

# Northern Shenandoah Valley Water Resources Initiative

December 14, 2005  
Winchester VA



# **Multidisciplinary Assessment of the Northern Shenandoah Valley in Virginia and West Virginia**

- The objective of this first integrated regional assessment is to better characterize the aquifer systems in the Northern Shenandoah Valley and provide relevant hydrogeologic information that can be used to guide the development and management of these water resources.
- This regional study of the karst and fractured-rock aquifer systems will use hydrologic, geologic, cartographic, and biologic information to improve the understanding of the aquifer systems, their relationship to surface features, and potential hazards over a multi-county area of Virginia and West Virginia.

# Study Approach for Regional System:

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Numerical Modeling

Yager and others

Geologic Mapping

Weary and others

Geophysical Techniques

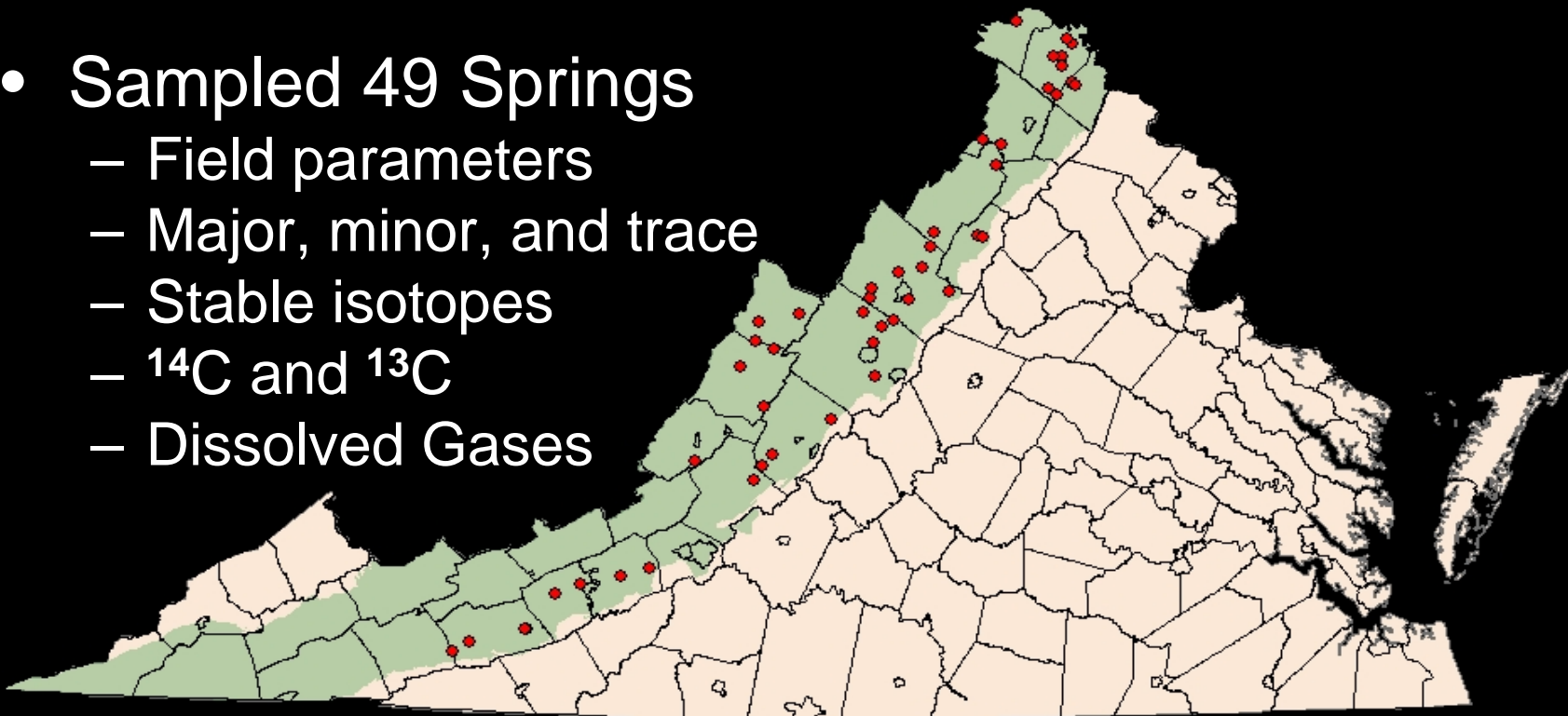
Lane and others

Environmental Tracers

Plummer and others

# Environmental Tracers:

- Sampled 49 Springs
  - Field parameters
  - Major, minor, and trace
  - Stable isotopes
  - $^{14}\text{C}$  and  $^{13}\text{C}$
  - Dissolved Gases
    - CFCs,  $\text{SF}_6$ ,  $^4\text{He}$ ,  $^3\text{H}$ ,  $^3\text{H}/^3\text{He}$

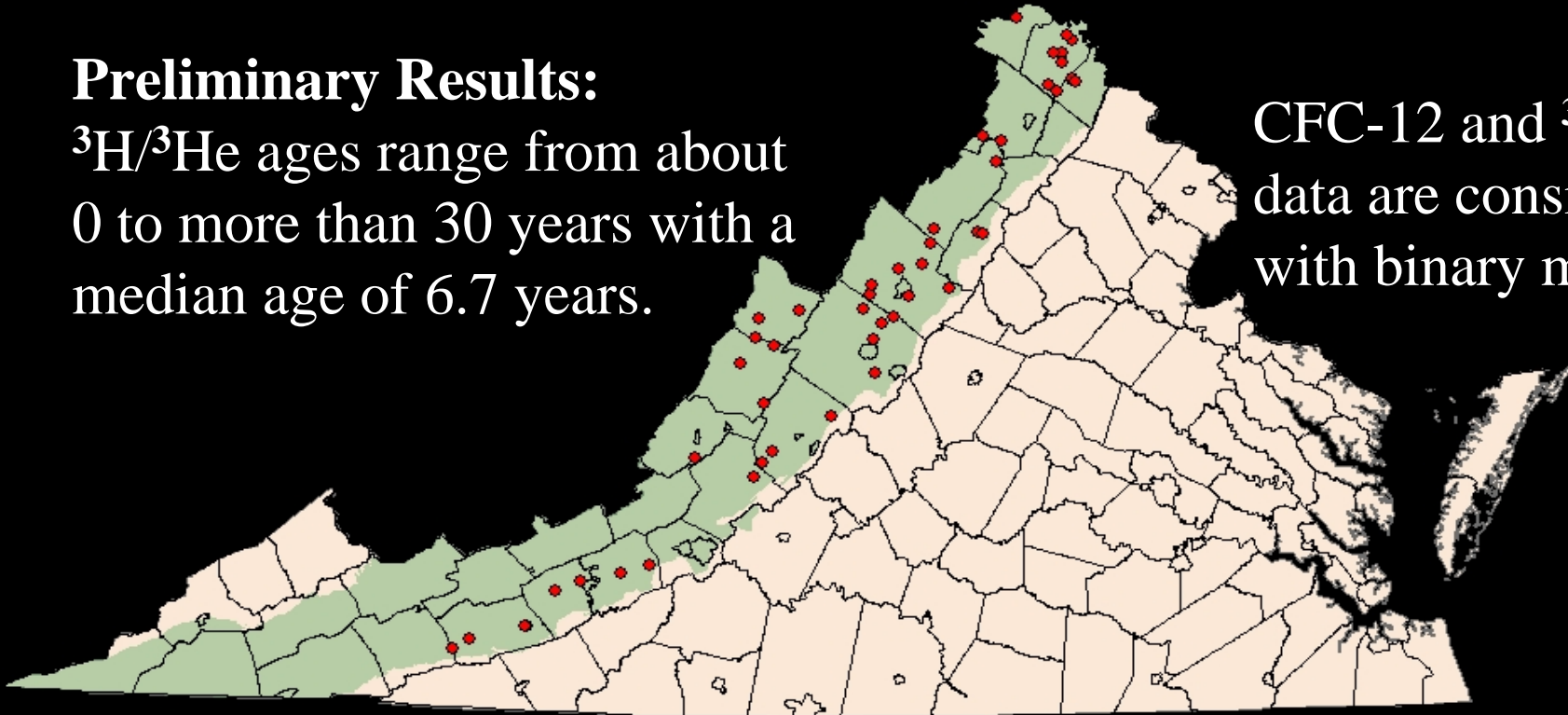


# Environmental Tracers:

## Preliminary Results:

$^3\text{H}/^3\text{He}$  ages range from about 0 to more than 30 years with a median age of 6.7 years.

CFC-12 and  $^3\text{H}$  data are consistent with binary mixing.

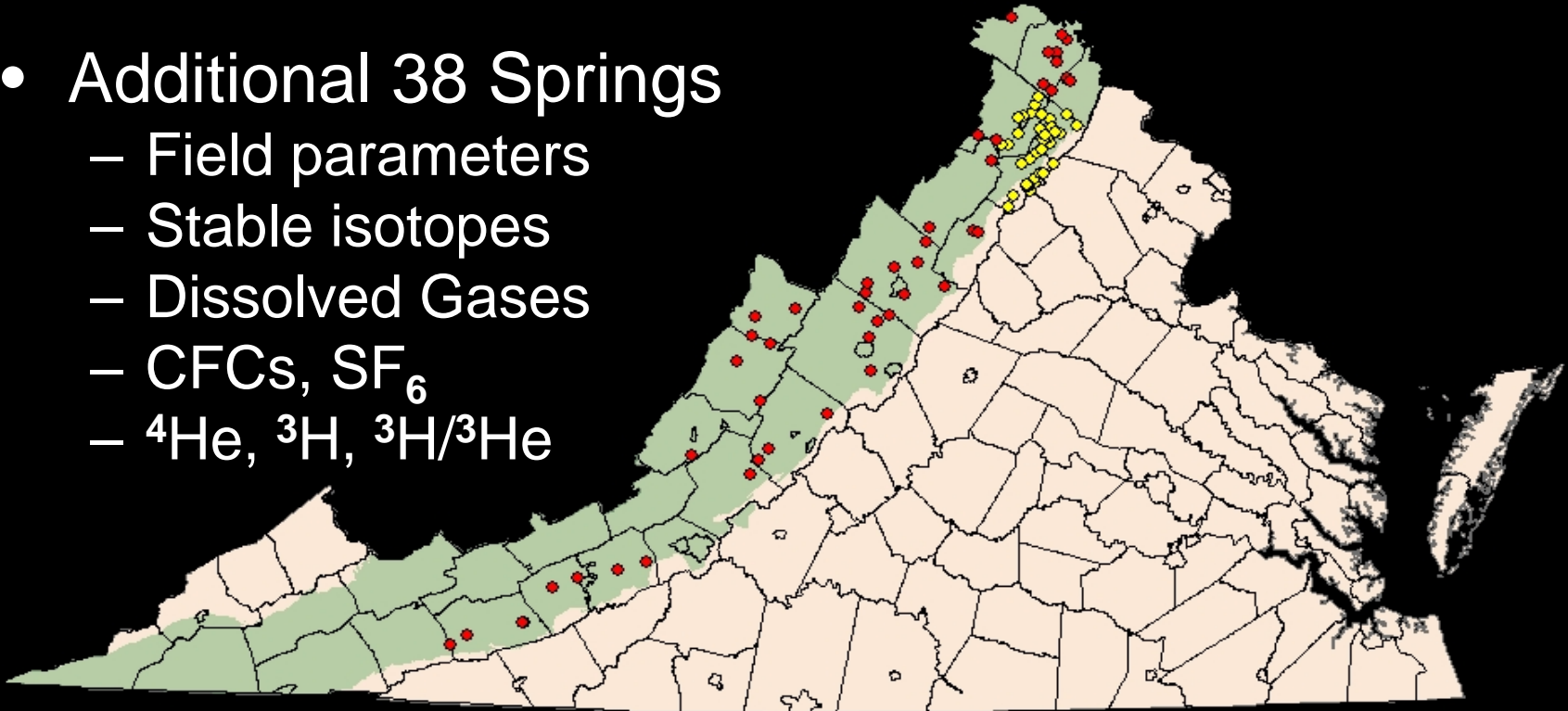


All of the samples contain at least a fraction of young water, ranging from around 20% young to 100% young.

**\*New  $\text{SF}_5\text{CF}_3$  dating technique to be applied in the future!**

# Environmental Tracers:

- Additional 38 Springs
  - Field parameters
  - Stable isotopes
  - Dissolved Gases
  - CFCs, SF<sub>6</sub>
  - <sup>4</sup>He, <sup>3</sup>H, <sup>3</sup>H/<sup>3</sup>He

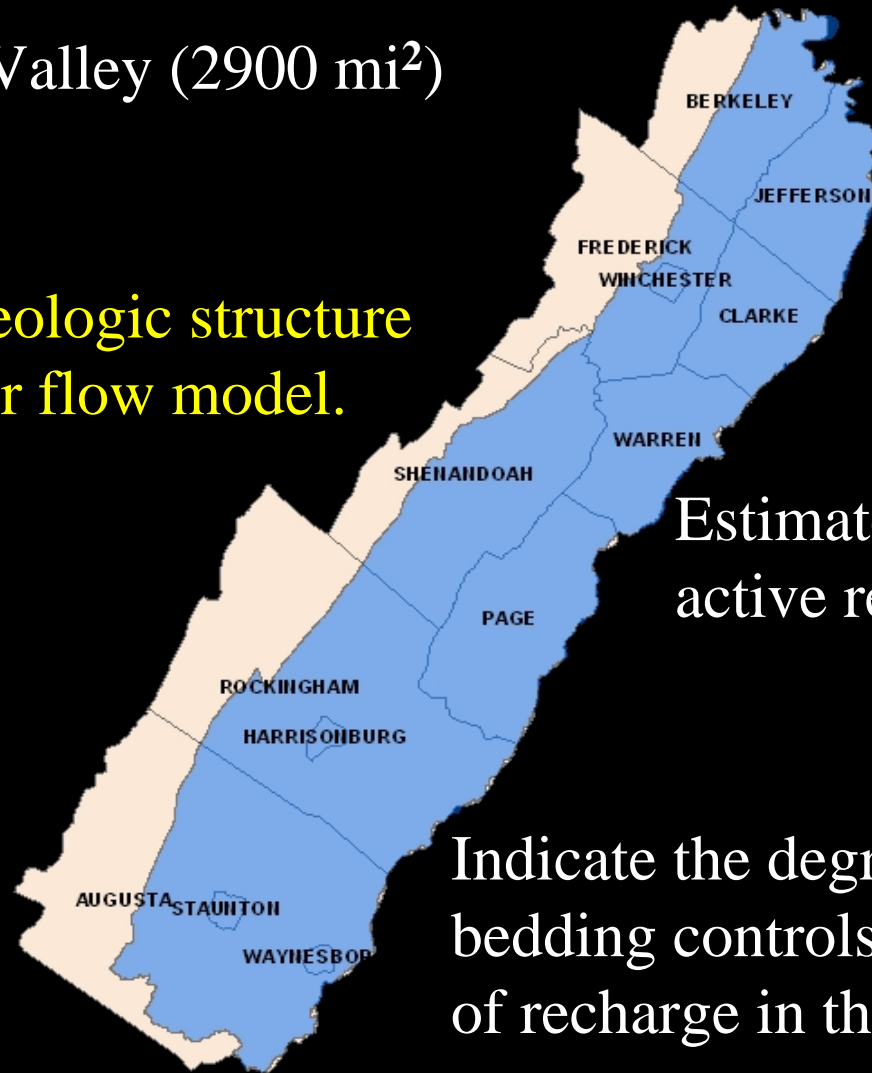


\*As part of USGS Virginia Water Science Center Cooperative Investigations

# Numerical Modeling:

Shenandoah Valley (2900 mi<sup>2</sup>)

\*Representing geologic structure in a ground-water flow model.

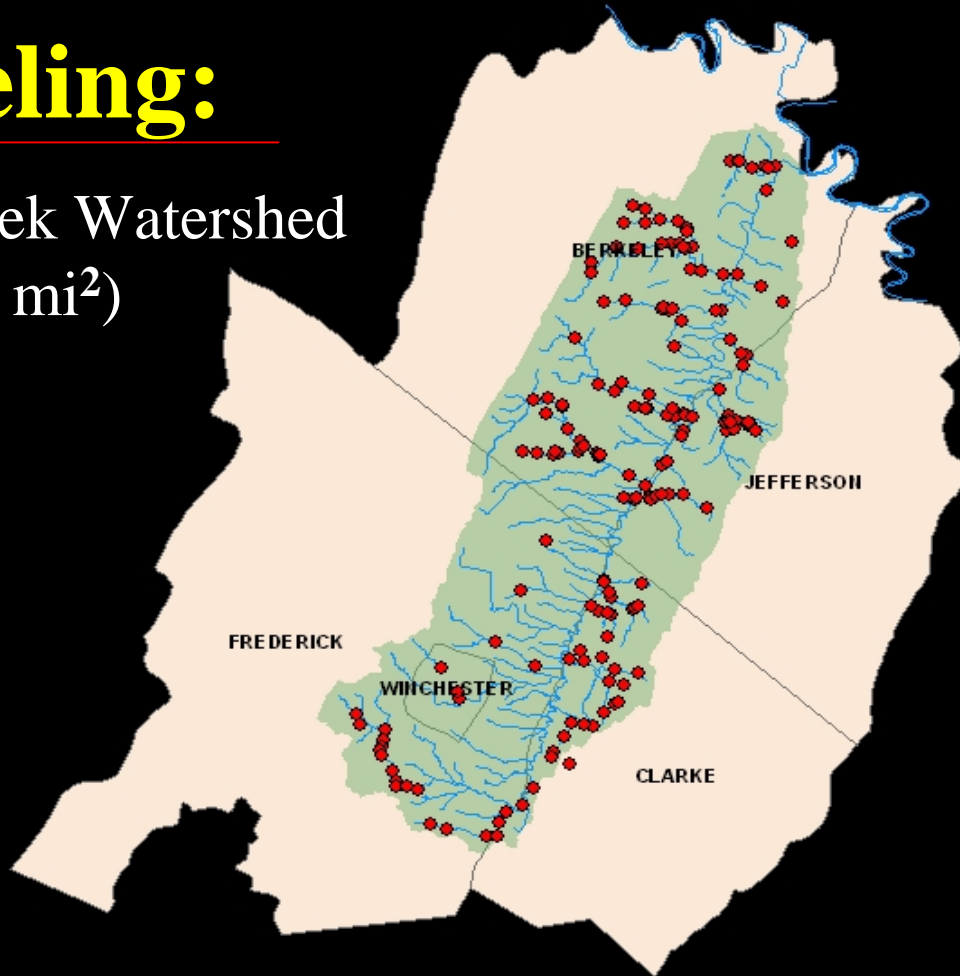


Estimate the depth of active recharge.

Indicate the degree to which bedding controls the distribution of recharge in the aquifer system.

# Numerical Modeling:

Opequon Creek Watershed  
(340 mi<sup>2</sup>)

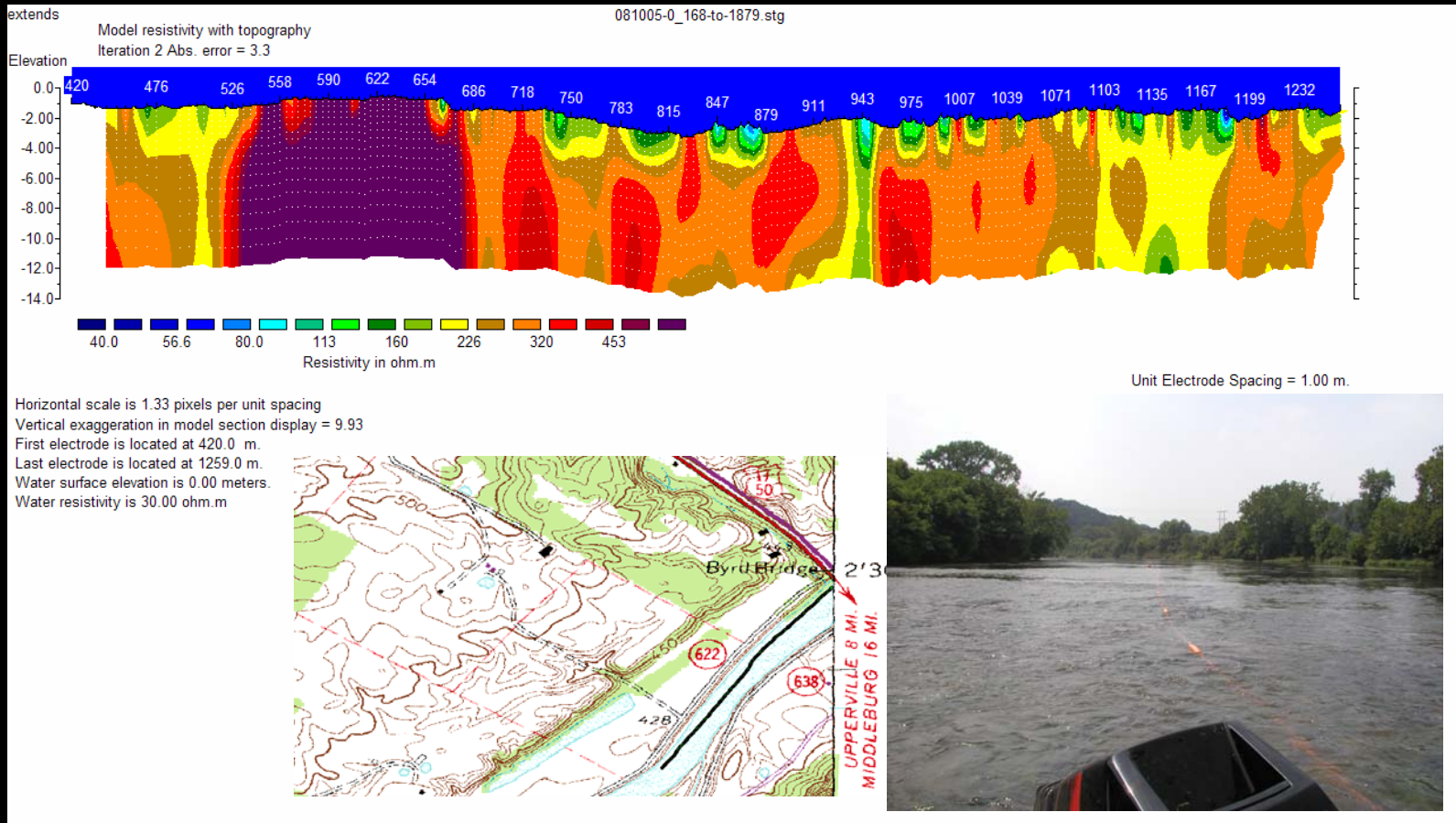


In July 2005 a synoptic survey of base flow and spring discharge was completed (177 sites/measurements).

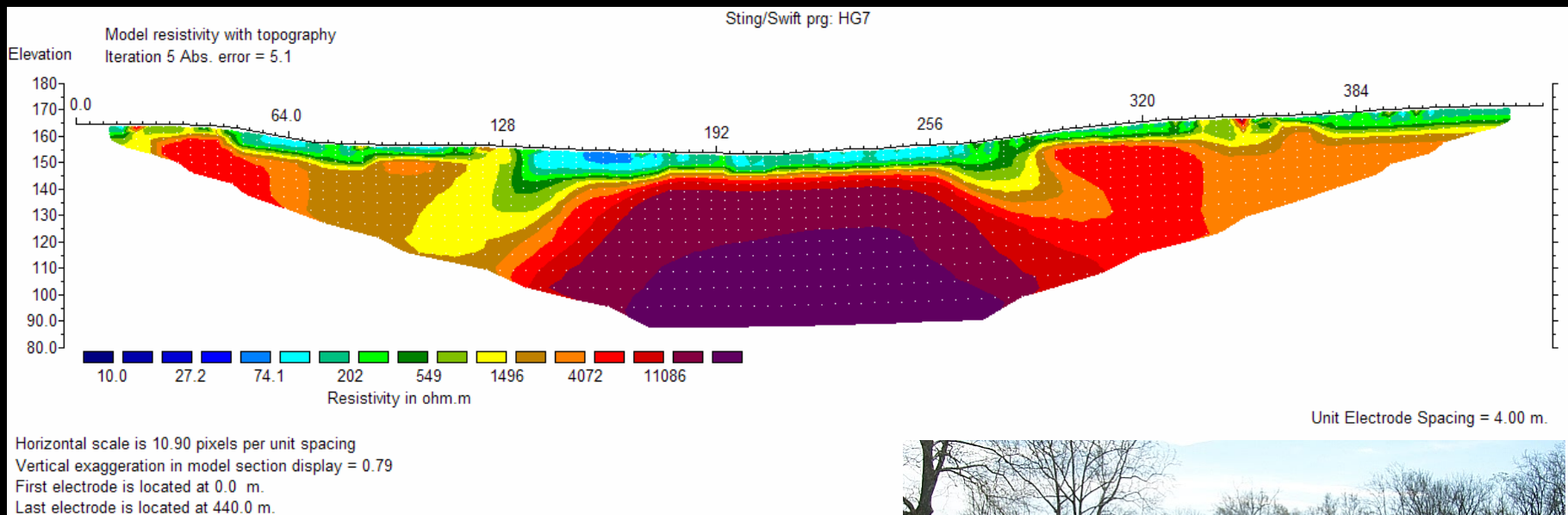


# Geophysical Techniques:

- Both Marine & Land: Continuous Resistivity Profiling



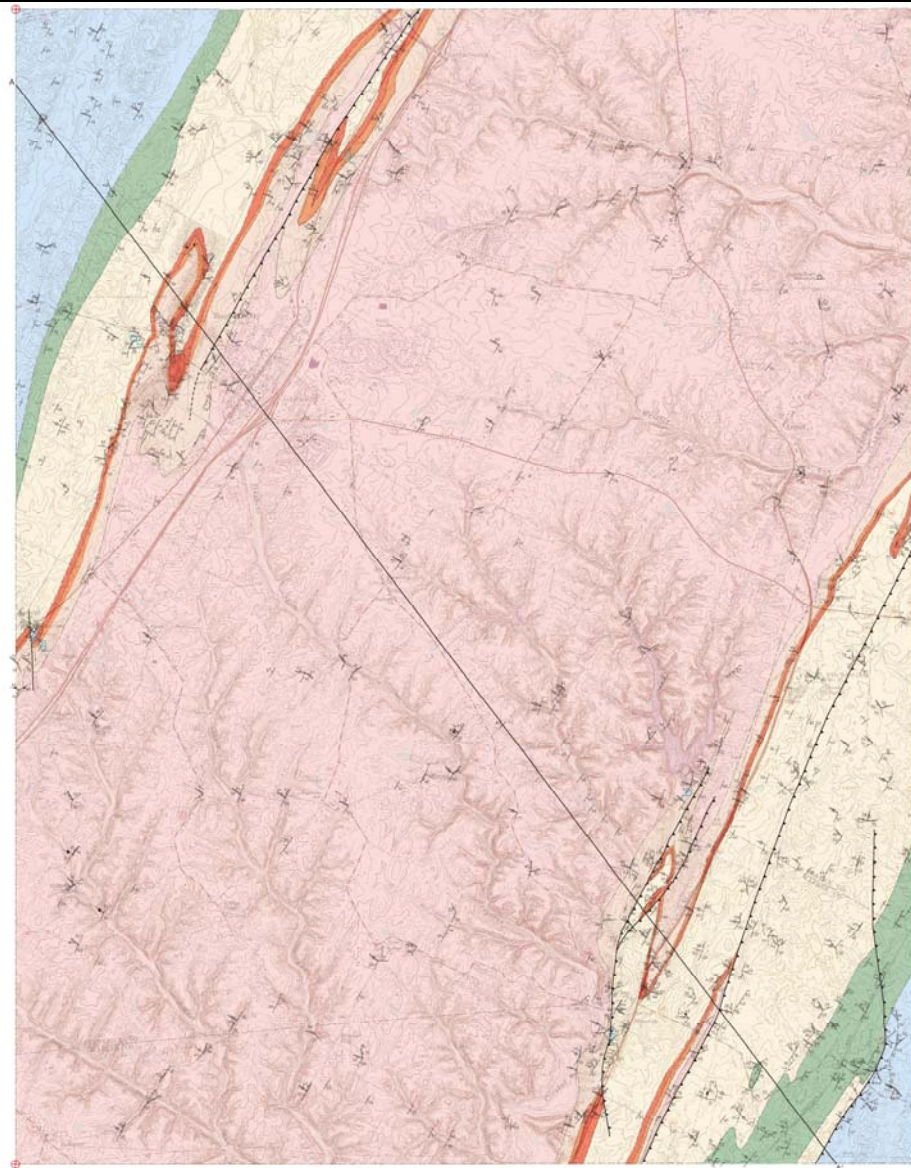
# Geophysical Techniques:



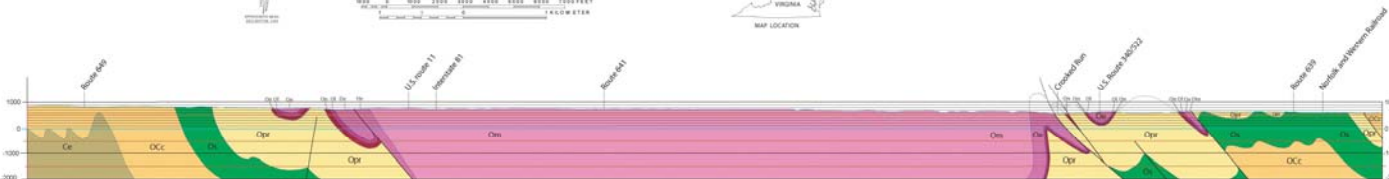
## \*Methods to come:

- Fiber optic temperature profiling
- Land seismic—streamer
- Passive seismic
- Audio-Magnetic-Tellurics (AMT)

# Geologic Mapping:

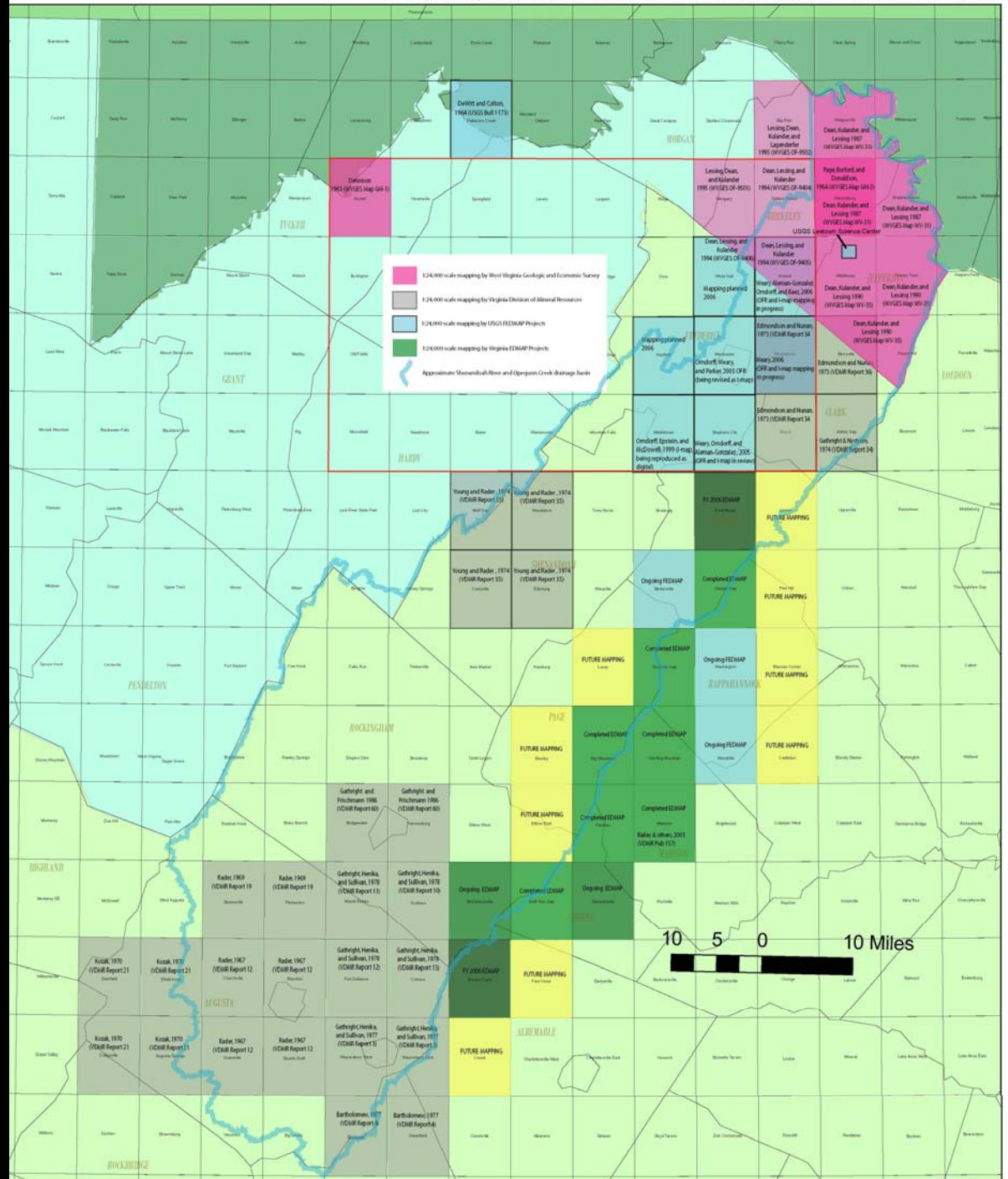


**Draft** Geologic map of the Stephens City Quadrangle, Frederick, Clarke, and Warren Counties, Virginia. Online Open-file Report: publication early 2006.



# Geologic Mapping:

Current USGS mapping in the Shenandoah Valley area (blue rectangles). Outline of the Winchester 1:100,000 sheet in red.



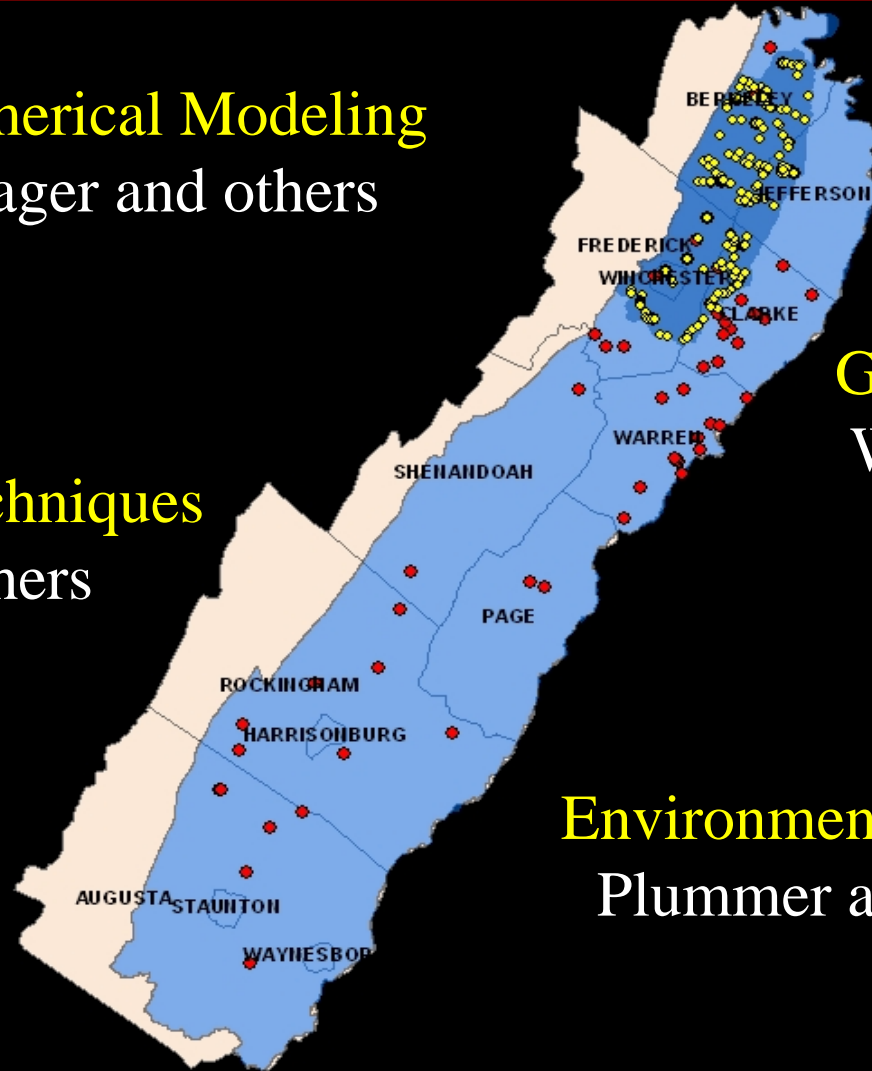
# A Great Deal of Research/Data Collection is On-going in the Shenandoah Valley!!

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Numerical Modeling  
Yager and others

Geophysical Techniques  
Lane and others

Geologic Mapping  
Weary and others



Environmental Tracers  
Plummer and others

## **Internet Sites**

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- **Water Resources of Virginia**

<http://va.water.usgs.gov/>

- **Frederick County Project**

<http://va.water.usgs.gov/projects/va134.html>

- **Clarke County Project**

<http://va.water.usgs.gov/projects/va146.html>

- **Warren County Project**

<http://va.water.usgs.gov/projects/va142.html>

- **Shenandoah River Minimum Instream Flow Project**

<http://va.water.usgs.gov/projects/va111.html>

- **Great Valley Water-Resources Science Forum**

<http://va.water.usgs.gov/GreatValley/Index.htm>