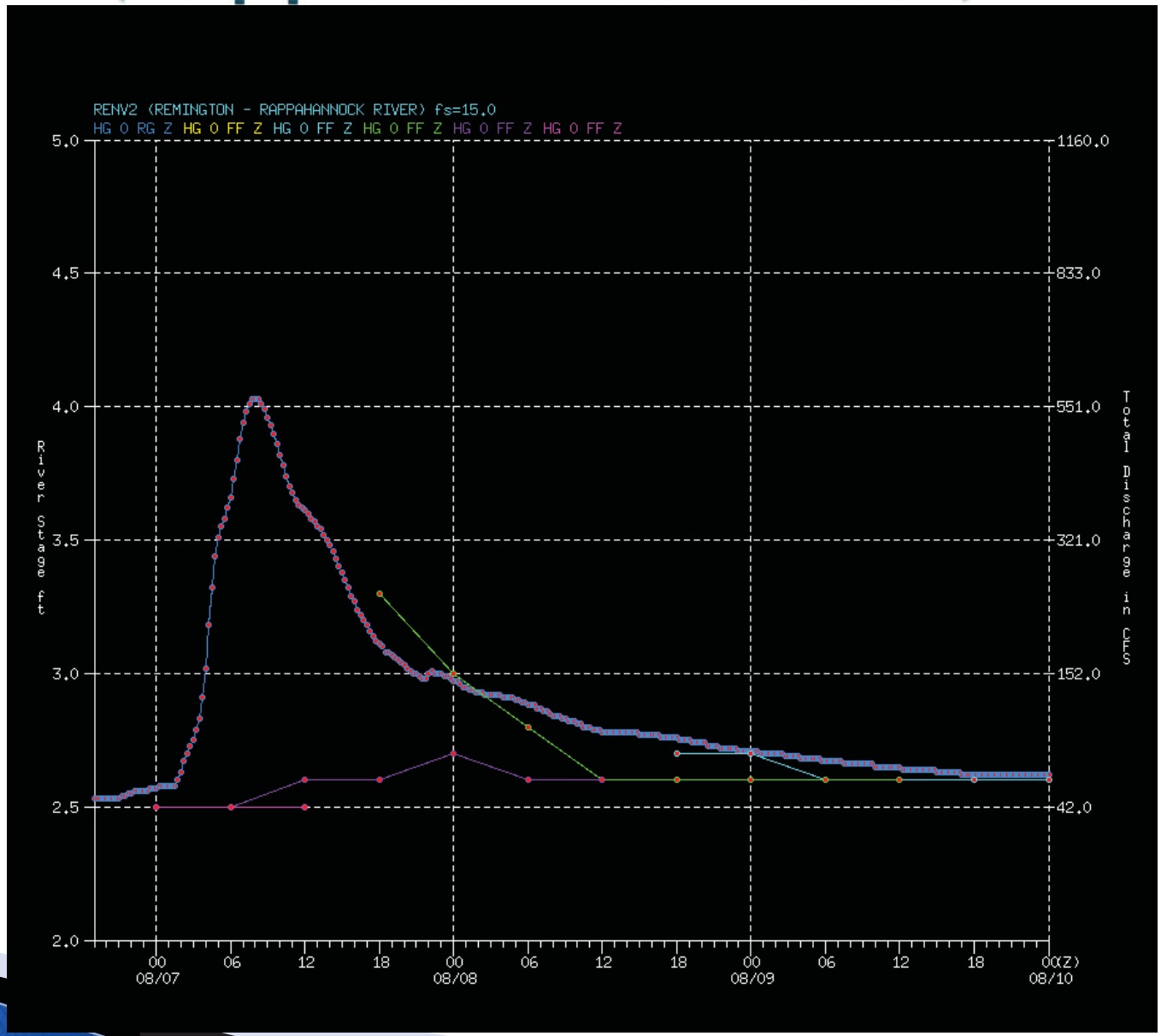
Peak flow:

566 cfs

0815 UTC

08/07

(4.03 feet)



Above Fredericksburg (Rappahannock)

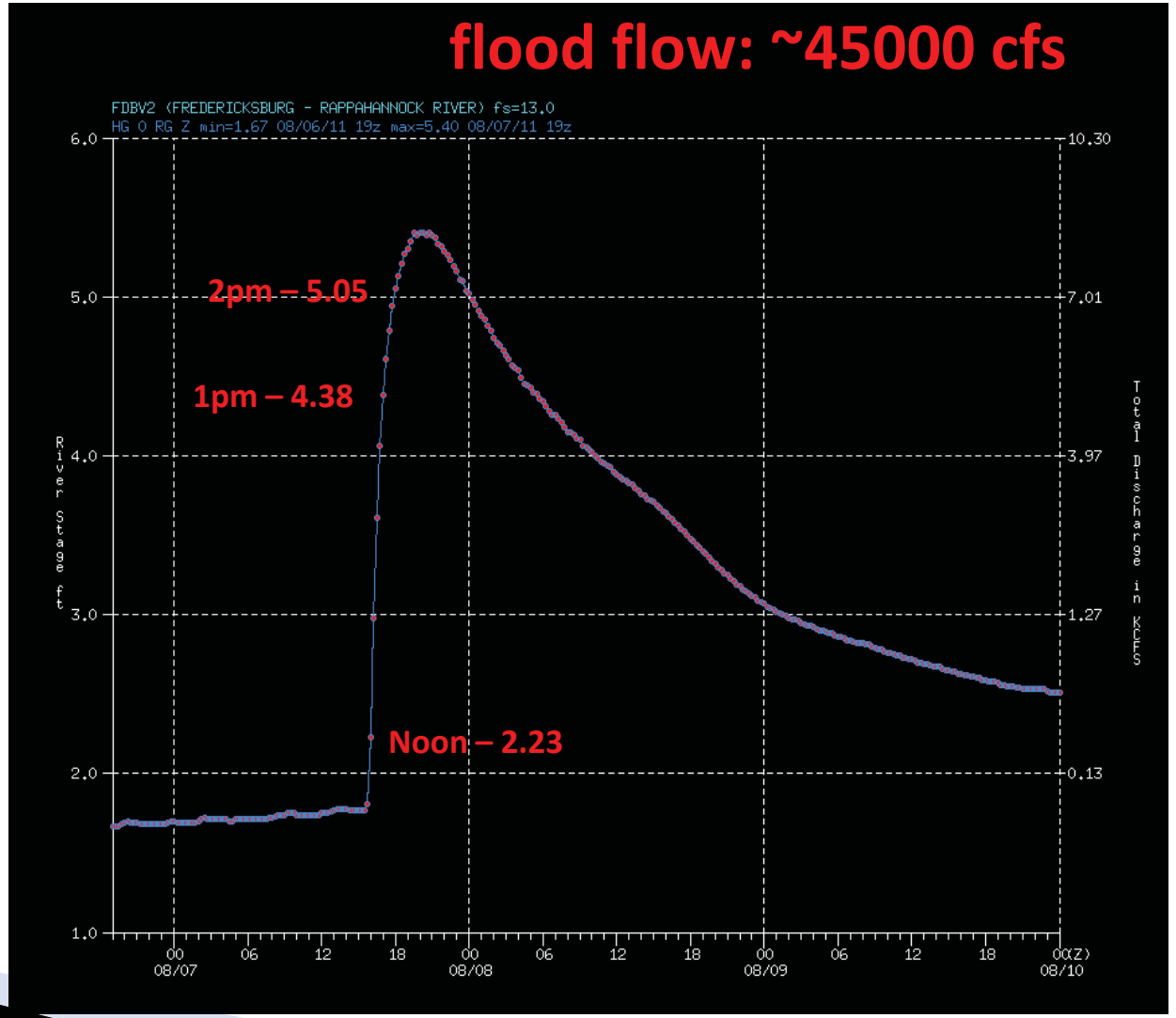
Peak flow:

8880 cfs

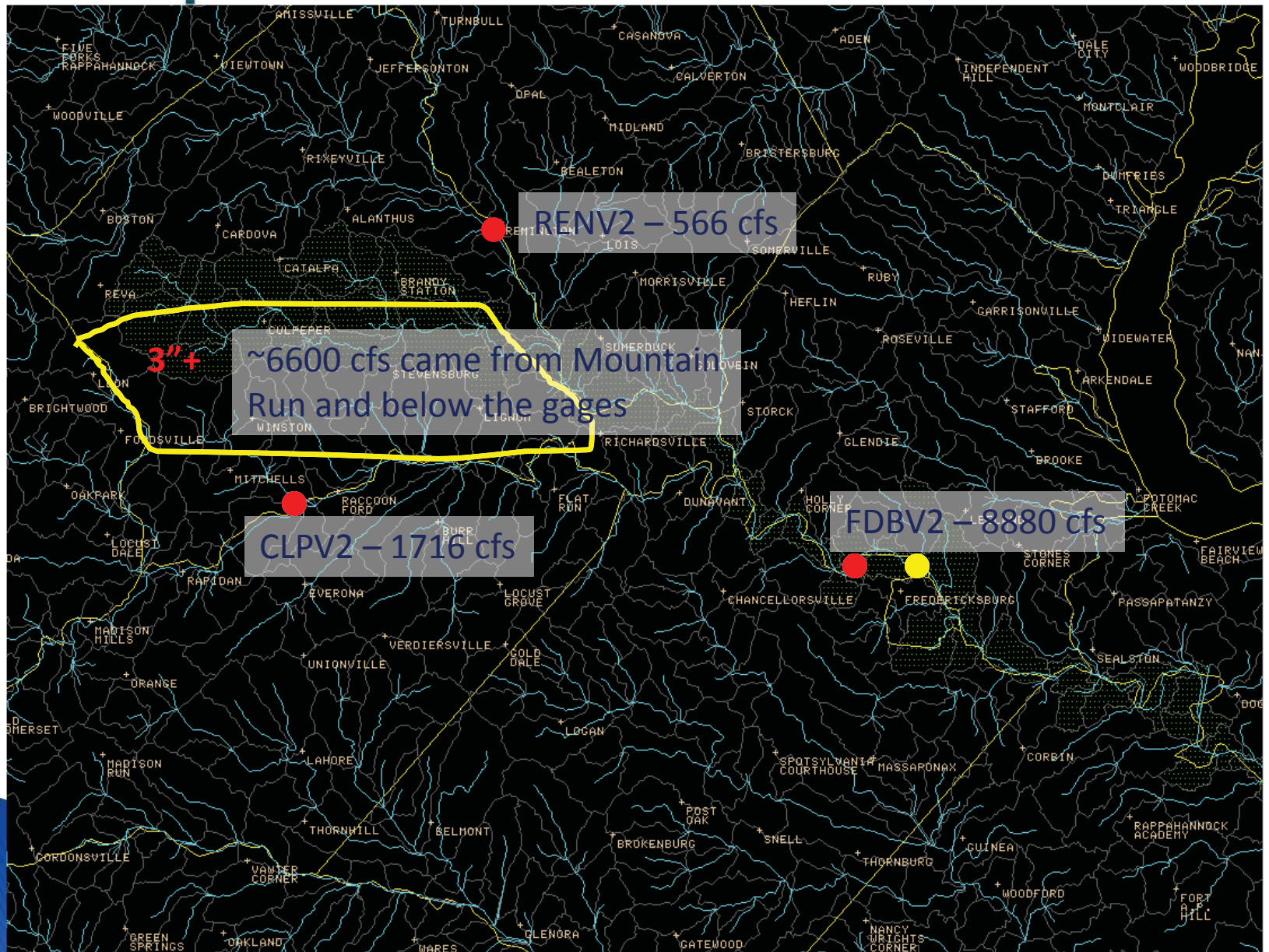
1930-2045

UTC 08/07

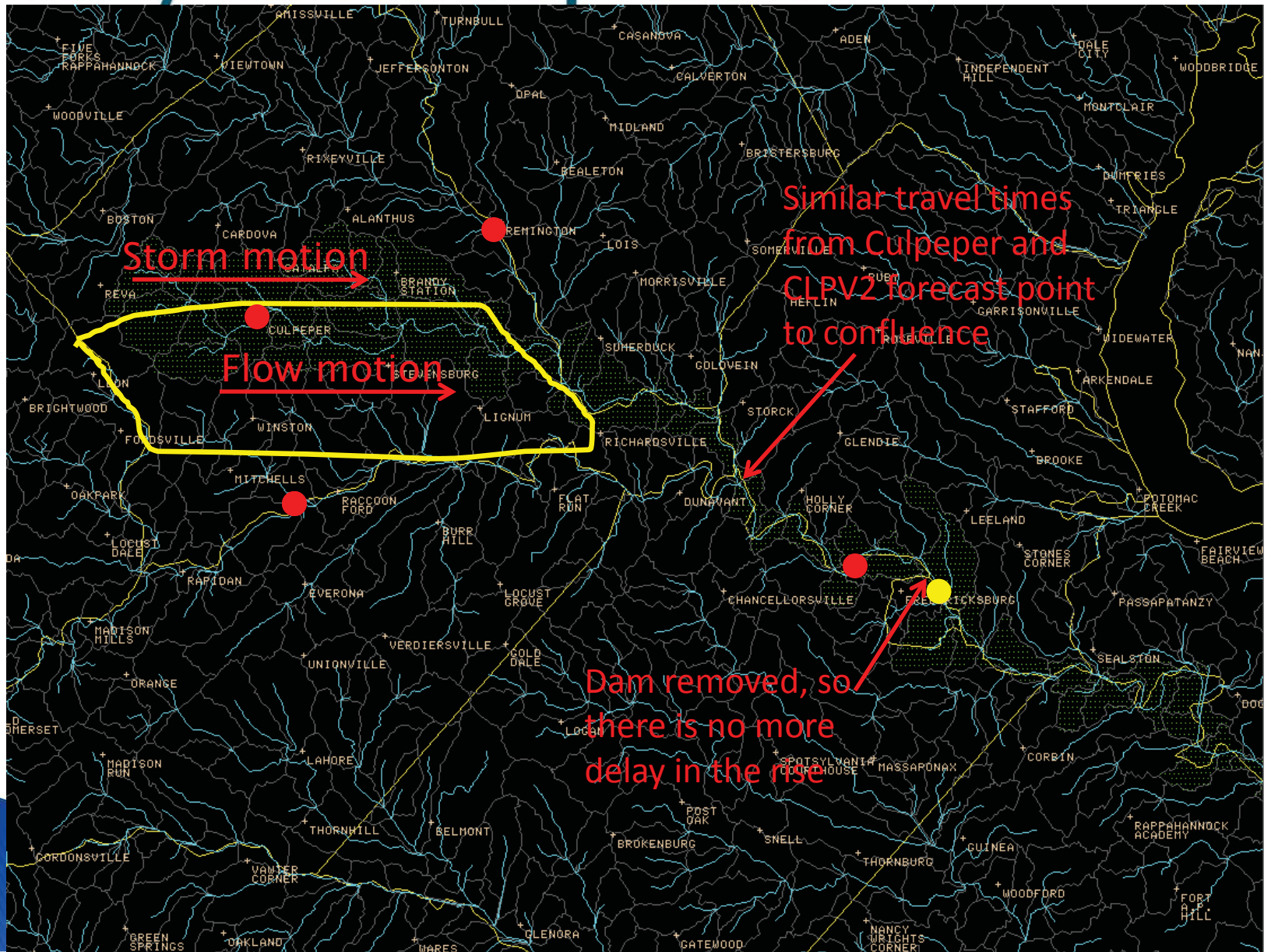
(5.40 feet)



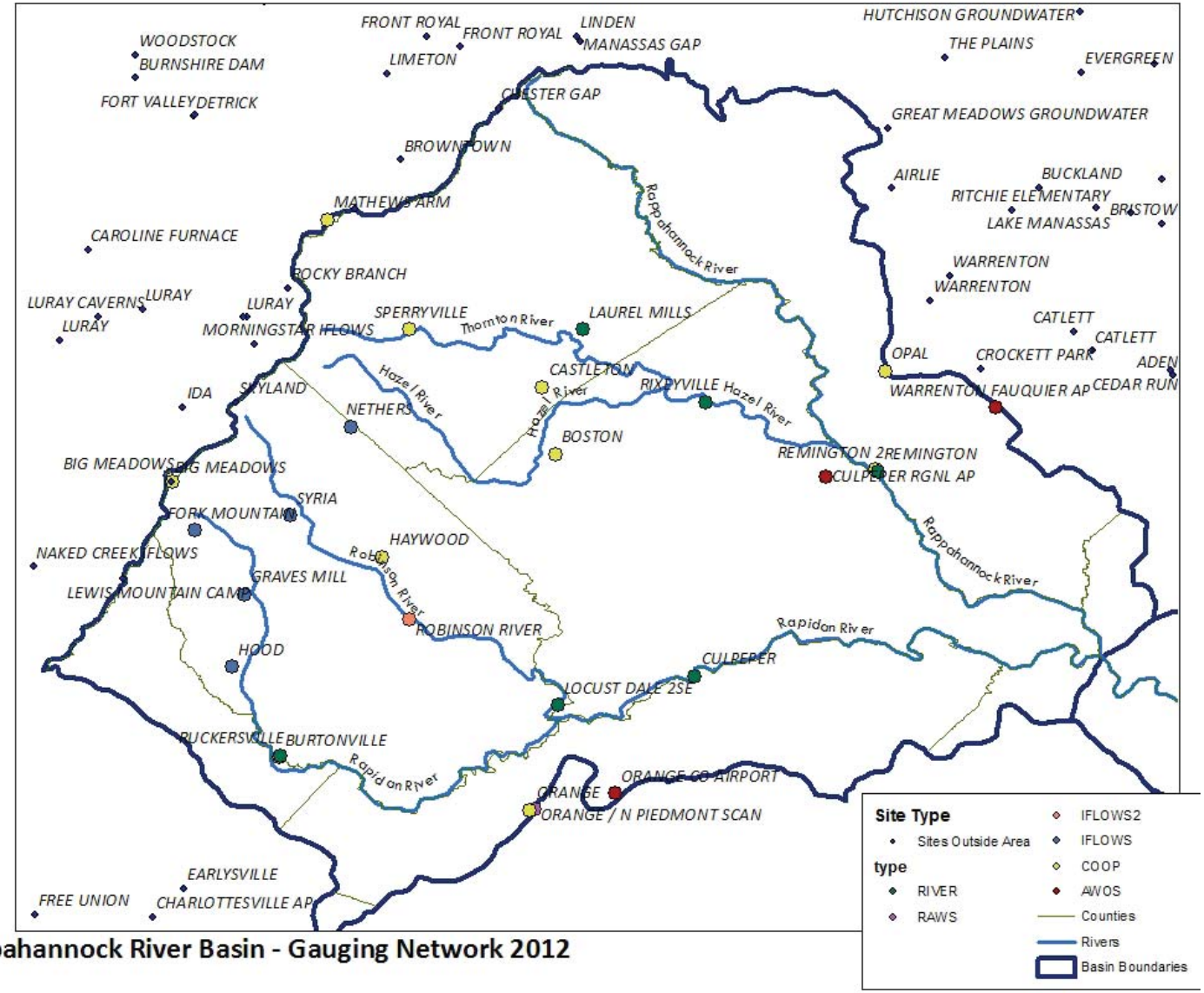
Not present and accounted for…



Why the sharp rise?



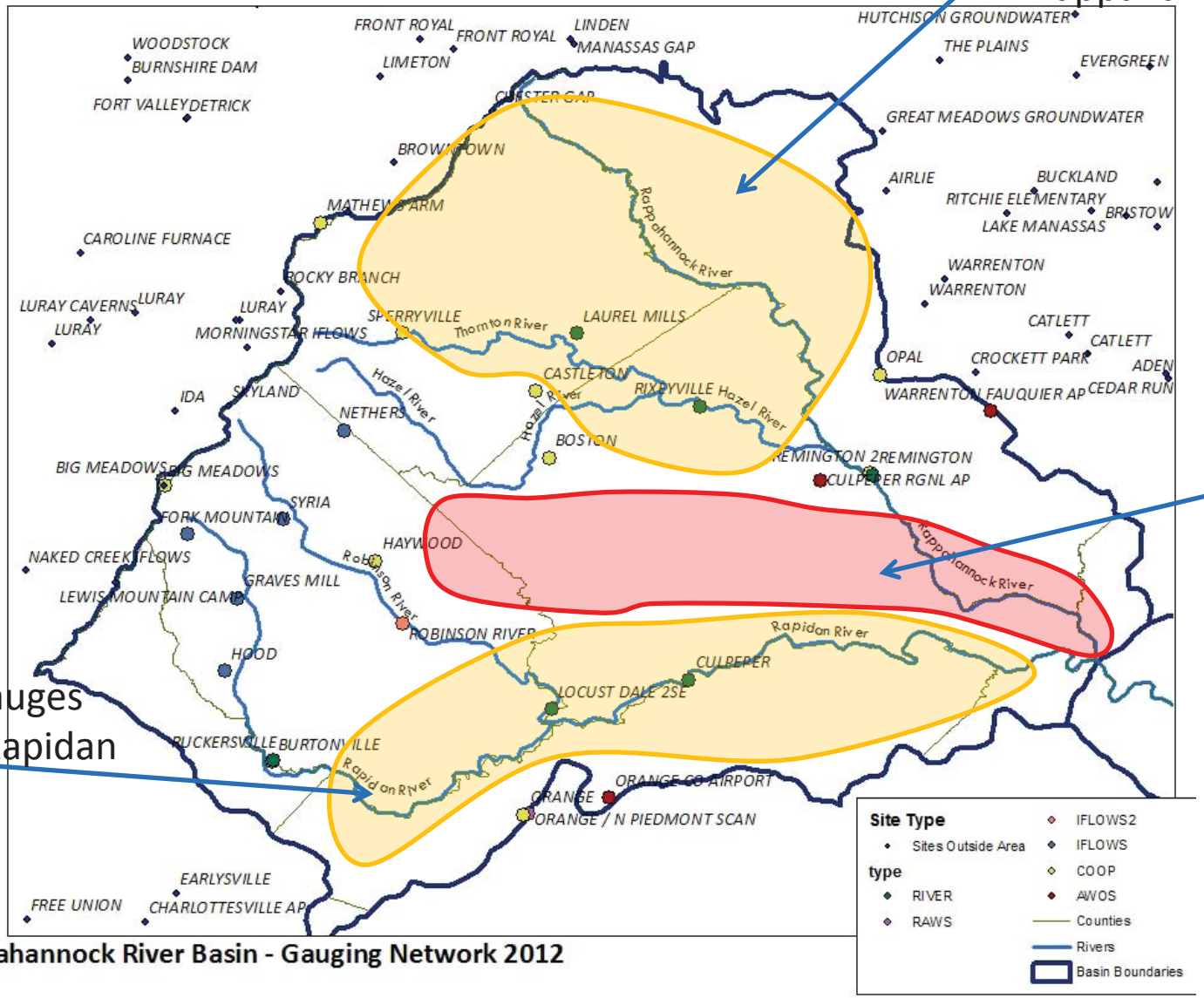
Existing Gauge Network



Rappahannock River Basin - Gauging Network 2012

Where are the gaps?

No rain or river gauges in uppermost Rappahannock



Absolutely nothing in Mountain Run (Culpeper)

No rain gauges in lower Rapidan

Rappahannock River Basin - Gauging Network 2012

What can be done to fill gaps?

- Multiple rain gauges needed in this part of the basin
- Stream gauge on upper Rappahannock (Cresthill Rd or below to capture flow from Jordan River)

What can be done to fill gaps?

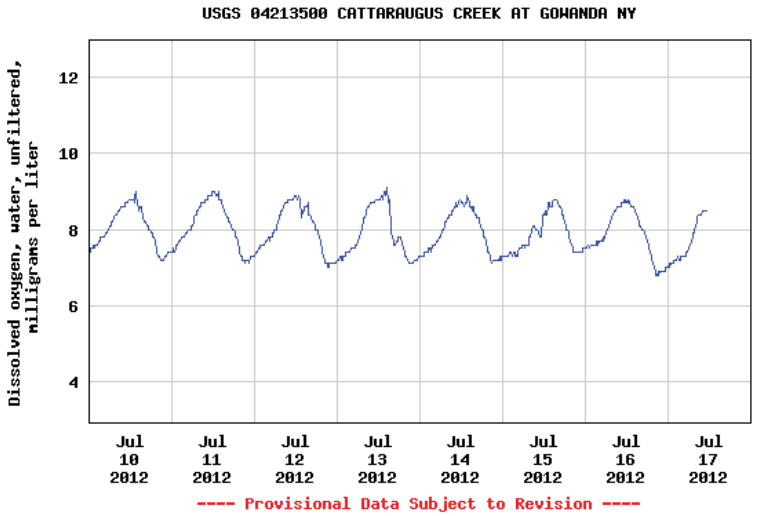
- Stream levels fairly well represented in the Rapidan
  - Perhaps something downstream of US 522?
- Almost no rain data in this section
  - Rain gauges desperately needed from Ruckersville eastward

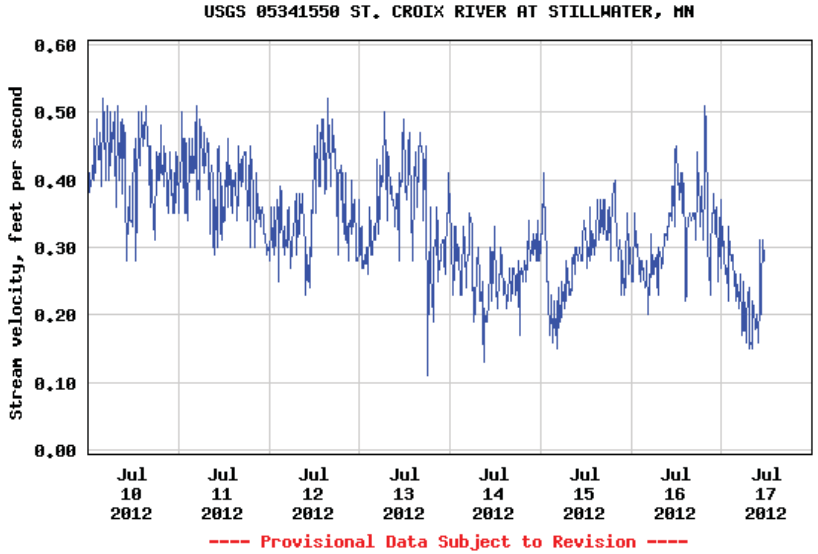
What can be done to fill gaps?

- No monitoring exists in Mountain Run basin
- Town of Culpeper left very vulnerable
- Also area on the Rappahannock downstream of Mountain Run mouth

Key Equipment Needs

- Real-Time Data
  - Better radar interpretation
  - Ingest into computer modeling
  - Forecast verification
- Stream Measurements
  - In addition to flow, elements like temperature (air & water?), water quality, even velocity can be important





Key Equipment Needs

- Rain Measurements
  - Need a heatable/winterized equipment set
  - Otherwise…it is no good in winter
  - Weighing rain gauges are preferred