

Issues Surrounding Uranium Mining in Pittsylvania County, VA

Virginia Conservation Network
Environmental Assembly 2010

September 18, 2010

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Uranium Mining

- There are several ways to mine uranium, but in Pittsylvania, VA open pit mining is most likely
- Uranium ore is excavated from deep under ground
- The ore is milled into very small sand and clay-like particles
- Uranium is leached from the ore and recovered as uranium oxide
- Leftover ore sediments are known as **Uranium Mill Tailings**

Uranium Mill Tailings

- One ton of uranium ore produces 2 lbs of uranium oxide (yellowcake) and 1,998 lbs of uranium mill tailings
- Unlike buried ore, tailings are very susceptible to transport by air & water
- Overburden, clay, and liners are used to construct confinement cells and caps to confine the tailings
- Mill tailings retain 85% of the original radioactivity for >>> 300,000 years

Uranium Mining in VA: 1973-85

- 1973-78: Uranium prices create push to mine uranium in the Piedmont of Virginia
- 1979-82: Three Mile Island, and decades of uranium mining/milling pollution in the west come under public scrutiny
- 1983: VA General Assembly enacts moratorium on uranium mining
- 1985: VA Coal and Energy Commission recommends lifting moratorium
- Uranium prices drop and remain low - the moratorium remains in effect

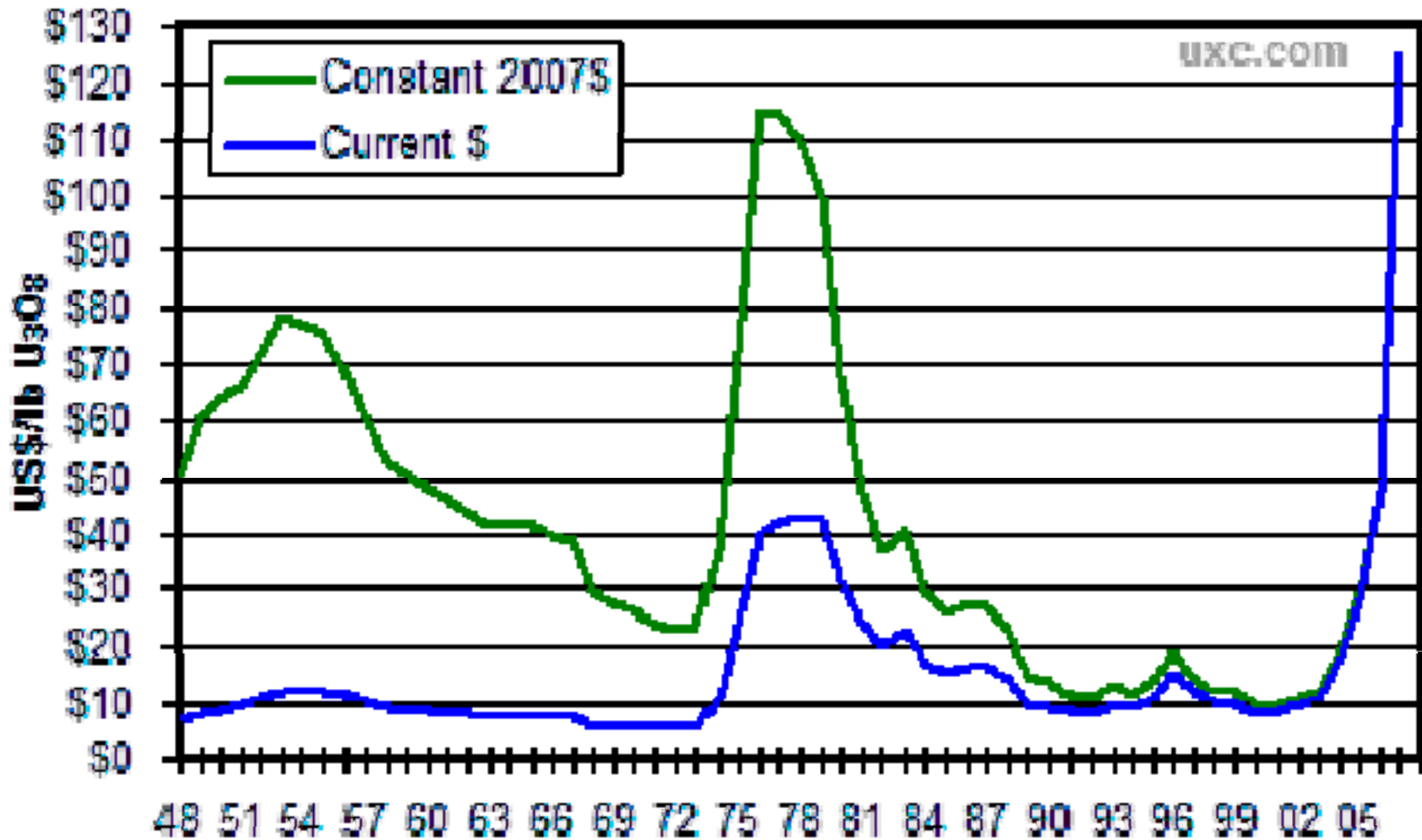
Uranium Mining in VA: 2007-08

- Skyrocketing uranium prices renew interest in uranium mining in Pittsylvania County
- Deposits in Cole's Hill may be worth billions
- VA Uranium (a VA firm) and VA Energy Resources (a Canadian firm) are formed to mine the deposits in Pittsylvania County
 - Better define the deposits at Cole's Hill
 - Conduct Public Relations campaign
 - Convince the Virginia General Assembly to lift the moratorium on uranium mining

Uranium Mining in VA: 2009-10

- VA Coal and Energy Commission has commissioned the NRC/NAS to conduct a study on uranium mining in Virginia
- Funding is provided by Virginia Uranium, but escrowed through VA Center for Coal and Energy Research
- The NRC/NAS Study will not include site-specific analysis, hydrologic or water quality modeling, or failure analysis
- VA Beach is undertaking a failure analysis to provide to the NRC/NAS

Historical Spot Price of Uranium



Source: 48-68 US/AEC, 69-86 Nuevo EV, 87-Present U₃O₈ Price

Uranium Spot Price

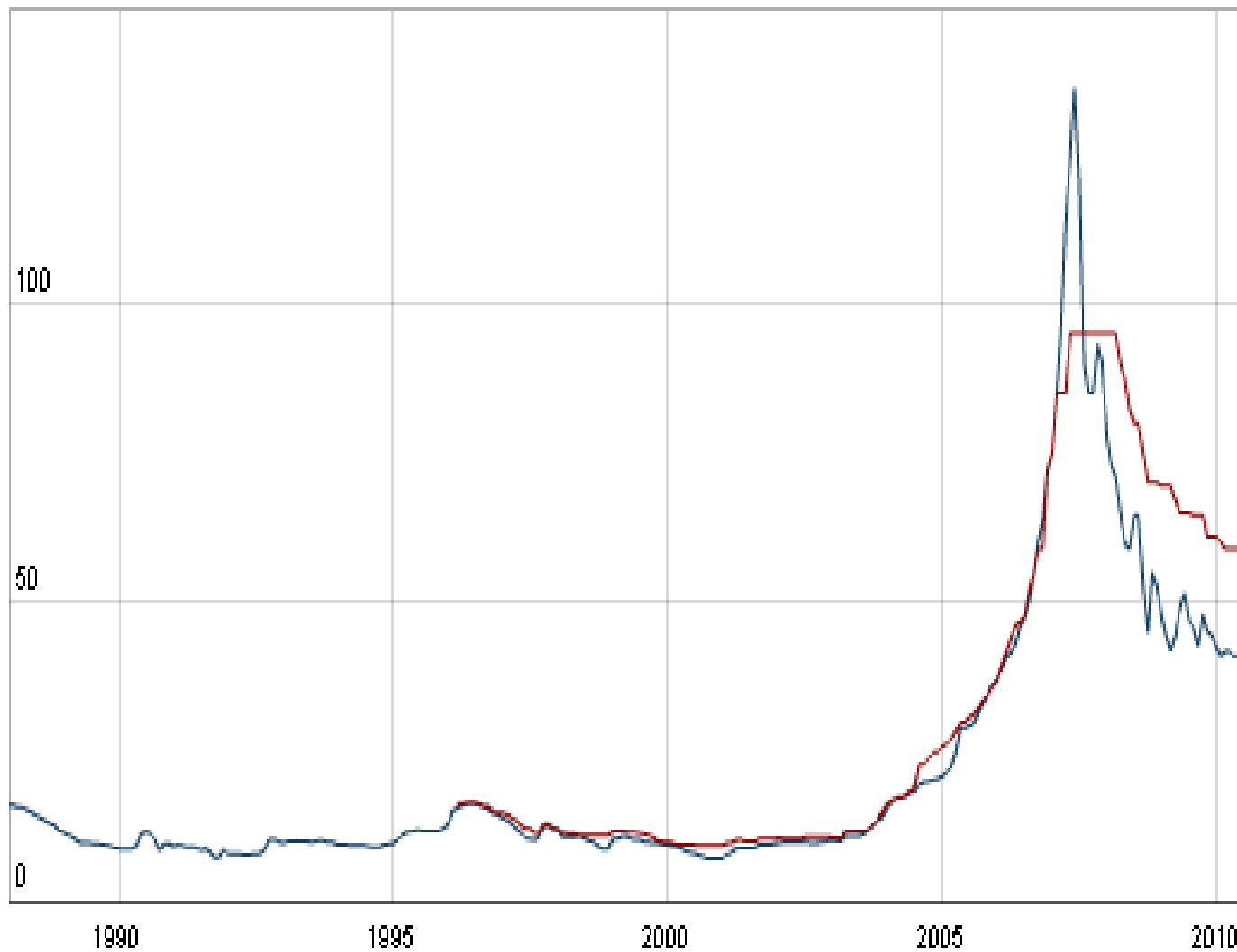
US\$/lb

Jan, 1988 - Jun, 2010

● Uranium Spot Price

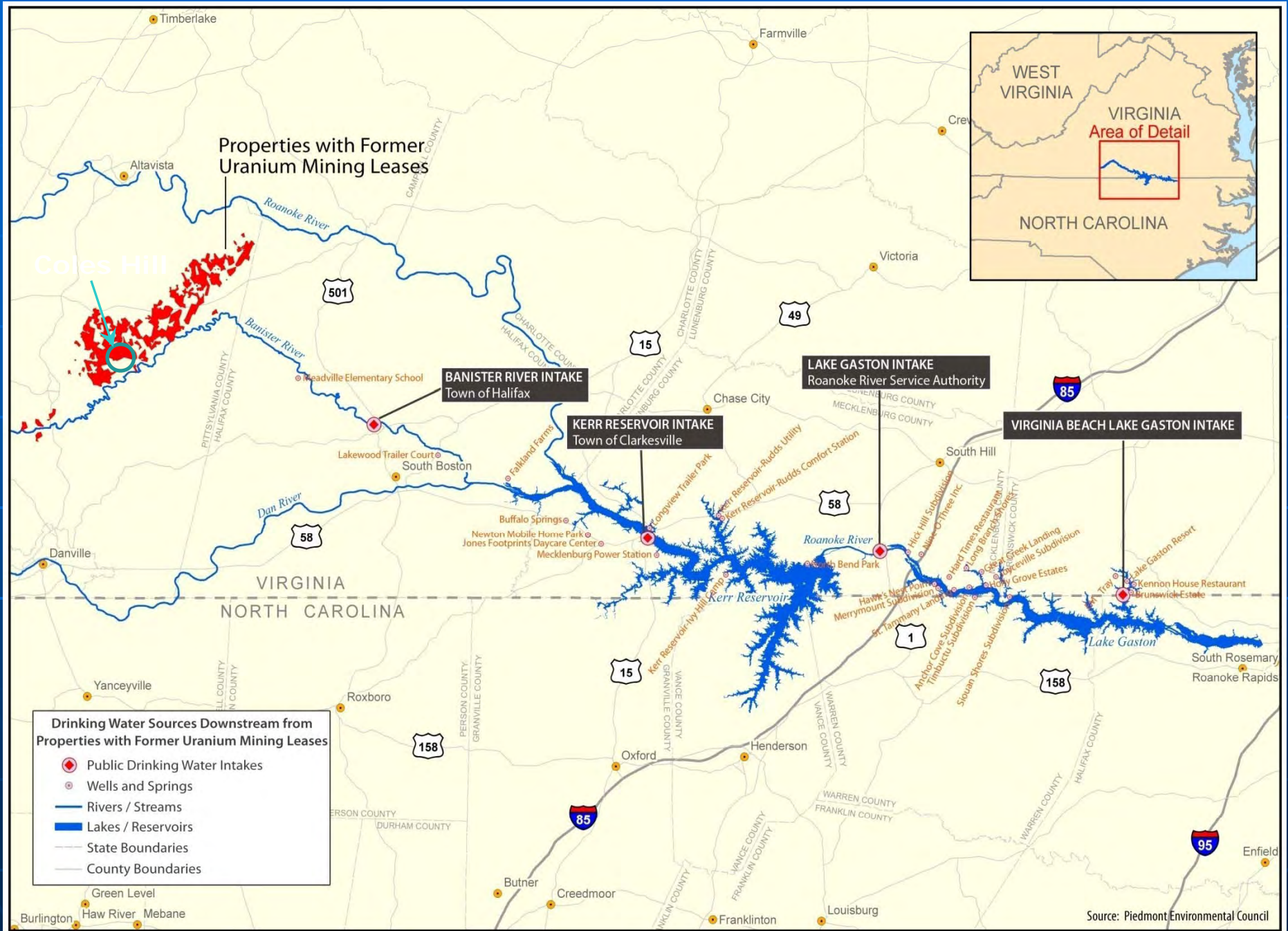
Compare to:

● Long-term Uranium Price



Uranium Mill Tailings

- Cole's Hill Site - 100 million pounds of uranium yellowcake
- 30 million cubic yards of mill tailings
- 12 confinement cells, each 40 acres and 2.5 million cubic yards
- Mount Trashmore = 20 acres and 1.3 million cubic yards
- Depending upon groundwater, much of the cell may be below ground



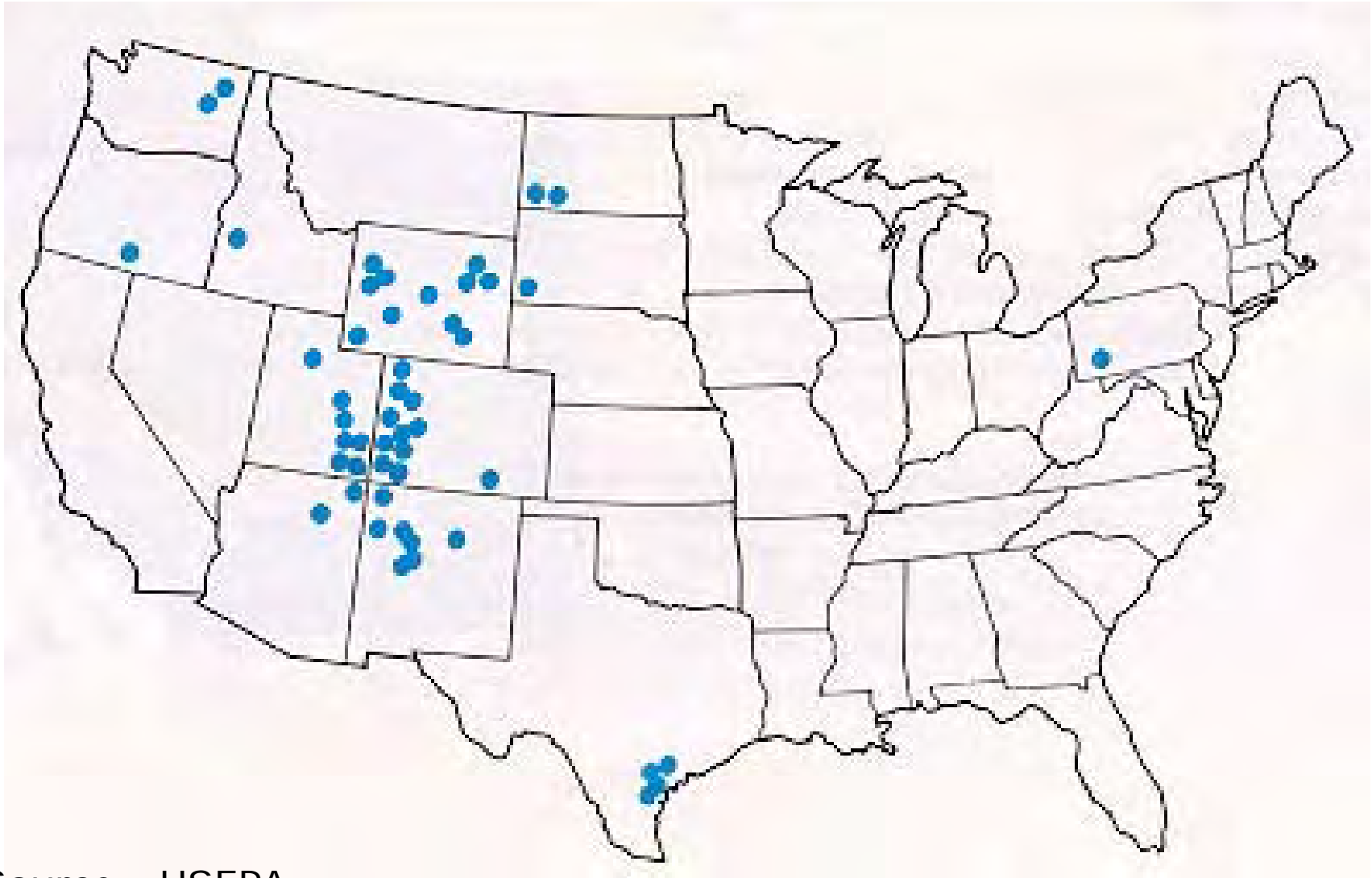
Water from Lake Gaston is a large percentage of SEVA Water Supply



Uranium Tailings Legacy

- Historically, tailings were not properly confined resulting in radioactive contamination of ground and surface waters
- Legacy of human and environmental tragedy: 1950's to early 1980's
- 1978: Federal government stepped in to remediate – UMTRCA (DOE, NRC)
- Clean up has cost billions over three decades – work and costs ongoing

UMTRCA Sites – DOE and NRC

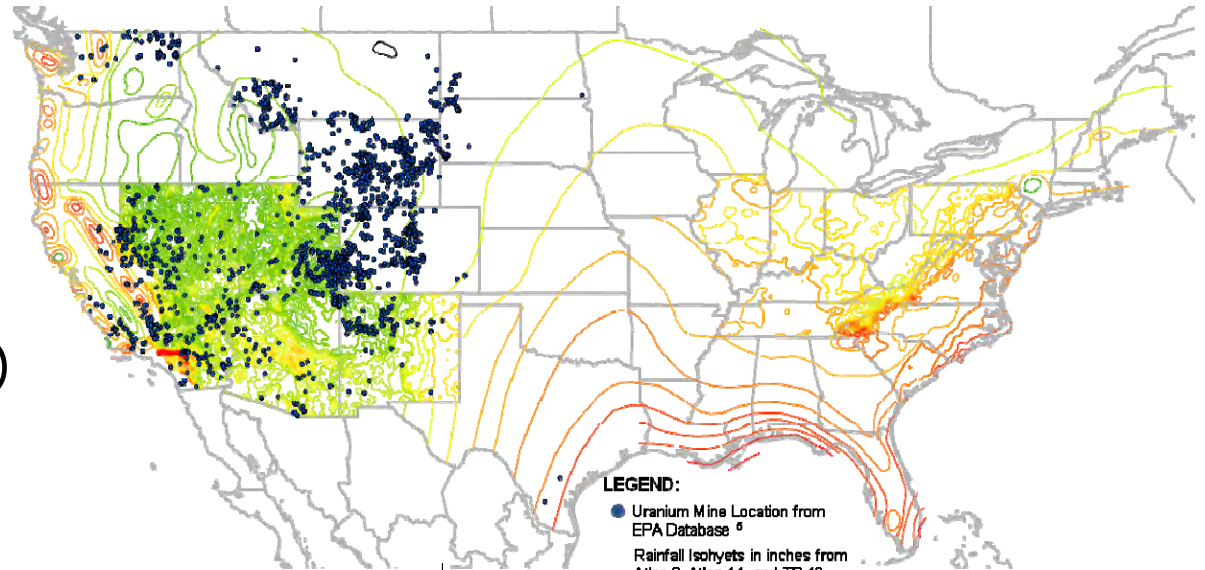


Source - USEPA

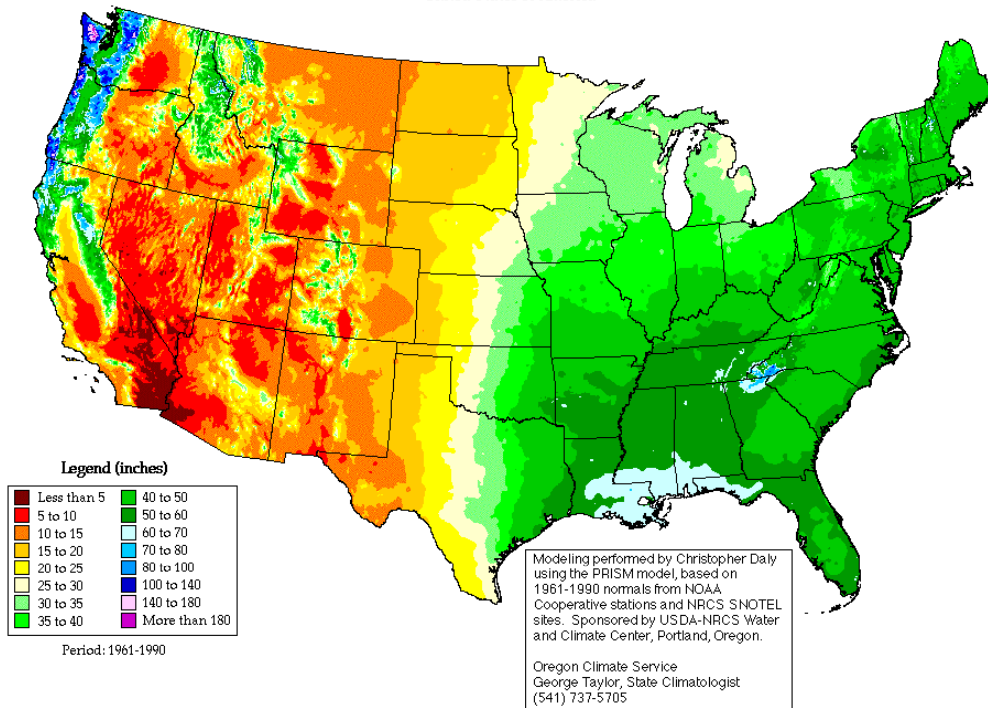
The Past vs the Present

- Uranium mining industry does not dispute past issues with mill tailings
- They say that modern confinement cell design and NRC regs will protect surface waters
- NRC regs require that confinement cells be designed for at least 200 yr life or 1,000 yrs if "reasonably achievable"
- In 1969, a storm in Nelson County was estimated to have caused 2,000 years of erosion in a single night

Historically, uranium mines have been located in western states (black dots show mine locations)



Annual Average Precipitation
United States of America



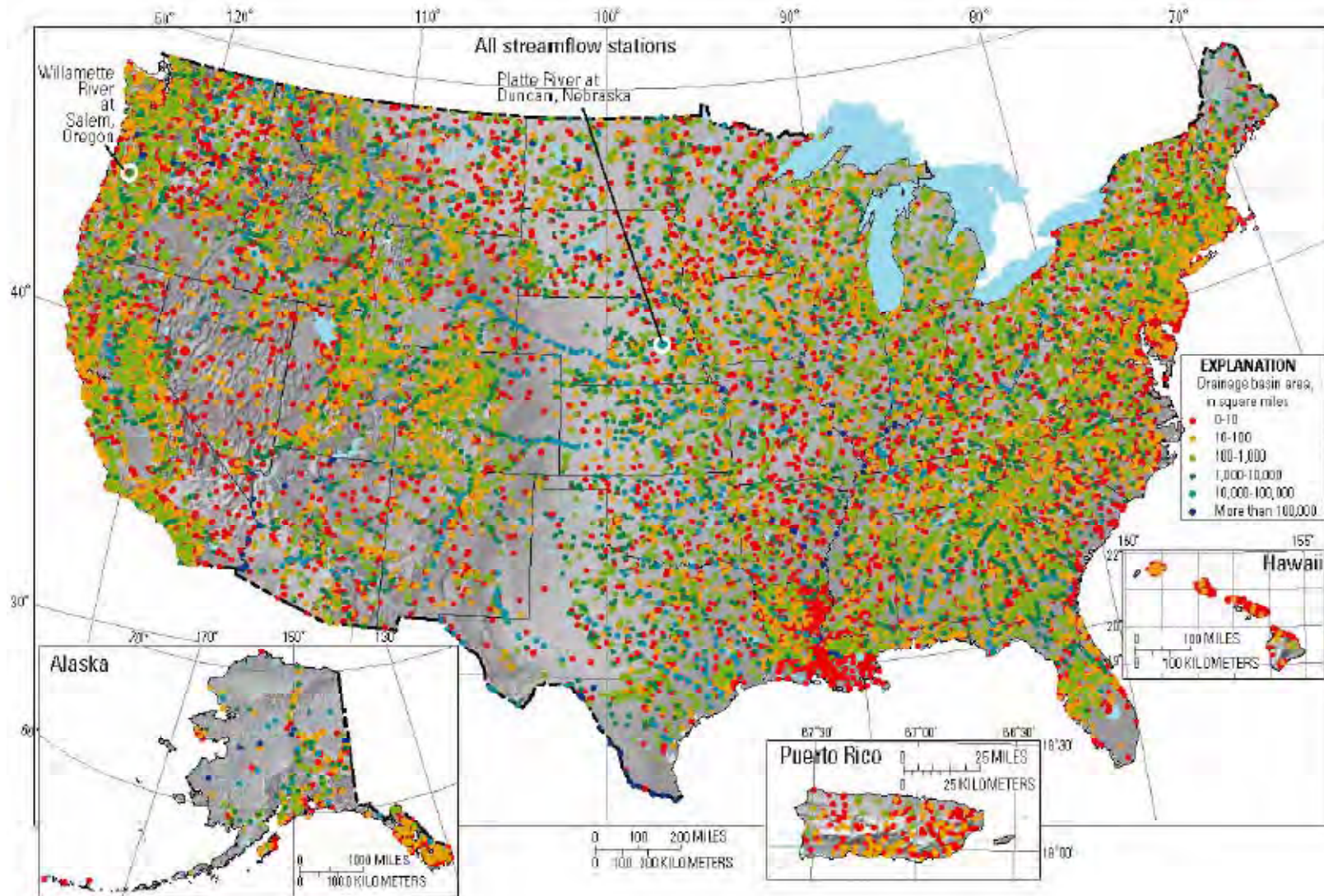
Climate and landscape features in Virginia produce much greater precipitation & runoff than in western US

PMP Storms in Virginia

- Historically, many uranium tailings confinement failures have been caused by inability to manage water
- Unlike the west, precipitation in Virginia is high and evaporation is low
- In Virginia, storms have generated near probable maximum precipitation (PMP)
- PMP can erode and fragment virtually any earthen structure (man-made or natural)
- PMP can transport large volumes of sediments downstream very quickly

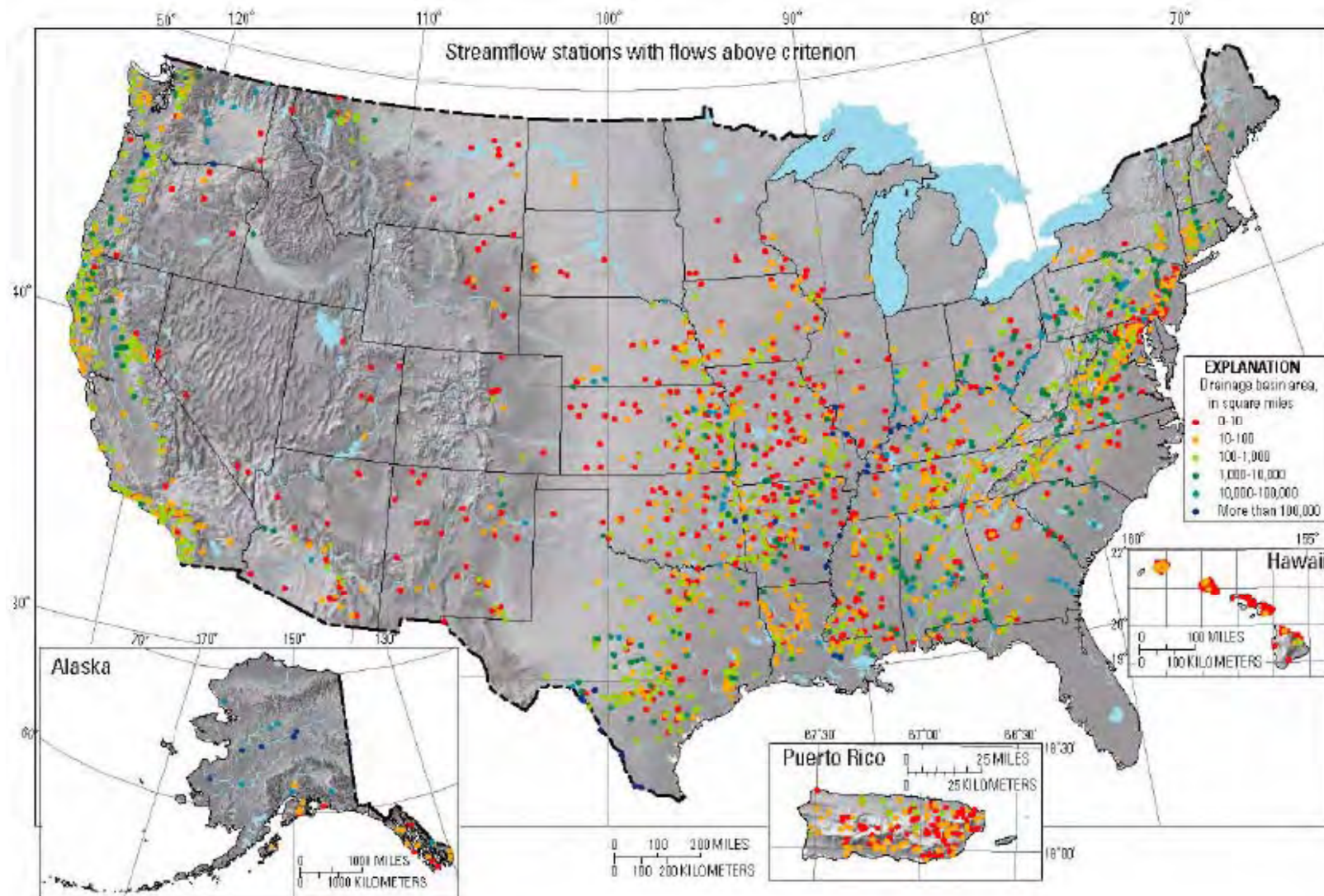
All 23,000 USGS Stream Gages

Average Stream flow in Virginia – 1 CFS per Square Mile



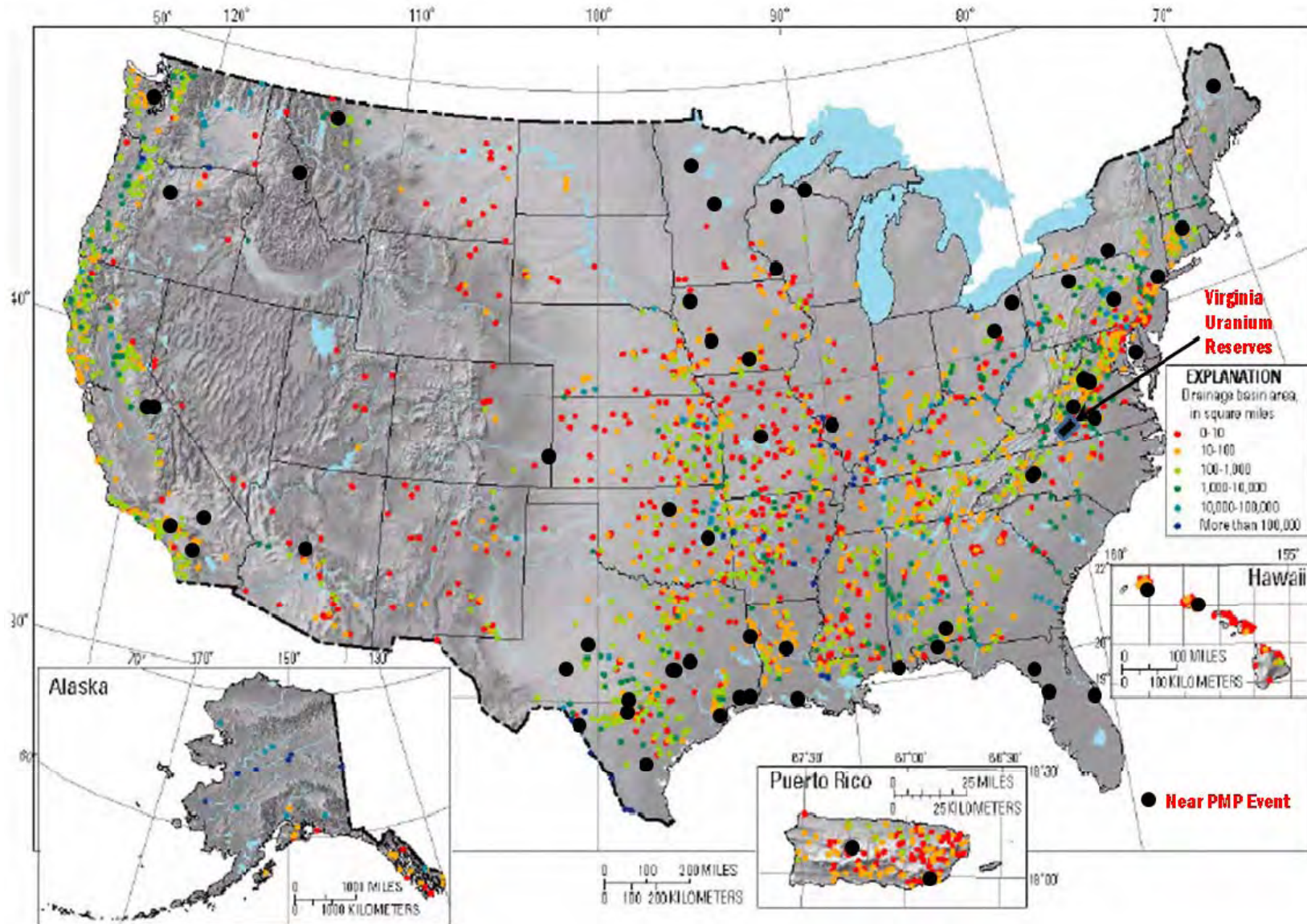
Stream Gages with Extreme Floods

50 to 300 CFS per Square Mile



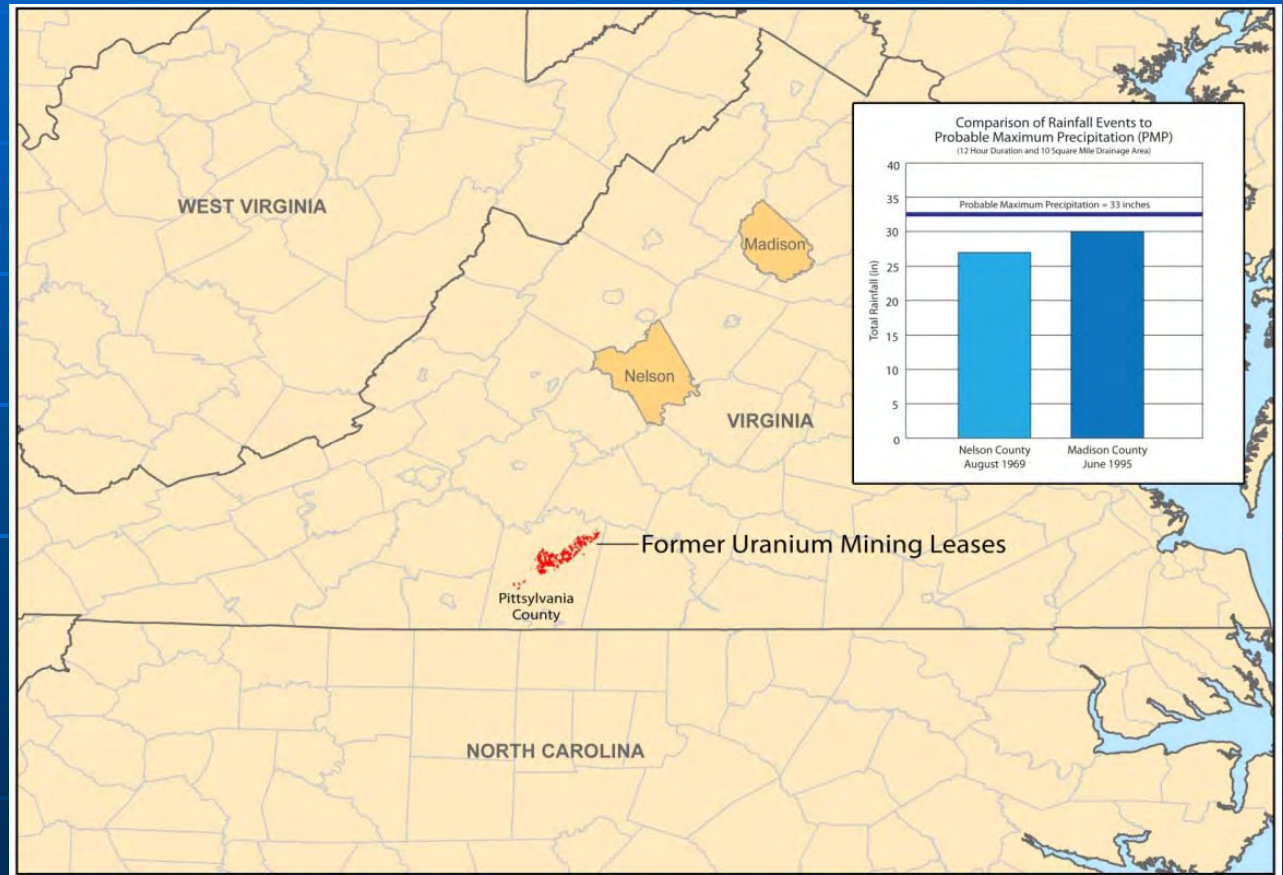
Probable Maximum Precipitation

PMP in Virginia - 1,000 to 7,000 CFS per Square Mile



Probable Maximum Precipitation Events in Virginia

- Nelson County
 - August 1969
 - 27 – 31 inches in 8-hours
- Madison County
 - June 1995
 - 30 inches in 14 hours



Worst Case Scenario

- A storm similar to the 1969 Nelson County storm fragments confinement cells and transports radioactive sediments to Kerr Reservoir, and in turn, to Lake Gaston
- Radiation levels in Kerr/Gaston increase:
 - To levels near or above state/federal regulatory limits in the Safe Drinking Water Act
 - To levels less than regulatory limits but significantly greater than existing background
- Existing treatment plants not designed for removal of radiological contaminants
- Remedies could be costly/problematic

Current Radiological Levels VA Beach-Norfolk Water Systems

	<i>Current Level</i>	<i>EPA/DEQ Limit</i>	<i>EPA Goal</i>	<i>Unit</i>
Gross Alpha Activity	0.4	15	0	pCi/L
Gross Beta Activity	3.1	50	0	pCi/L
Radium 226/228	0.6	5	0	pCi/L

NRC/NAS Study

- The NRC/NAS Study will not include site-specific analysis, hydrologic or water quality modeling, or failure analysis
- It's not a conspiracy – it's just not what the NRC/NAS is set up to do
- VA Beach is undertaking the aspects of the study that the NRC/NAS can't
- Results will be provided to the NRC/NAS for its consideration

VA Beach Failure Analysis Study

■ Phase I Assessment:

- Assume a PMP-type catastrophe and sediment release
- Estimate of contaminated sediment to reach Kerr Reservoir
- Assess potential increase in background radiation levels in Kerr Reservoir

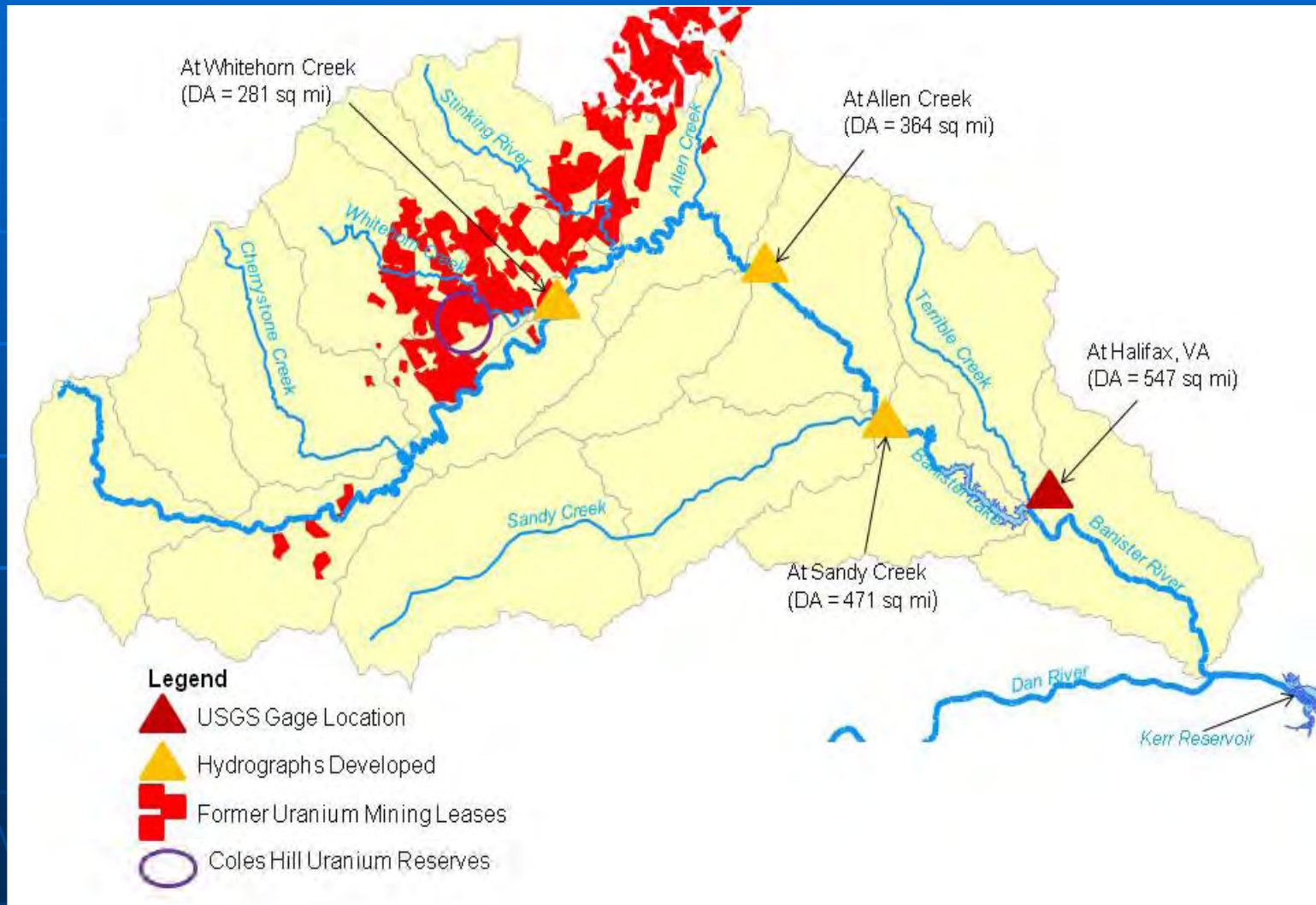
■ Phase II Assessment:

- Detailed analysis based on Phase I results (if deemed necessary).

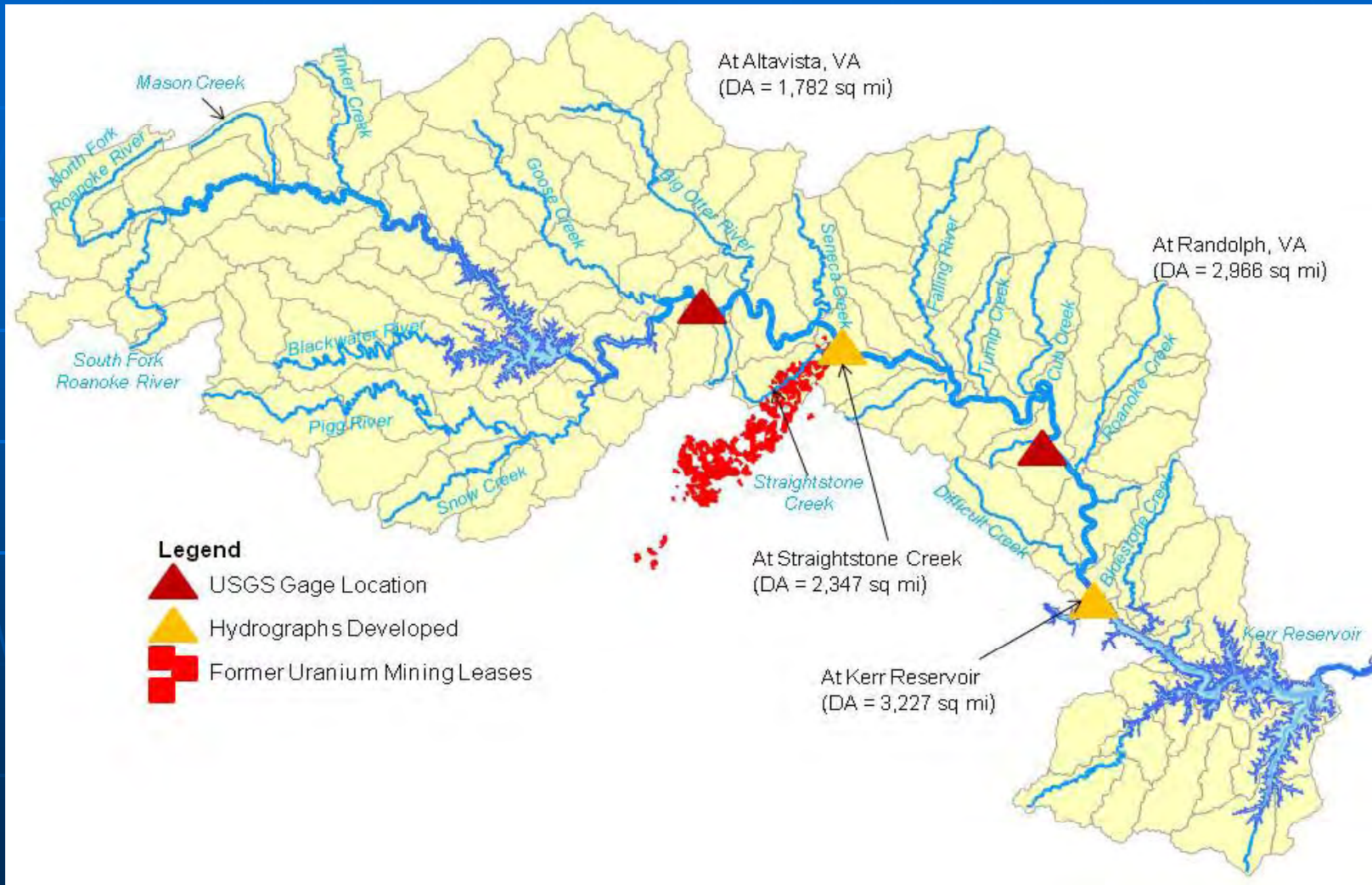
Phase I Assessment

- Banister and Roanoke Rivers
- CCHE1D: Center for Computational Hydroscience and Engineering at the University of Mississippi
- CCHE1D simulates unsteady flows and sediment transport in dendritic channel networks
- CCHE1D also simulates transport and fate of radionuclide's

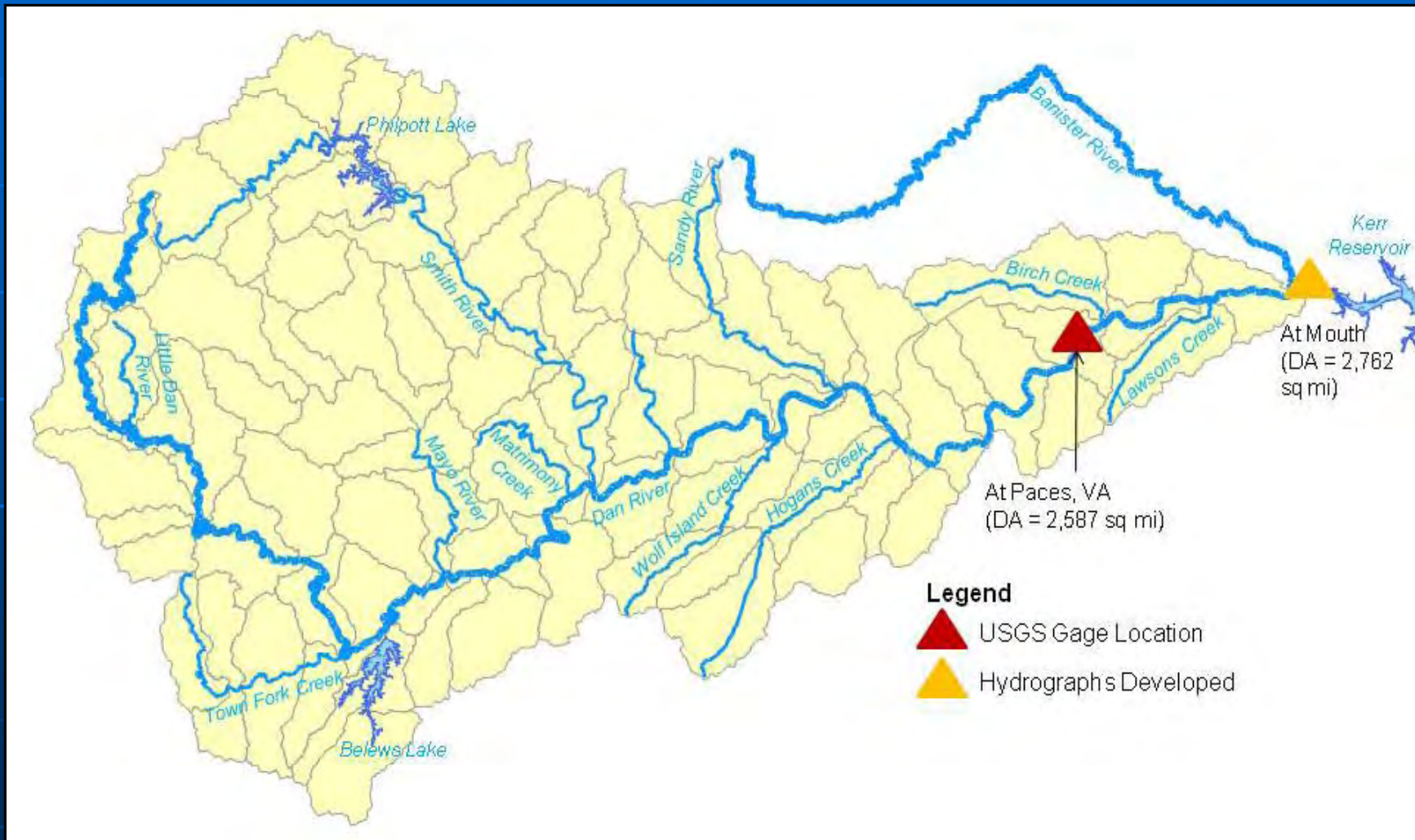
Banister River Watershed



Roanoke River Watershed



Dan River Watershed



One Dimensional Modeling Objectives

Following a hypothetical PMP-event which releases certain quantities of mill tailings and effluents into the Banister or Roanoke Rivers:

What amount of radionuclide-contaminated sediment and water might reach Kerr Reservoir?

- **In the short term** (i.e. during the high-flow caused by the extreme precipitation event that triggered the failure) and
- **In the long term** (during subsequent high-flow events of lesser magnitude, but higher frequency)

What would be the potential increase in background radiation levels and other contaminants levels in Kerr Reservoir?

Sensitivity Analysis

Model parameters: watershed and sediment coefficients

Meteorological Parameters:

- Extreme events (500-yr & 100-yr storms)
- Small and large released tailings
- Short and long duration releases

Uncertainty Analysis

Volume of the sediment released

Initial radioactivity of the tailings and the effluents

The distribution coefficients

Independent Expert Review Panel

Specialized in key disciplines:

- Uranium Milling/Disposal of Milling Waste/Geotechnical
- Surface/Sub-Surface Water Contamination
- Sediment Transport, Unsteady Hydrodynamic Modeling
- Hydrology
- Water Chemistry/Treatment

Assist in development of the approach for the Phase 1

Review adequacy of data collected, critique the assumptions and the Phase 1 assessment design

Review, Critique and Evaluate Phase 1 report and conclusions

Current Status

- Model has been constructed, calibrated and tested
- Initial scenarios are being run
- It's very early – but no surprises yet
 - Heavier sediments settle closer to point of assumed release
 - Lighter sediments transported to Kerr
 - There is some Ra deposition in Kerr
- Results have not yet been converted to water quality impacts

QUESTIONS?