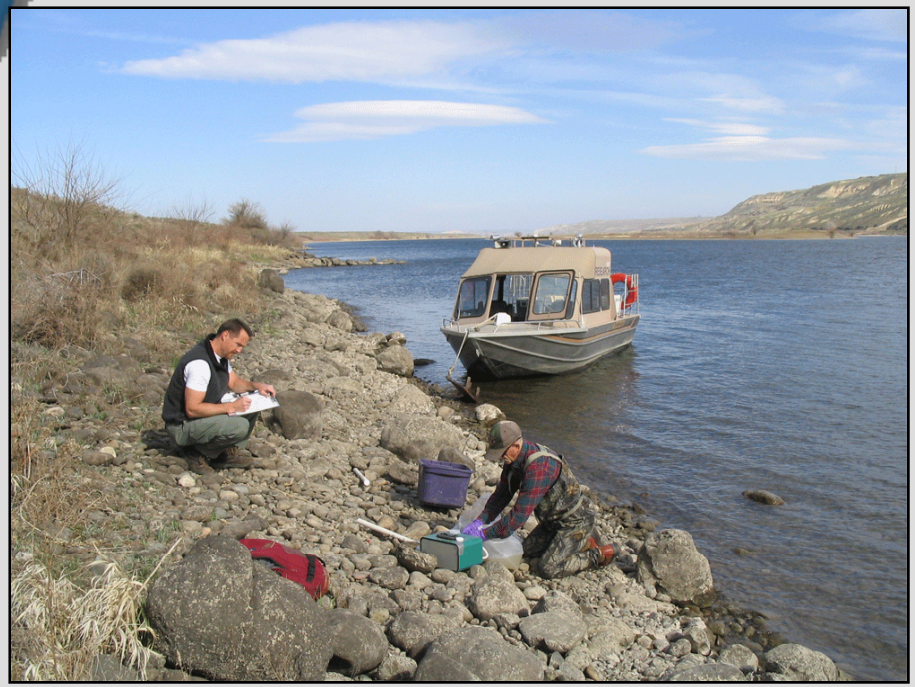
Monitoring the Influence of River Stage on Contaminant Concentrations in the Hyporheic Zone at the Hanford Site's 300 Area

Remediation and Closure Science Project (Fluor Hanford, Inc.)
Hanford Site Surface Environmental Surveillance Project

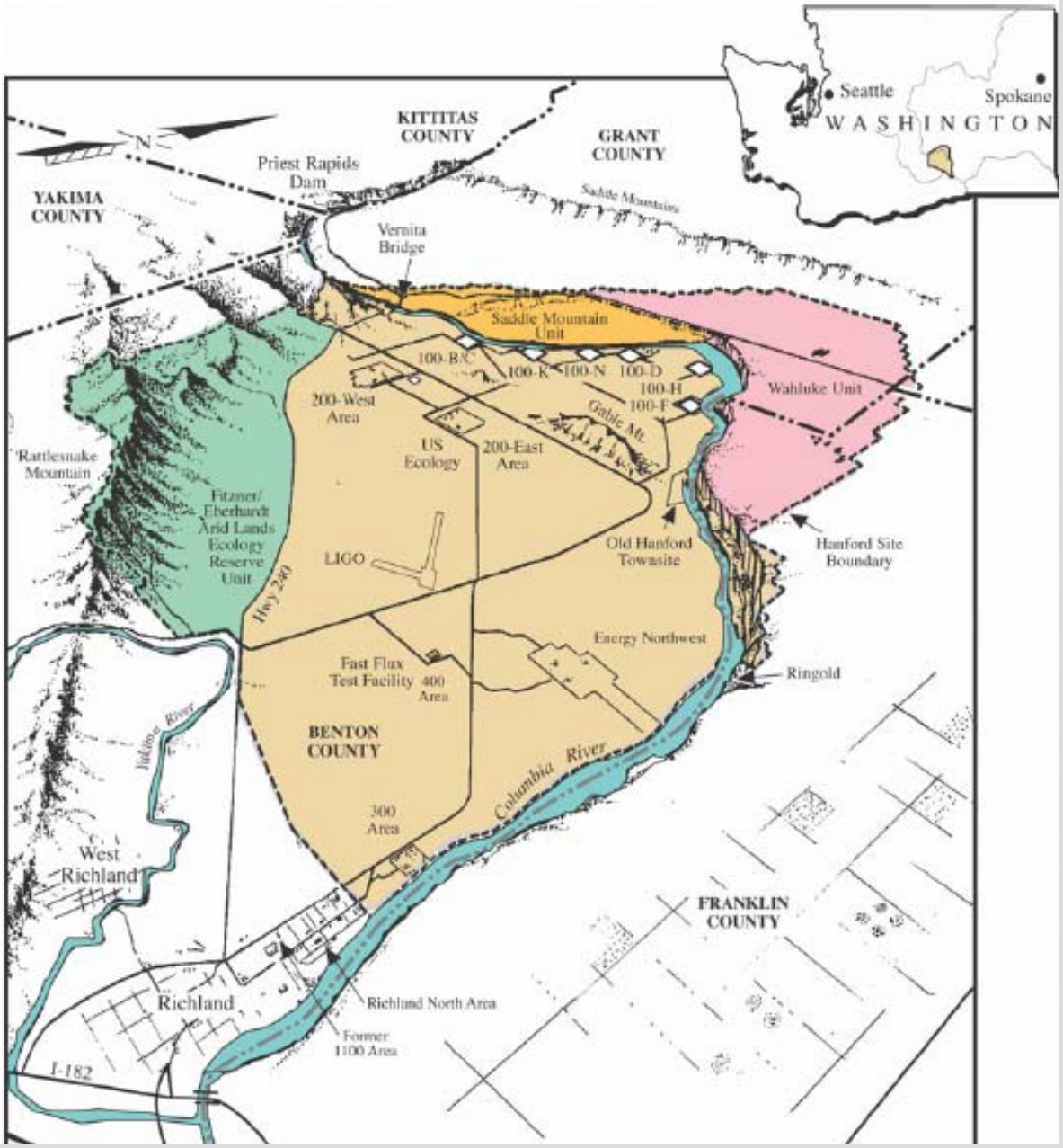
Presentation to Hanford Natural Resources Trustee Council, Richland, WA on July 24, 2007. PNNL-SA-56322



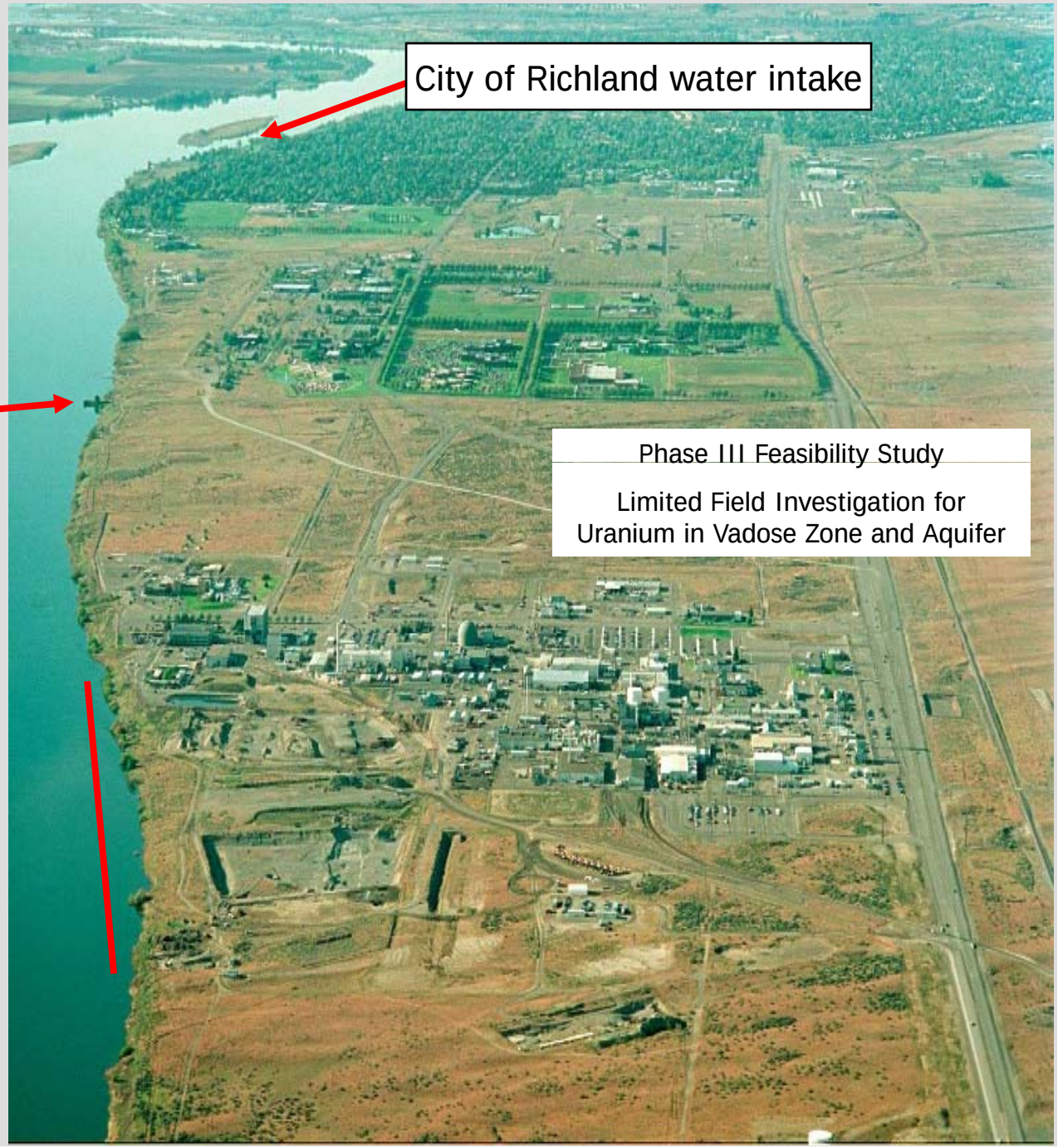
Greg Patton, Brad Fritz, and
Donny Mendoza

Battelle

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy


Seattle
Spokane
WASHINGTON
KITTITAS COUNTY
GRANT COUNTY
YAKIMA COUNTY
Priest Rapids Dam
Saddle Mountains
Vernita Bridge
Saddle Mountain Unit
100-B/C
100-K
100-N
100-D
100-H
100-F
Wahluke Unit
200-West Area
Gable Mt.
US Ecology
200-East Area
Rattlesnake Mountain
Fitzner/ Eberhardt Arid Lands Ecology Reserve Unit
LIGO
Old Hanford Townsite
Hanford Site Boundary
Hwy 240
Energy Northwest
Fast Flux Test Facility
400 Area
Ringold
Yakima River
BENTON COUNTY
Columbia River
300 Area
West Richland
FRANKLIN COUNTY
Richland
Richland North Area
Former 1100 Area
I-182

300 Area Looking South to Richland



Irrigation withdrawal

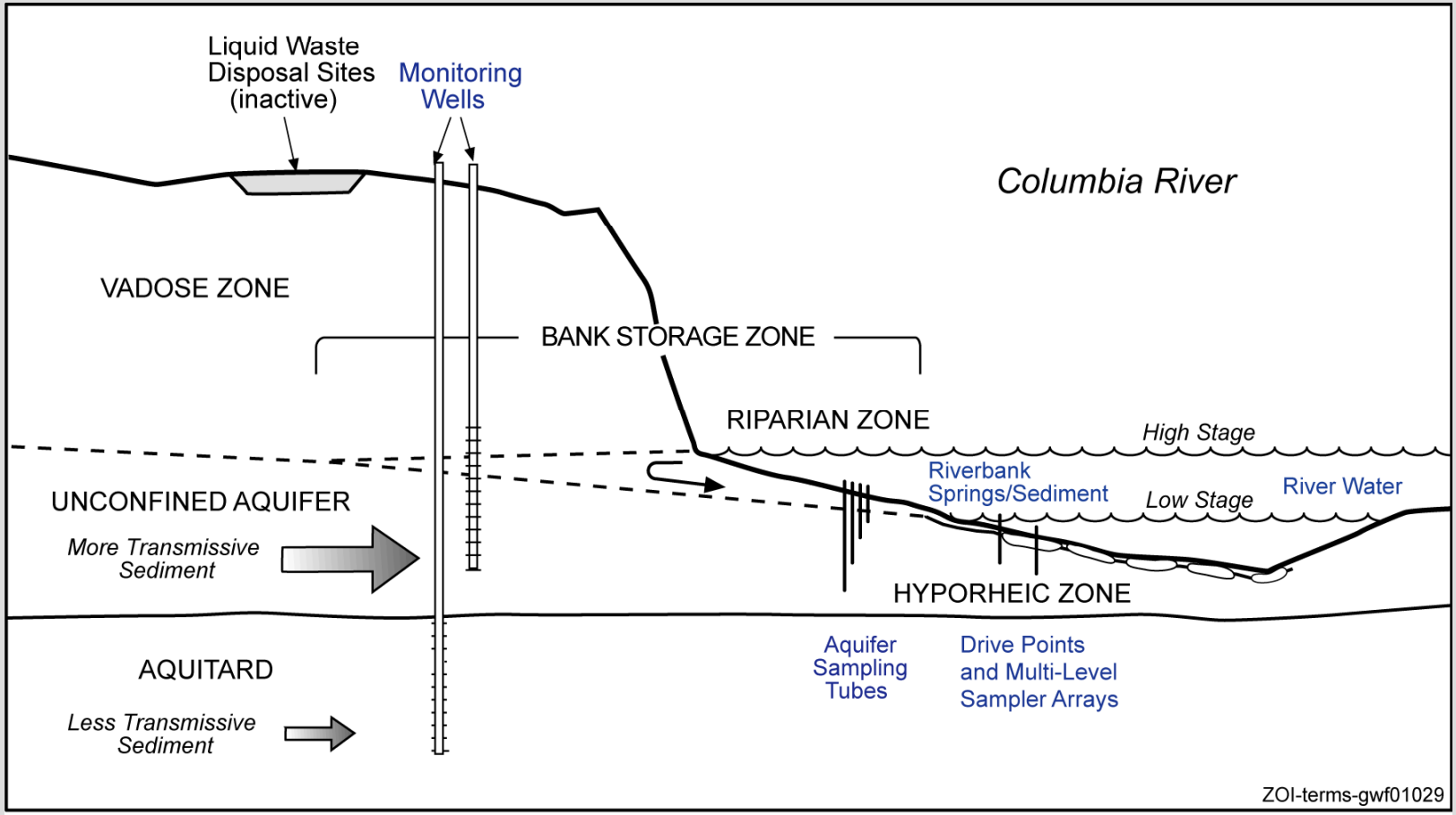
Uranium plume discharge area

Battelle

River and Spring Monitoring at the 300 Area
Hanford Site Surface Environmental Surveillance Project

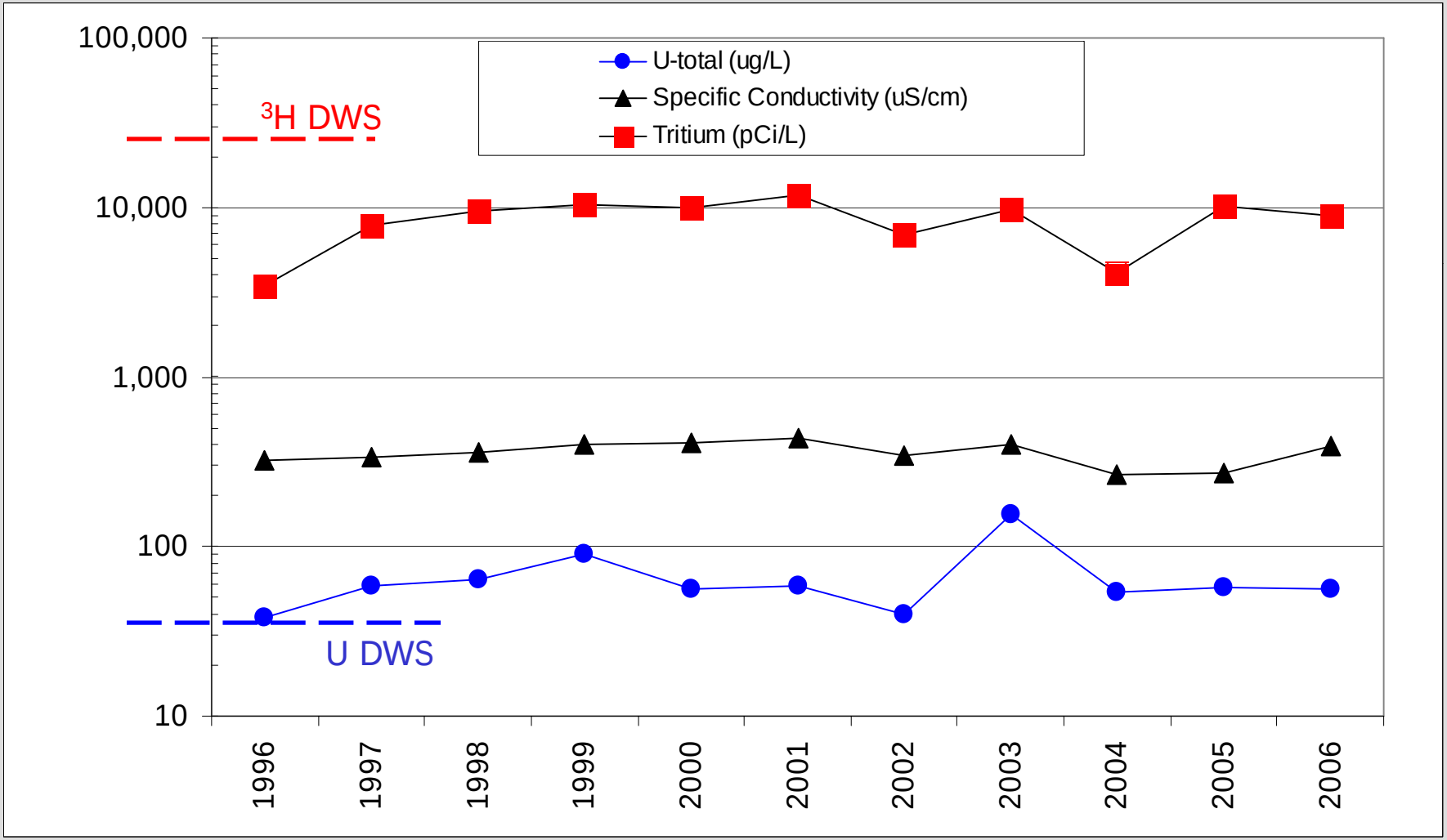
- Annual riverbank spring water and sediment monitoring (1988 to present: 1 - 5 springs)
  - 1 sample/spring/year
  - radionuclides/metals/anions
  - VOC at selected locations
  - sediment results will not be presented in this talk
- Springs typically emerge when river stage falls below ~70,000 cfs
  - some springs dry up with extended low river stage
- Annual transect and near shore river water
  - 6 cross river samples [300 south fence]
    - 4 near shore samples
    - radionuclides/metals/anions
    - usually collected in September at low river stage

Hyporheic Zone



300 Area Riverbank Spring #7
(70K cfs, low McNary pool)

300 Area Riverbank Spring #7



DWS = drinking water standard

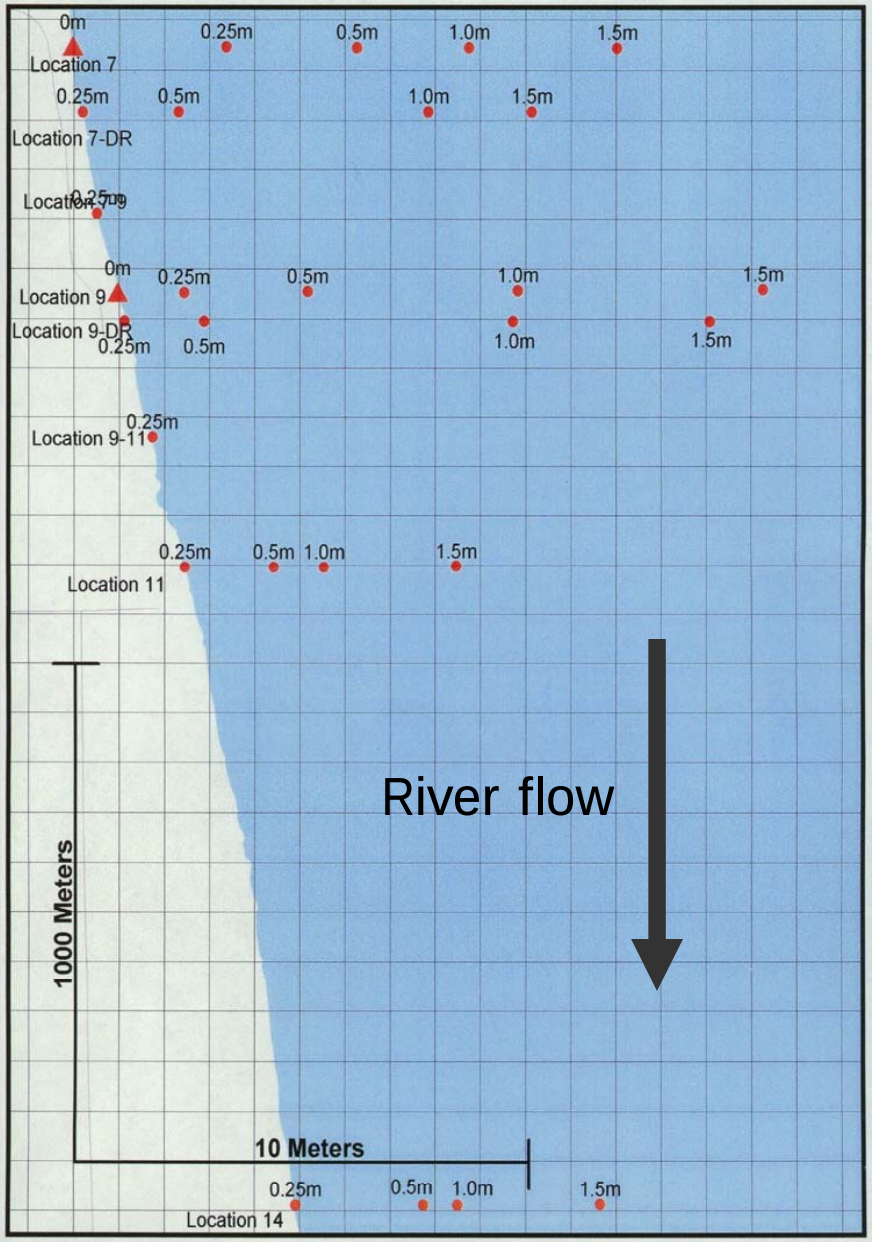
Sampling matrix for near shore river water at the 300 Area *PNNL 13692, Rev.1*

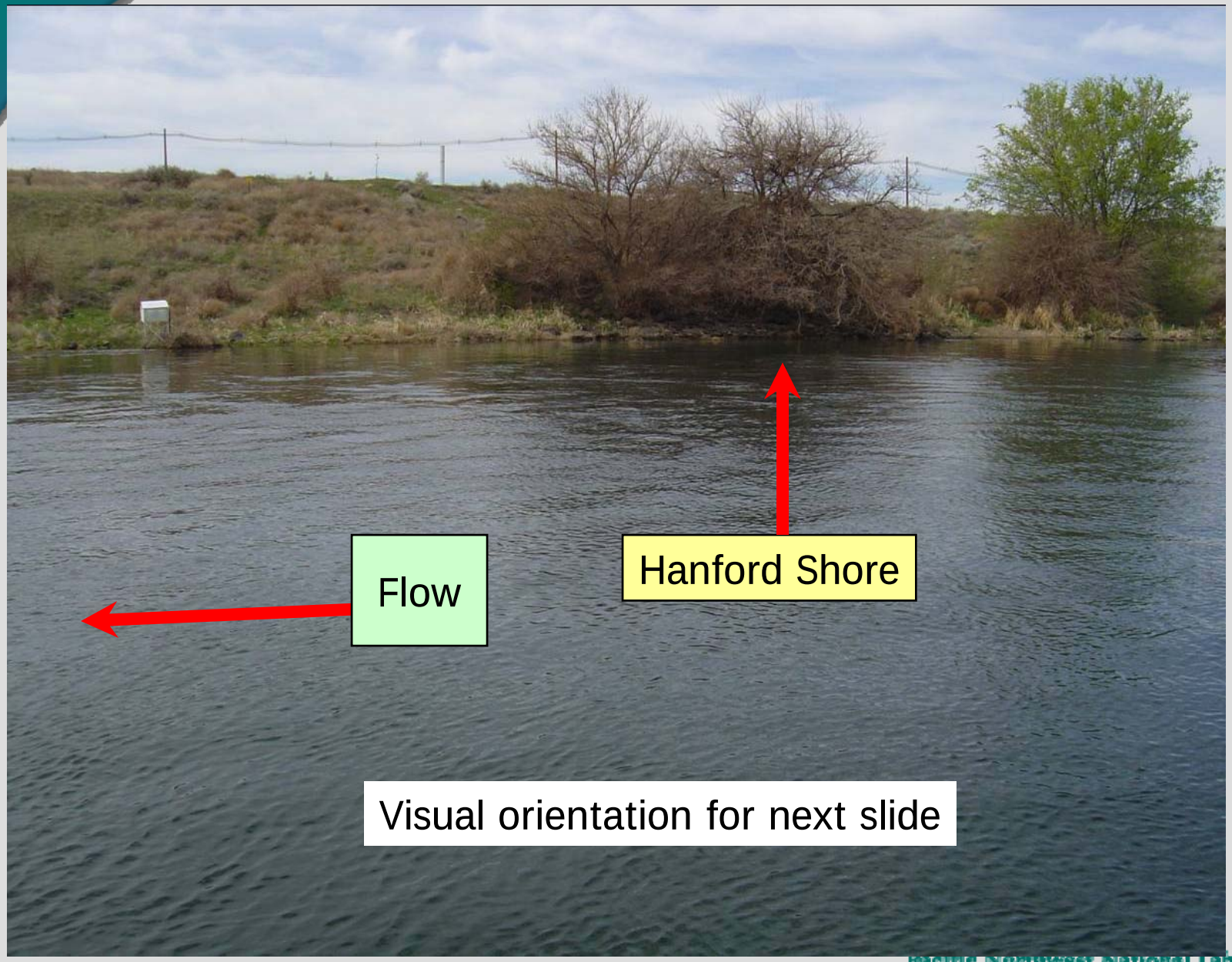
-Riverbank spring water collected at locations #7 and #9, no visible flow at other locations

-River water collected near stream bottom at total depths of 0.25, 0.5, 1, and 1.5 m

--Sample were analyzed for specific conductivity, radionuclides, metals, and anions

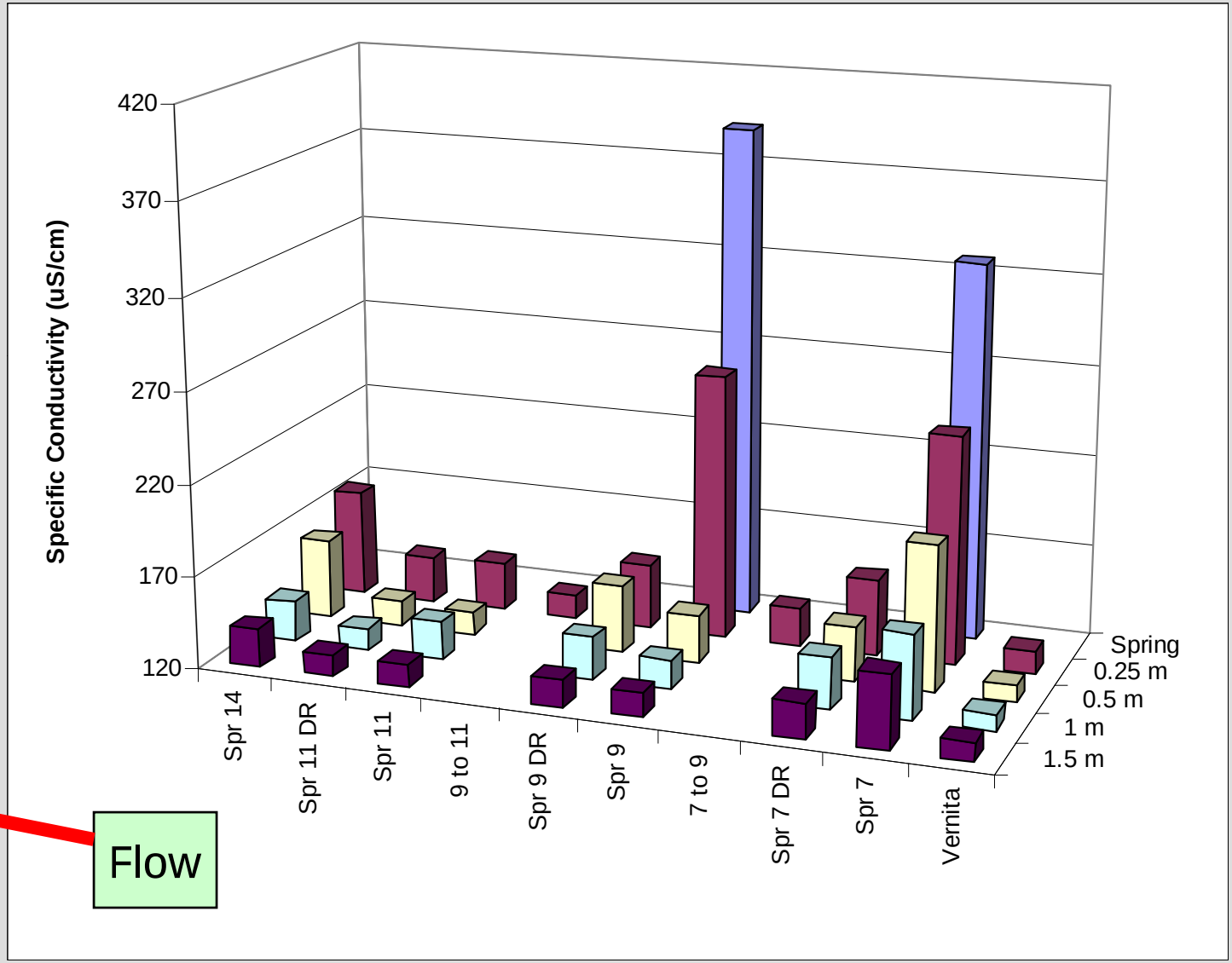
-- 1 sample/location




Flow
Hanford Shore
Visual orientation for next slide

300 Area Near-Shore

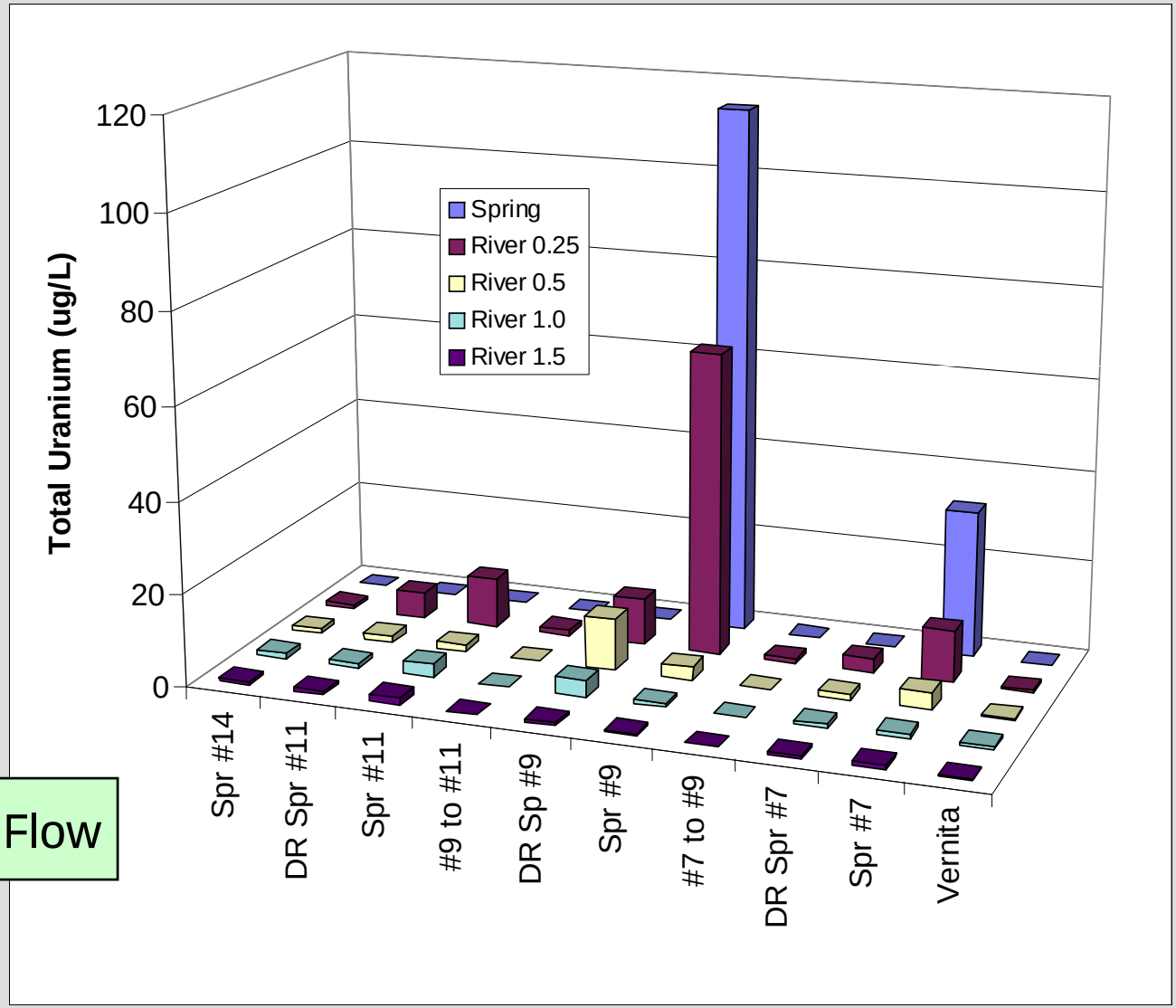
August 2001, PNNL 13692, Rev.1



Flow

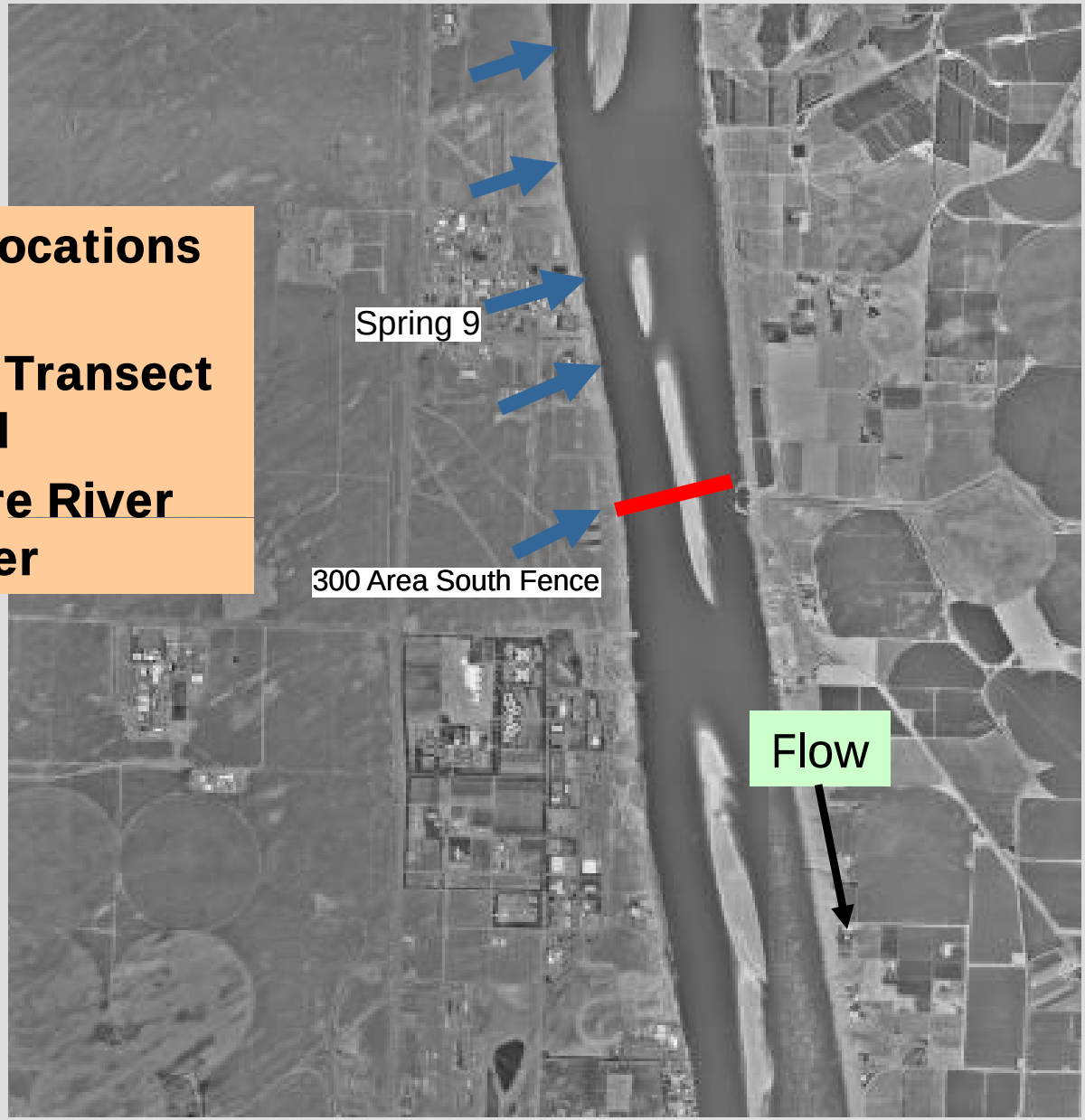
300 Area Near-shore Total Uranium

August 2001, PNNL 13692, Rev.1



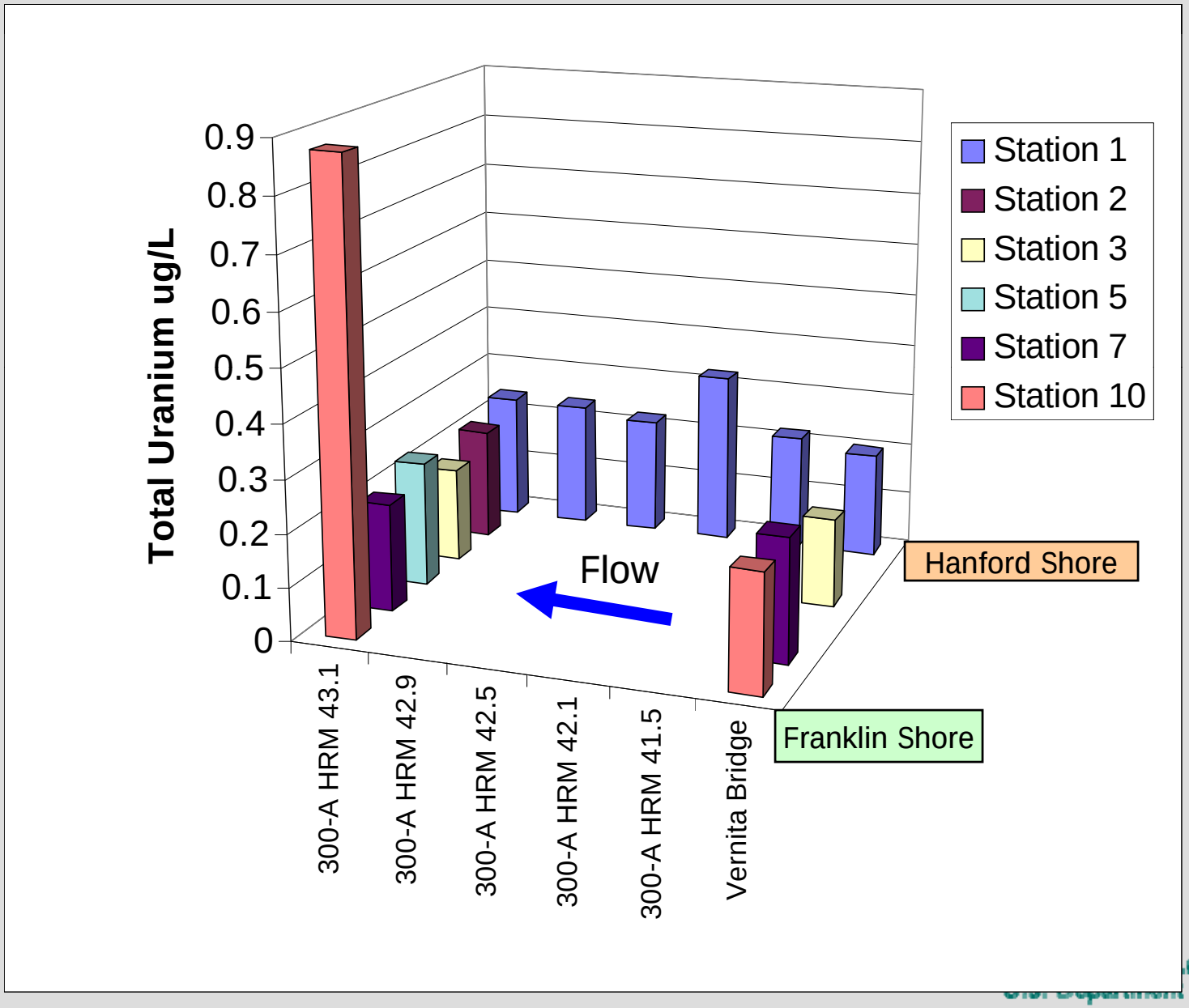
Flow

Sampling Locations for Cross River Transect and Near-Shore River Water



Uranium in Cross River and Near-Shore River Water

August 2001, *PNNL 13692, Rev.1*



S&T Remediation Task
Research Focus Presented at 6th Washington Hydrogeology Symposium

- Fritz, B.G and E.V. Arntzen. 2007. *Effect of Changing River Stage on Uranium Flux Through the Hyporheic Zone of the Columbia River Along the Shoreline of the 300 Area of the Hanford Site.* PNNL-SA-52531.

- Mackley, R.D. and B.G. Fritz. 2007. *Characterizing the Hydrogeology of the Hyporheic Zone Along the 300 Area of the Hanford Site, Washington.* PNNL-SA-56035.

- Mendoza, D, BG Fritz, and GW Patton. "Use of a passive flux chamber for measurement of contaminant discharge into the Columbia River along the Hanford Reach". PNNL-SA-53838.

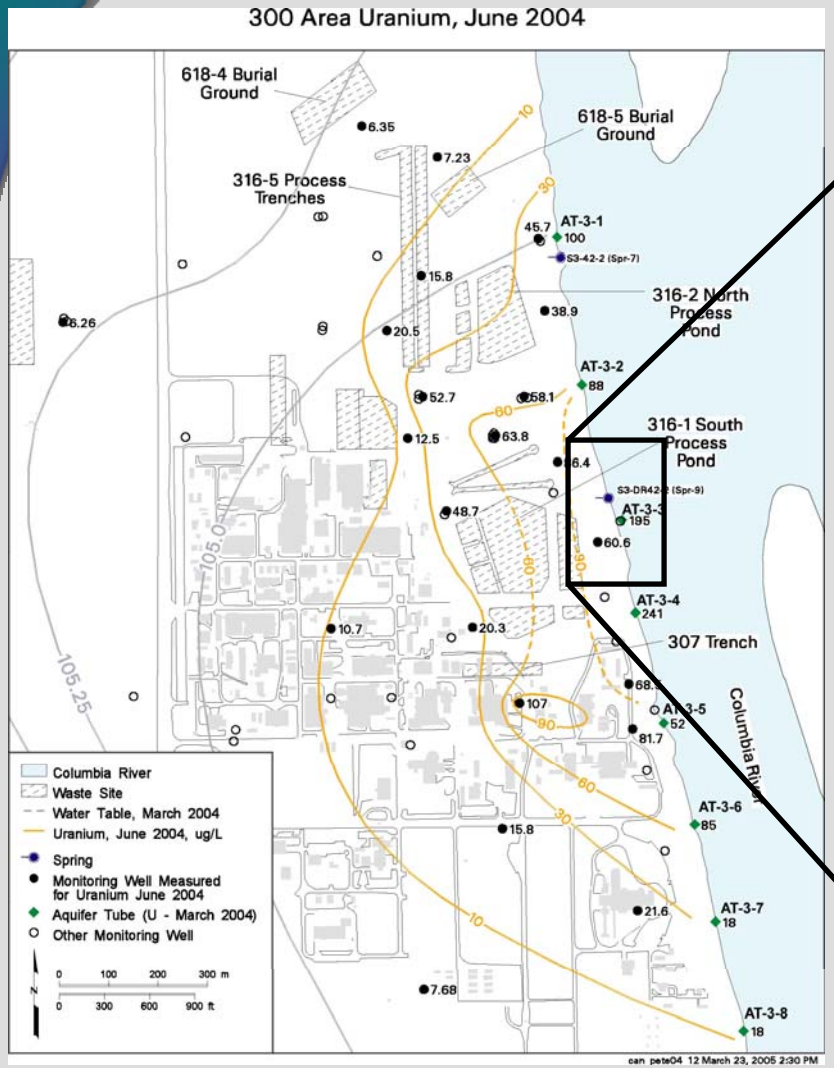
- Patton, G.W., B.G. Fritz, and D.P. Mendoza. 2007. *Monitoring the Influence of River Stage on Contaminant Concentrations in the Hyporheic Zone of the Columbia River at the Hanford Site's 300 Area.* PNNL-(tbd).

Hyporheic Zone Monitoring

- Characterize hydrogeology for the hyporheic zone
- Develop the capability to continuously monitor hyporheic zone installations
  - River stage, specific conductivity, and temperature
- Evaluate water chemistry during low, intermediate, and high river stage

Hyporheic Zone Network

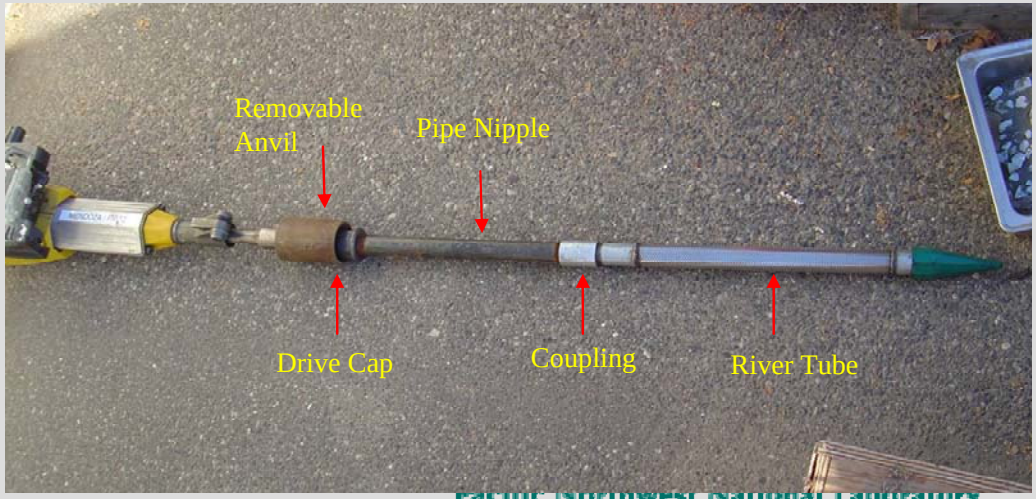
S&T Tube Network



Water Sampling Points

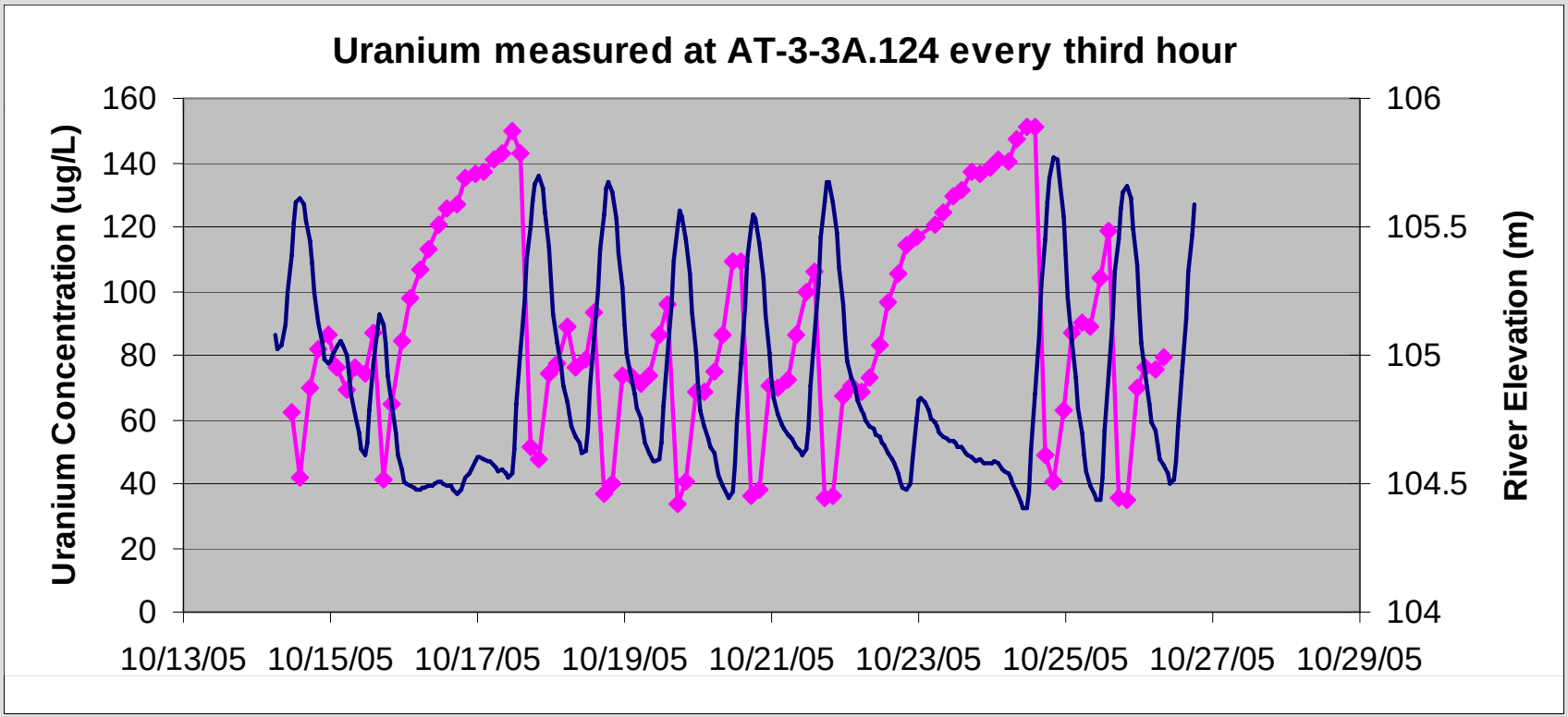
- Aquifer tubes
  - 6” SS screen attached to ¼” poly tubing
  - Water sample only

- Piezometers
  - Water samples and Pressure-Temperature-Conductivity probes
  - 18” screened interval
  - 1-1/4” steel pipe
  - Installed with a jackhammer



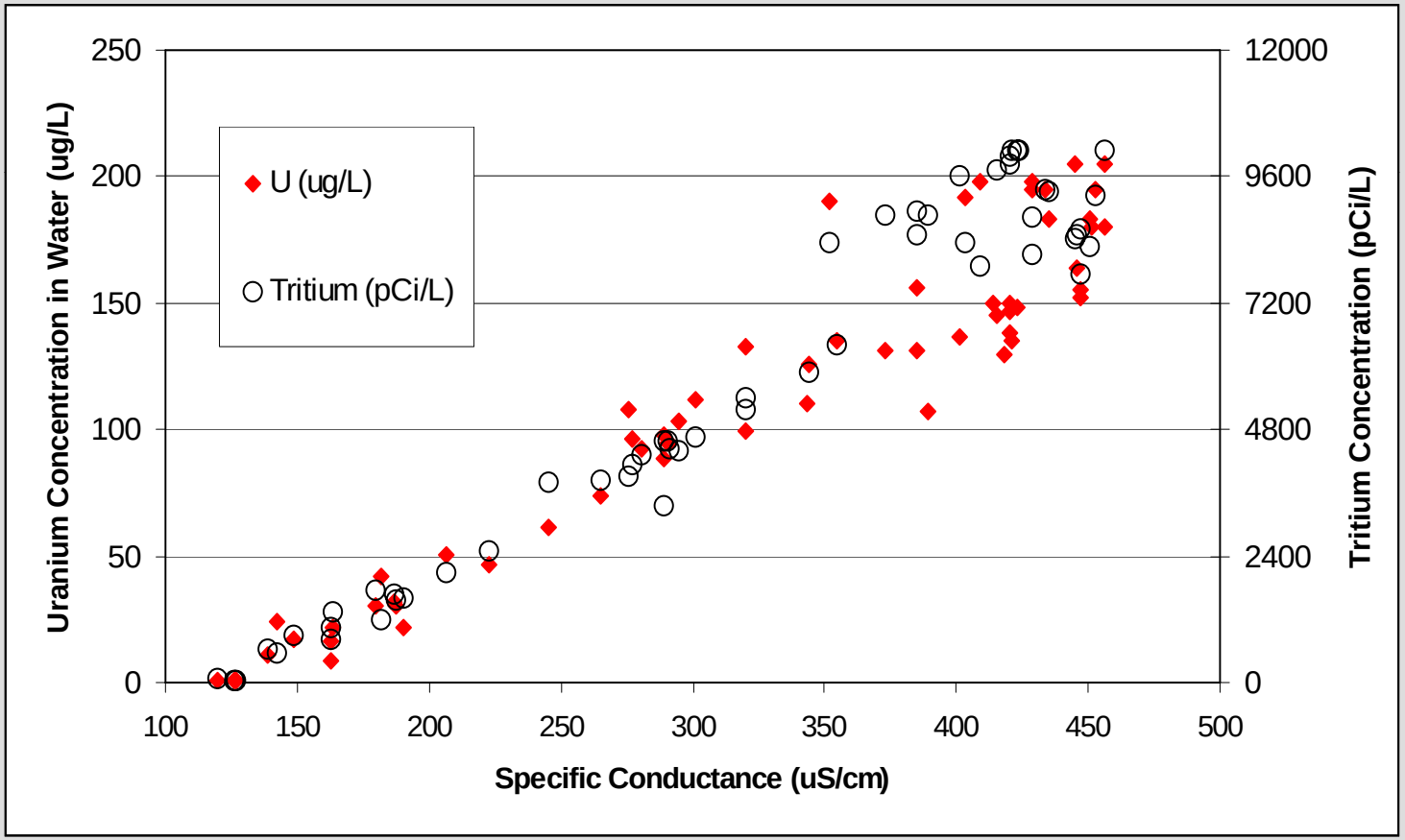
Fast Response of Hyporheic Zone

- High frequency water sampling for uranium in October 2005
- River elevation shown in blue, uranium concentration shown in red



Indicator Parameters for Contaminants

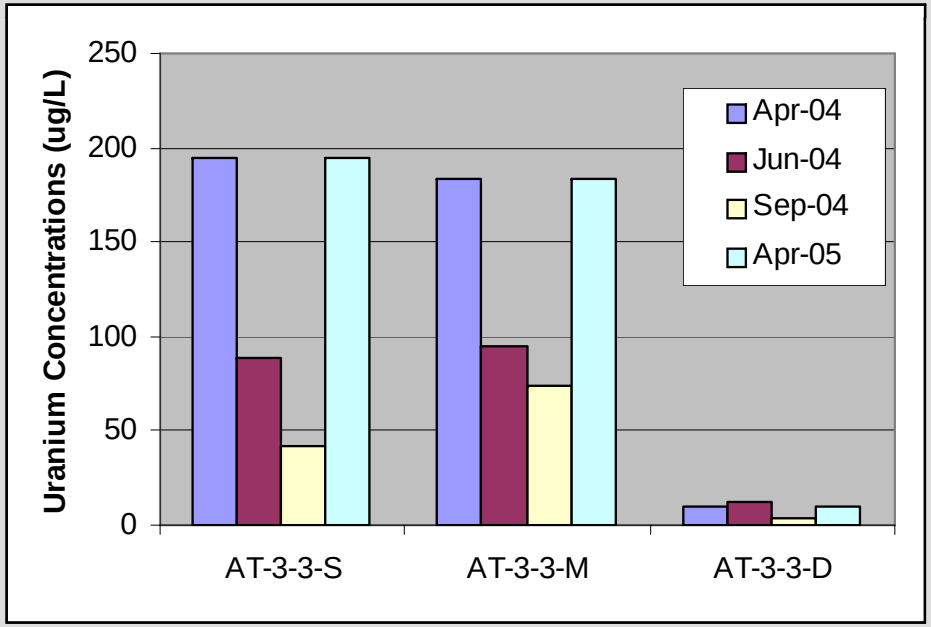
- Uranium and tritium are correlated to specific conductance



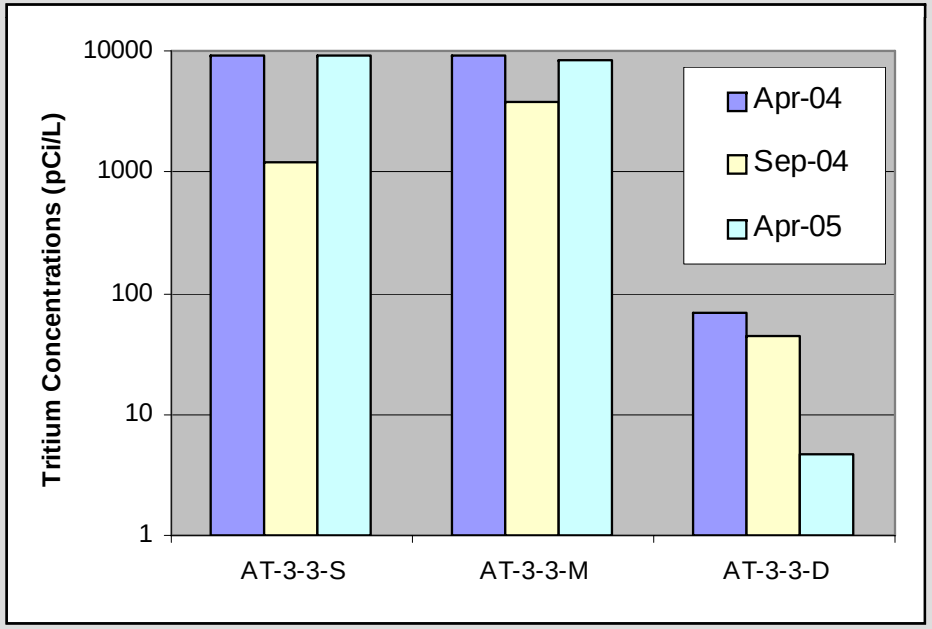
Delineate Vertical Extent of Contamination in the River Bottom

- AT-3-3-D suspected to be below top of contaminant confining layer

Uranium



Tritium



Environmental Monitoring Conclusions

- Progression of uranium was observed from

groundwater→ piezometers→ spring→ river→

- Uranium exceeded ambient surface water quality criteria for <u>riverbank spring water</u>; however, river water exceeded criteria only in the immediate vicinity of the springs

Hyporheic Monitoring Conclusions

- Inverse relationship for uranium concentrations and river stage
- Specific conductivity provides a useful indicator for river water and groundwater mixing
- Additional monitoring and installations needed to better establish temporal and spatial trends
- Provided data for time periods when riverbank springs were underwater