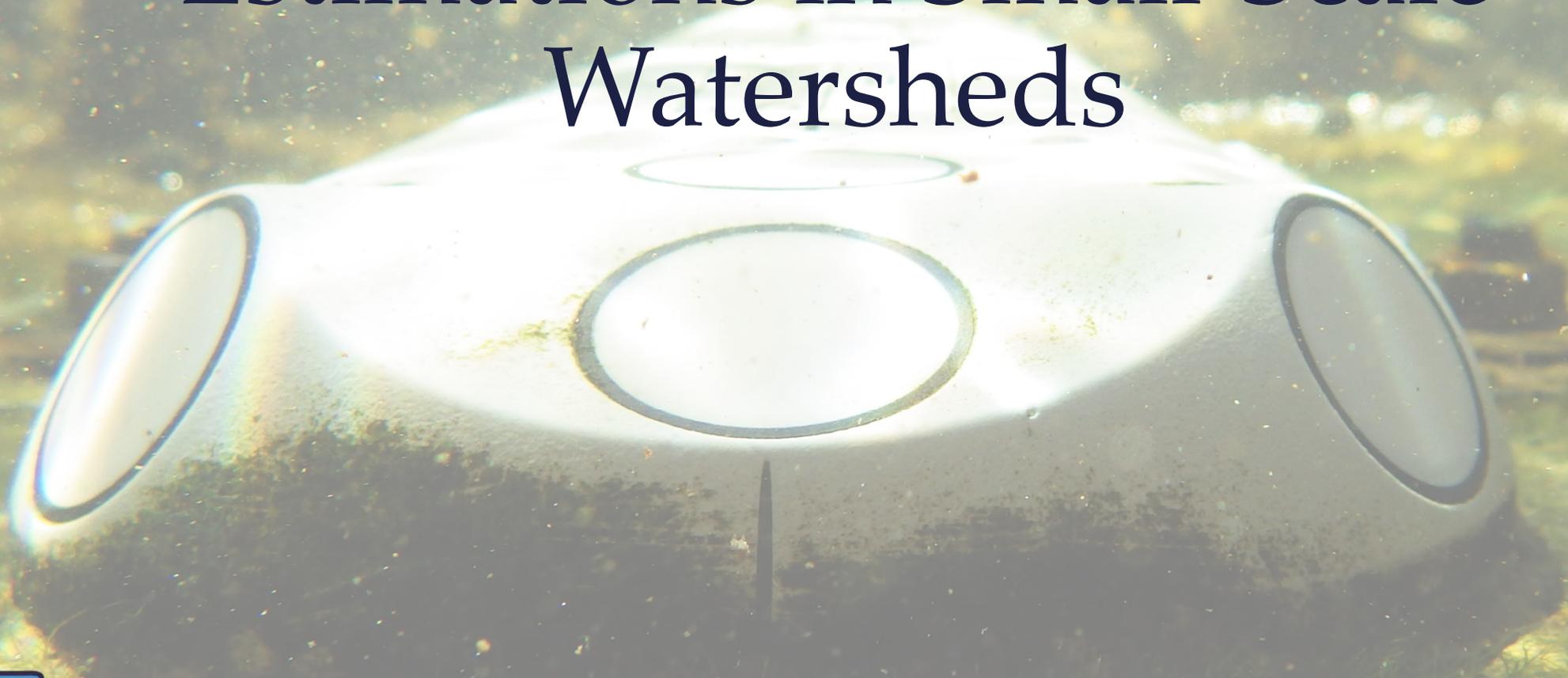


Streamflow Monitoring and Load Estimations in Small-Scale Watersheds



Abbie Lasater, Brad Austin, Erin Scott, and Brian Haggard

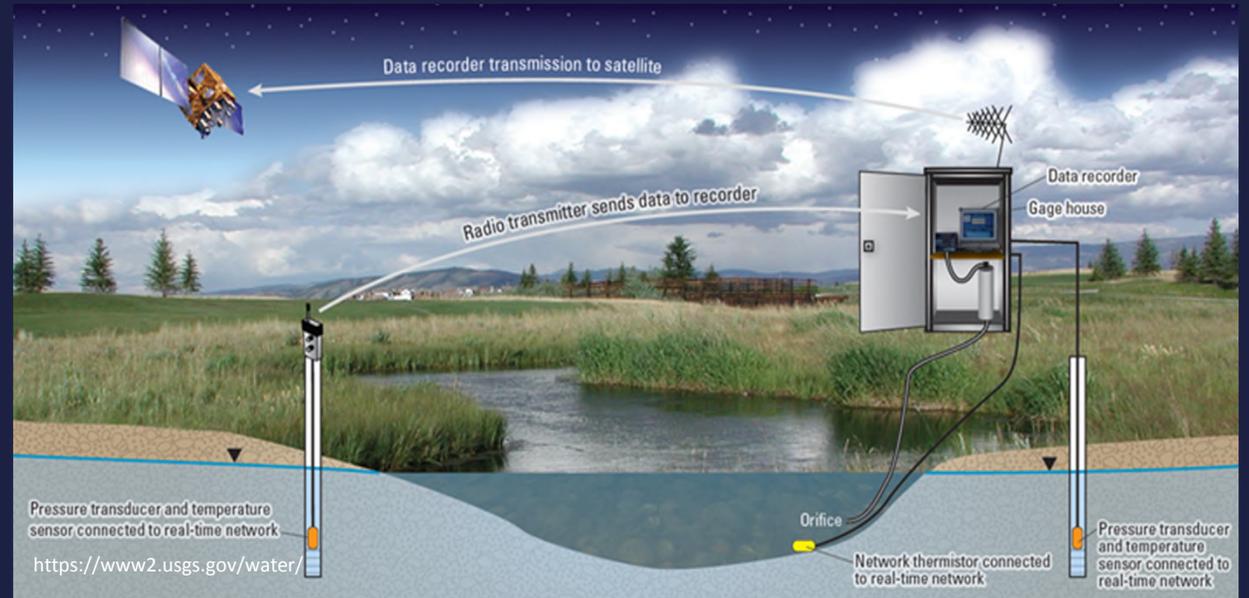
University of Arkansas

Photo by Brad Austin



Introduction

- USGS Stations can cost about \$25,000 for equipment and installation & about \$15,000 for yearly operation and maintenance (M. Norris, personal communication)
- Data on small scale streams are very limited due to cost and feasibility
- Often times, watershed models are calibrated at larger scale rivers, but data is typically not available to validate on the subwatershed scale



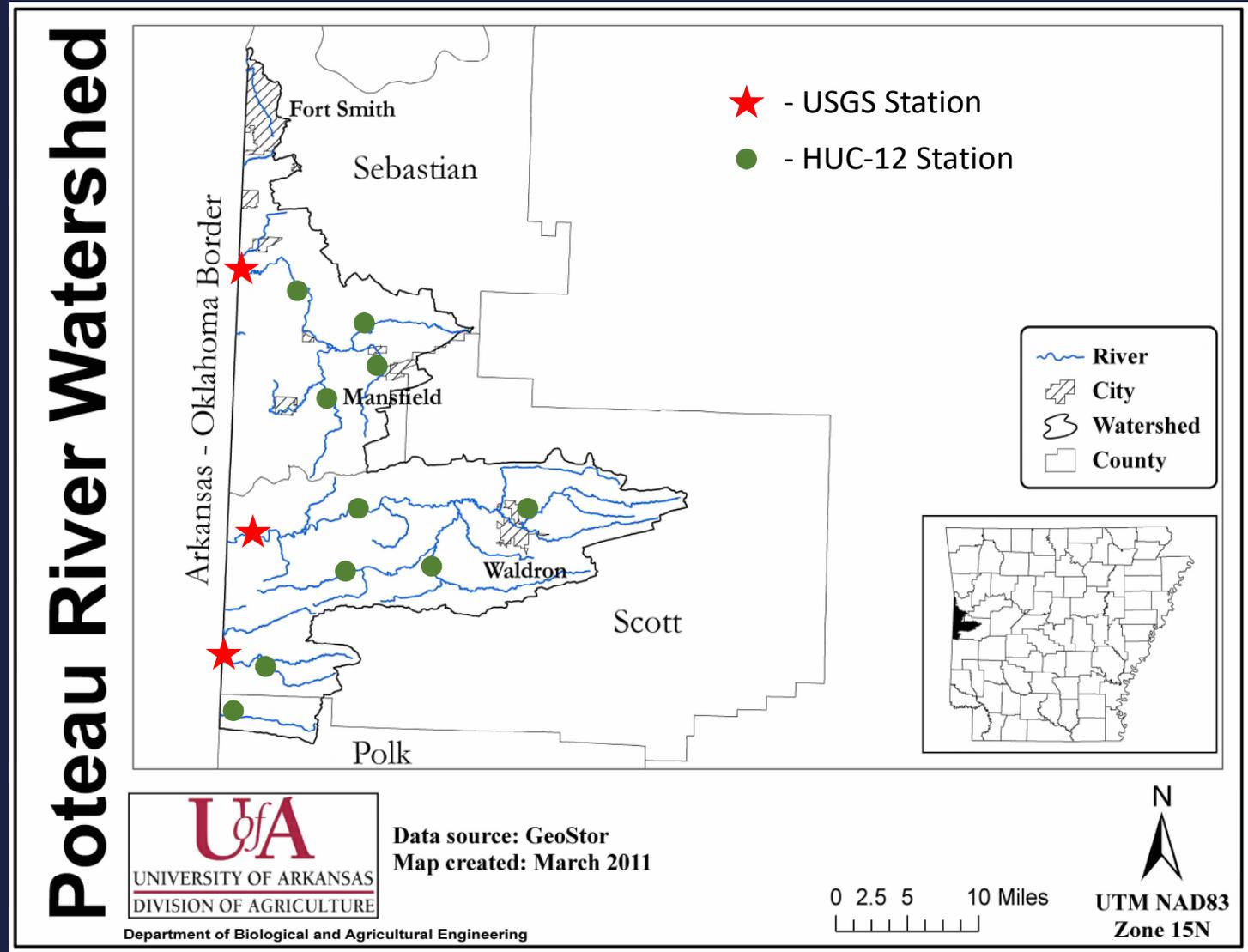
Objectives

- Introduce a streamflow monitoring method for small scale watersheds.
- Discuss challenges and solutions with data collection and rating curve development
- Analyze costs and benefits of proposed monitoring method



Upper Poteau River Watershed

- Listed as a priority watershed within the Arkansas Nonpoint Source (NPS) Pollution Plan by ANRC since 1998
- Drains into Lake Wister in OK
- Only 3 USGS stations throughout watershed
- Using this method, we'll develop rating curves across 10 HUC-12 subwatersheds within 3 years
- Help the ANRC determine where to implement BMPs on smaller scale



Methods-Stage



- A HOBO water level logger is deployed to obtain continuous stage record.
- A HOBO barometric pressure transducer is installed within 16 km of the water level logger to account for fluctuations in atmospheric pressure.
- Data collected on 15 minute intervals



Sager Creek



Ross Creek

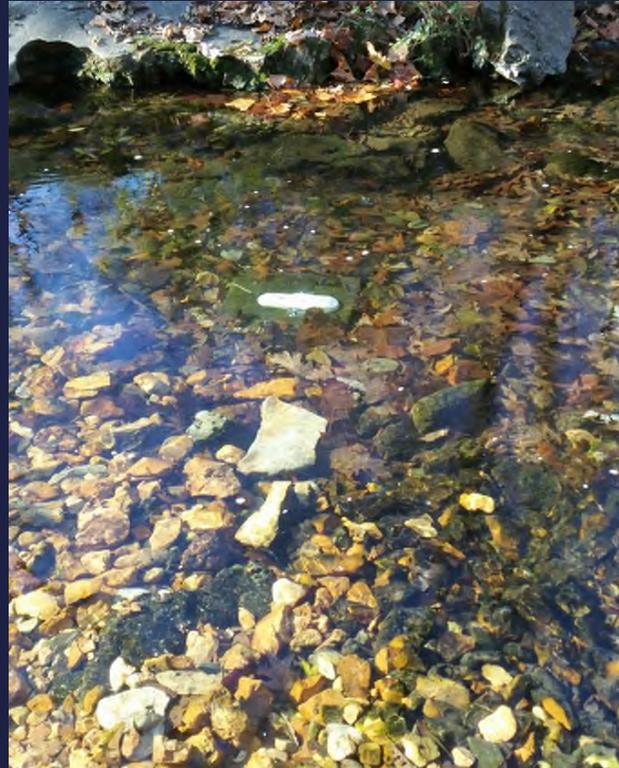


Upper Cherokee Creek

Methods-Discharge



- Roving discharge monitoring equipment, a SonTek acoustic Doppler instrument, was used to measure discharge during high flow events.
- SonTek is calibrated to the stream channel geometry and measures velocity of water using the Doppler shift
- Data collected on 15 minute intervals

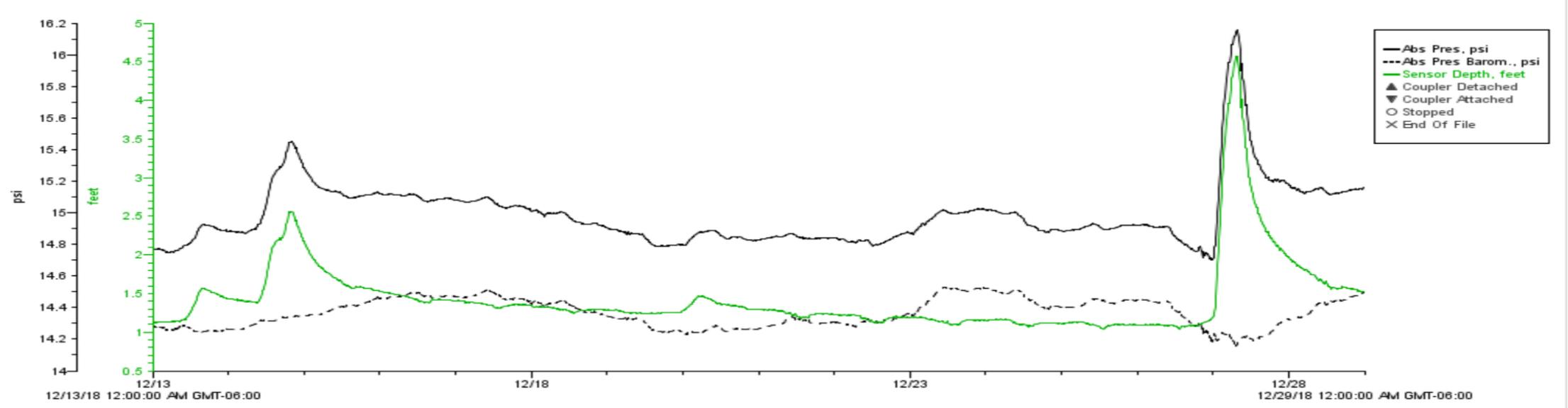


Methods-SonTek Installation

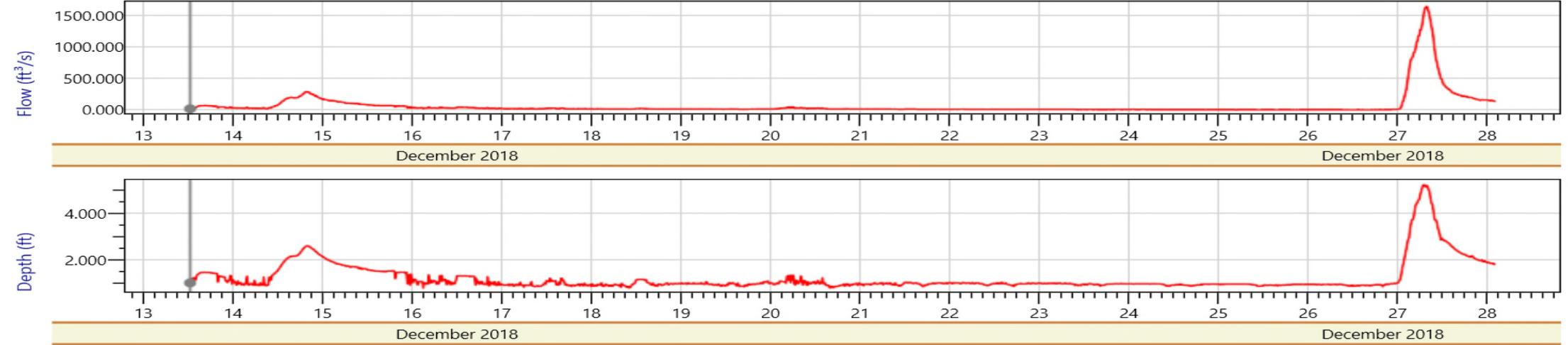
- SonTek stations are installed to allow the SonTek to be easily installed and removed between flood events.
- SonTek stations include:
 - a concrete base staked into the stream bed,
 - a container to store the battery and wiring, and
 - PVC from the concrete base, up the stream bank and to the battery container.
- SonTek stations allow for easy transfer of SonTeks among sites between flood events



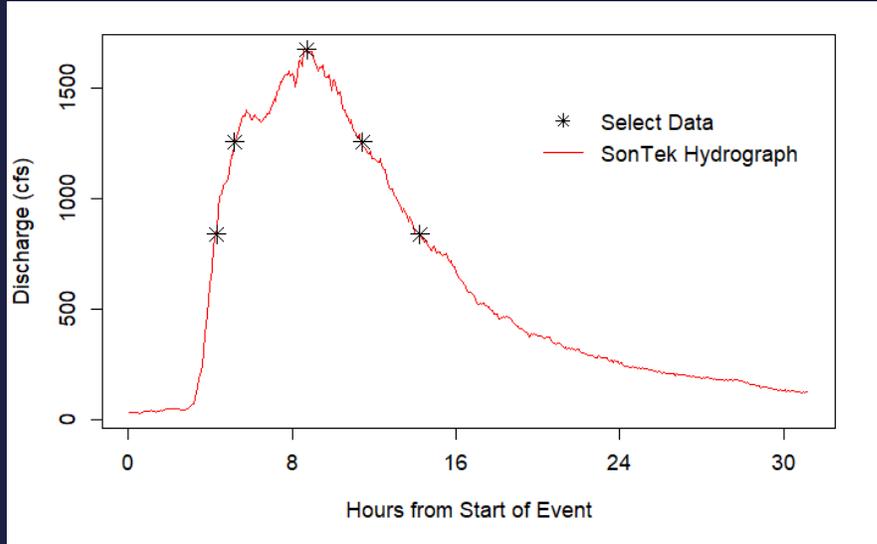
Data Collected



View data

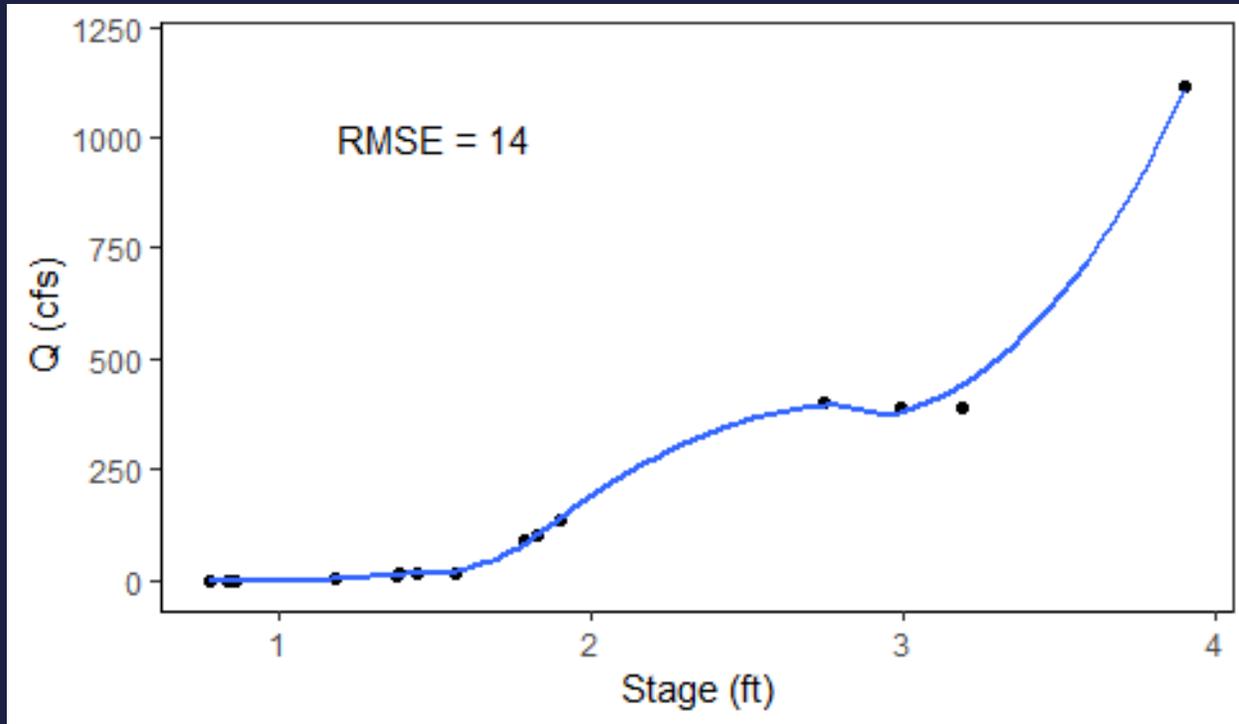


Rating Curve Development and Load Estimations



- From each high flow event, data was selected from the SonTek record
- Baseflow discharge measurements are collected on a monthly basis using velocity-area methods.
- Water samples are collected across the range of discharge measurements to estimate constituent loads

Upper James Fork Rating Curve

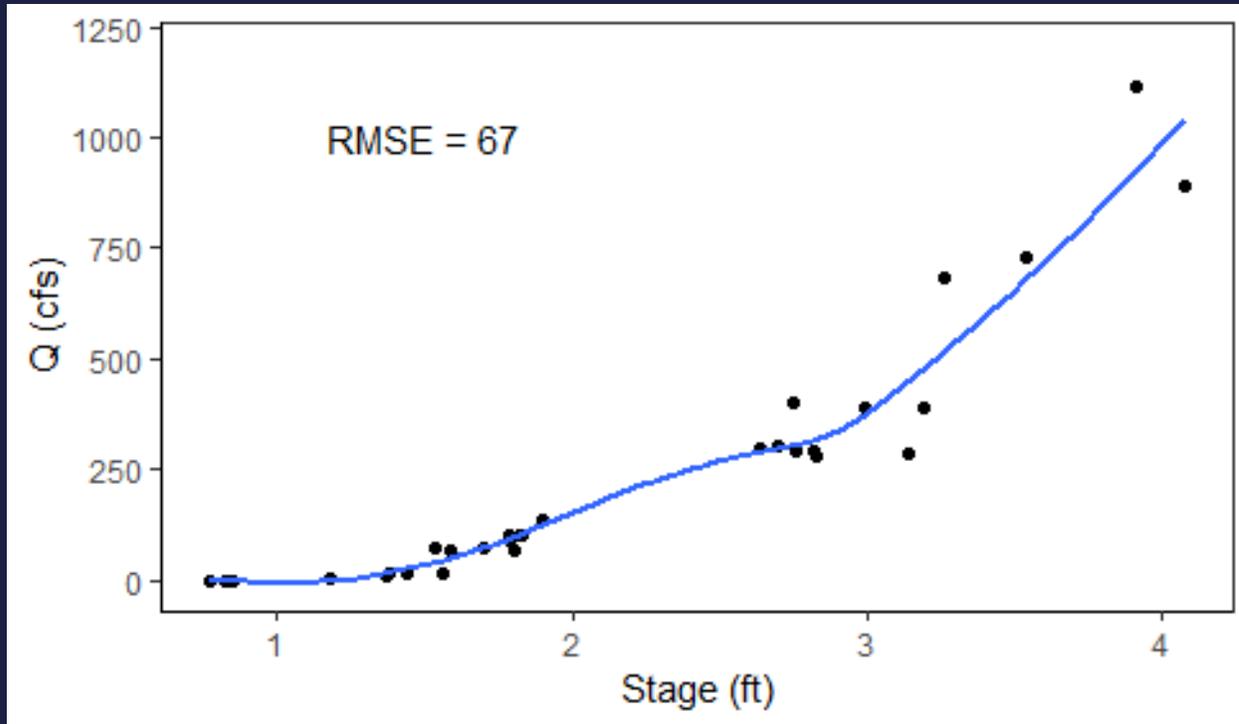


Rating Curve using Peaks Only



Upper James Fork near Hackett, Arkansas

Upper James Fork Rating Curve

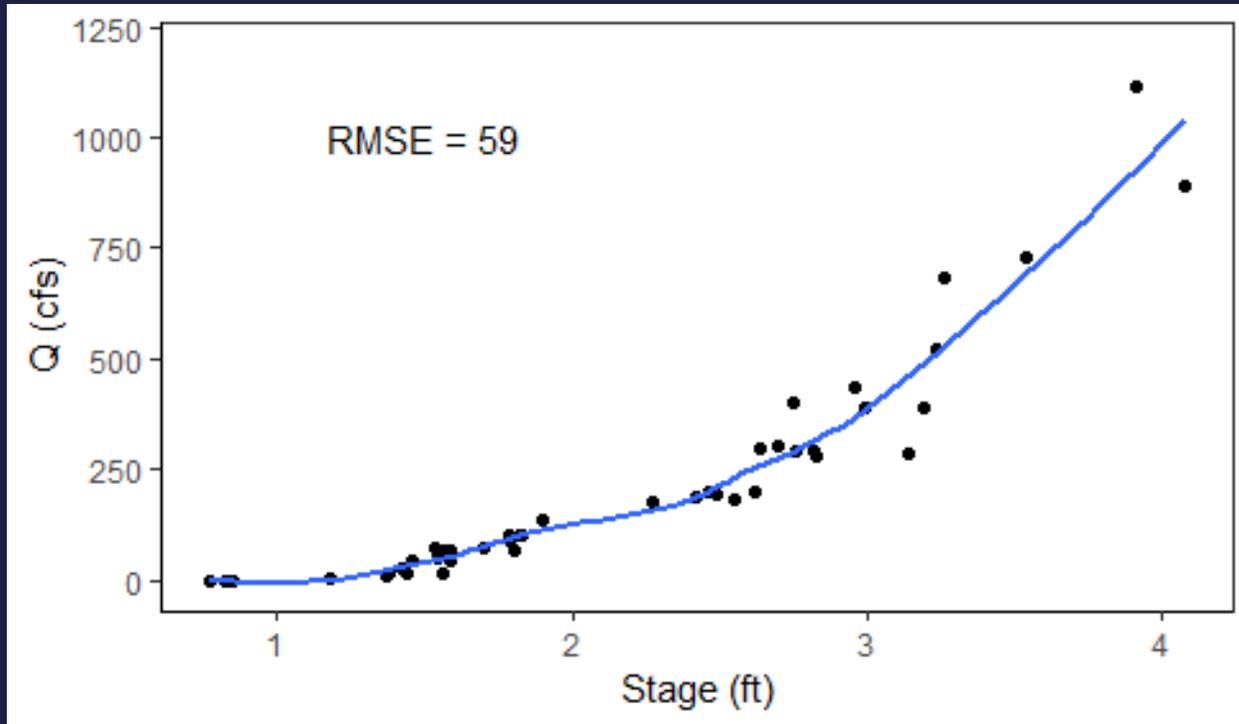


What if we included 75% of the Peak?



Upper James Fork near Hackett, Arkansas

Upper James Fork Rating Curve

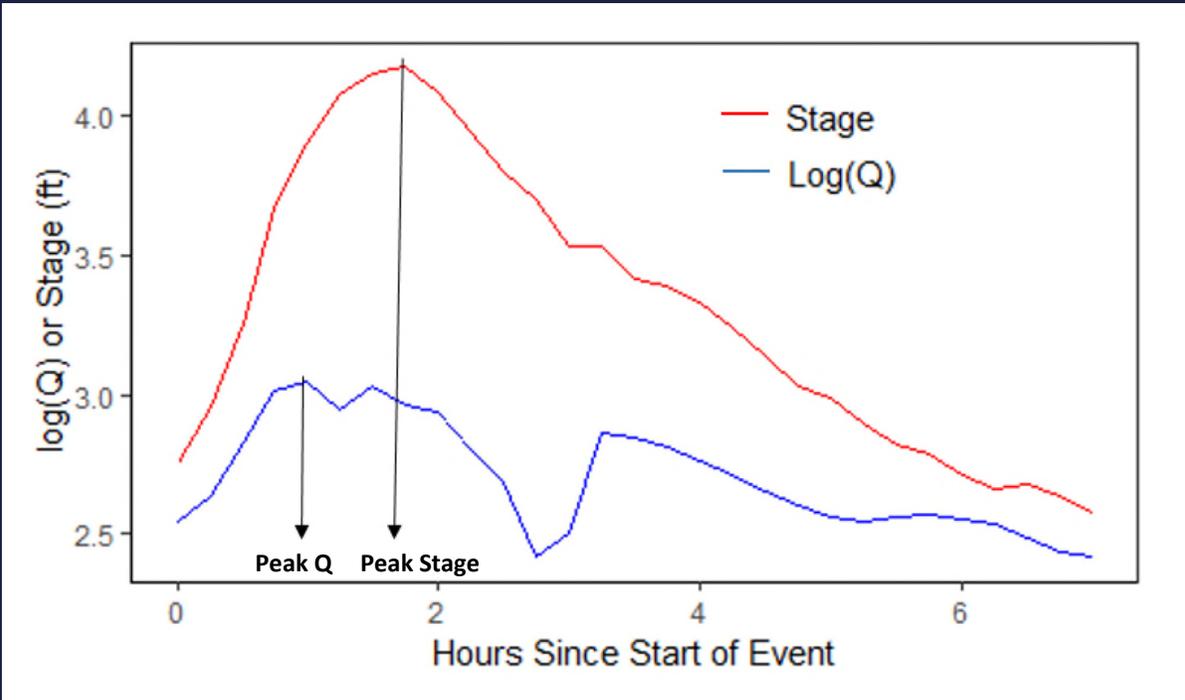


What if we included 75% and 50% of the Peak?

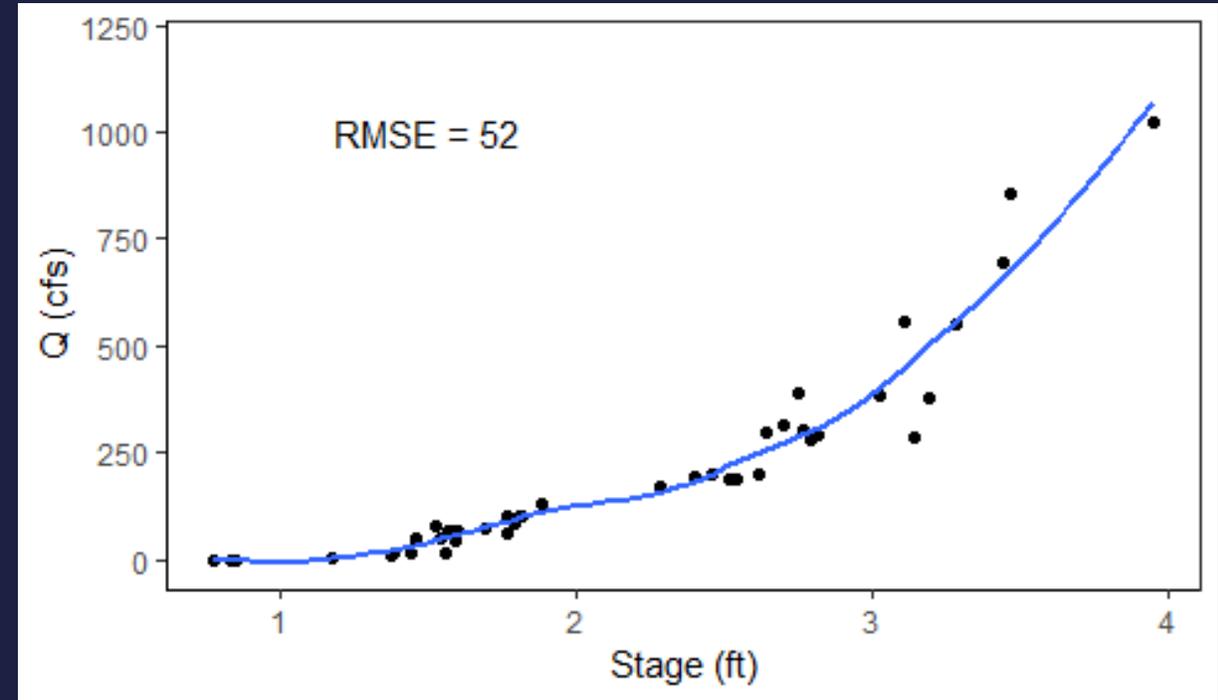


Upper James Fork near Hackett, Arkansas

Upper James Fork Rating Curve

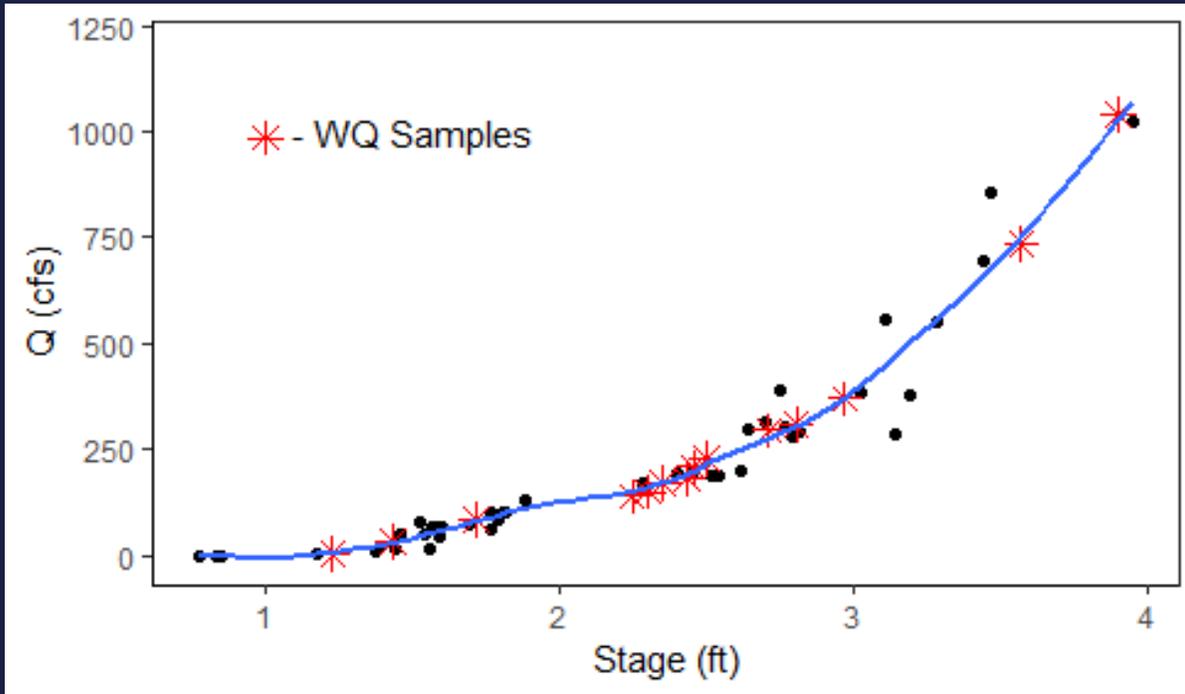


Hydrograph from Single Storm Event
Showing Hysteresis

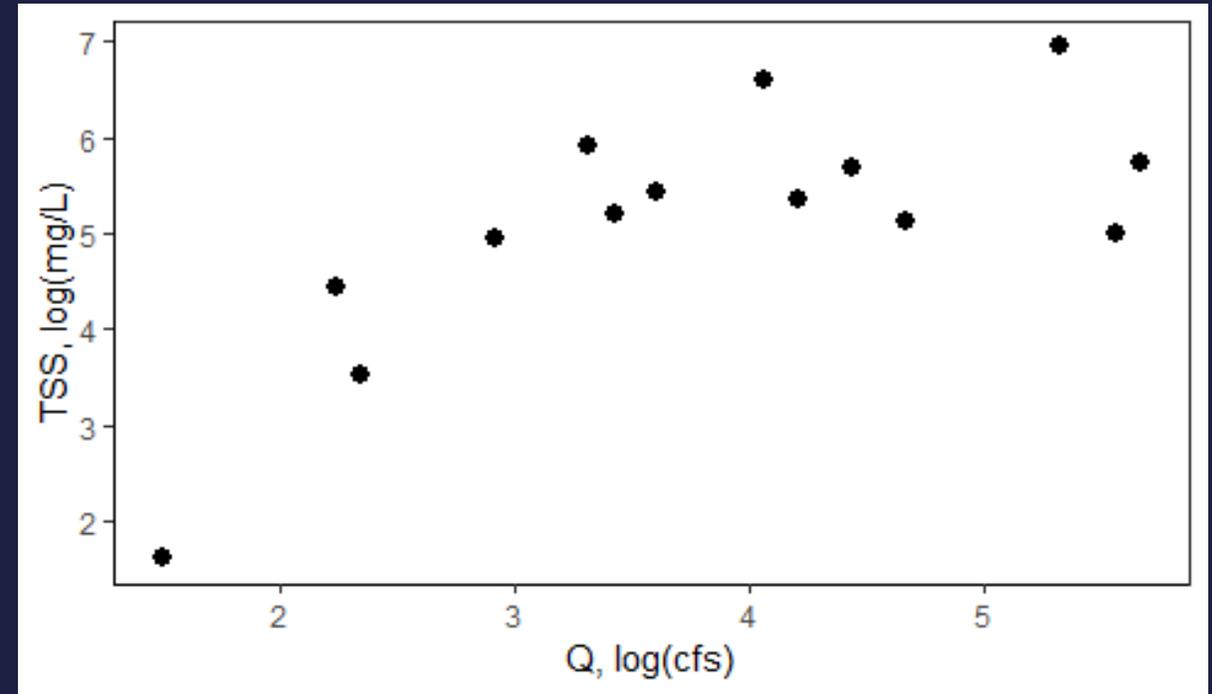


What if we use averages around Peaks, 75%
of Peaks, and 50% of Peaks?

Upper James Fork Load Estimations

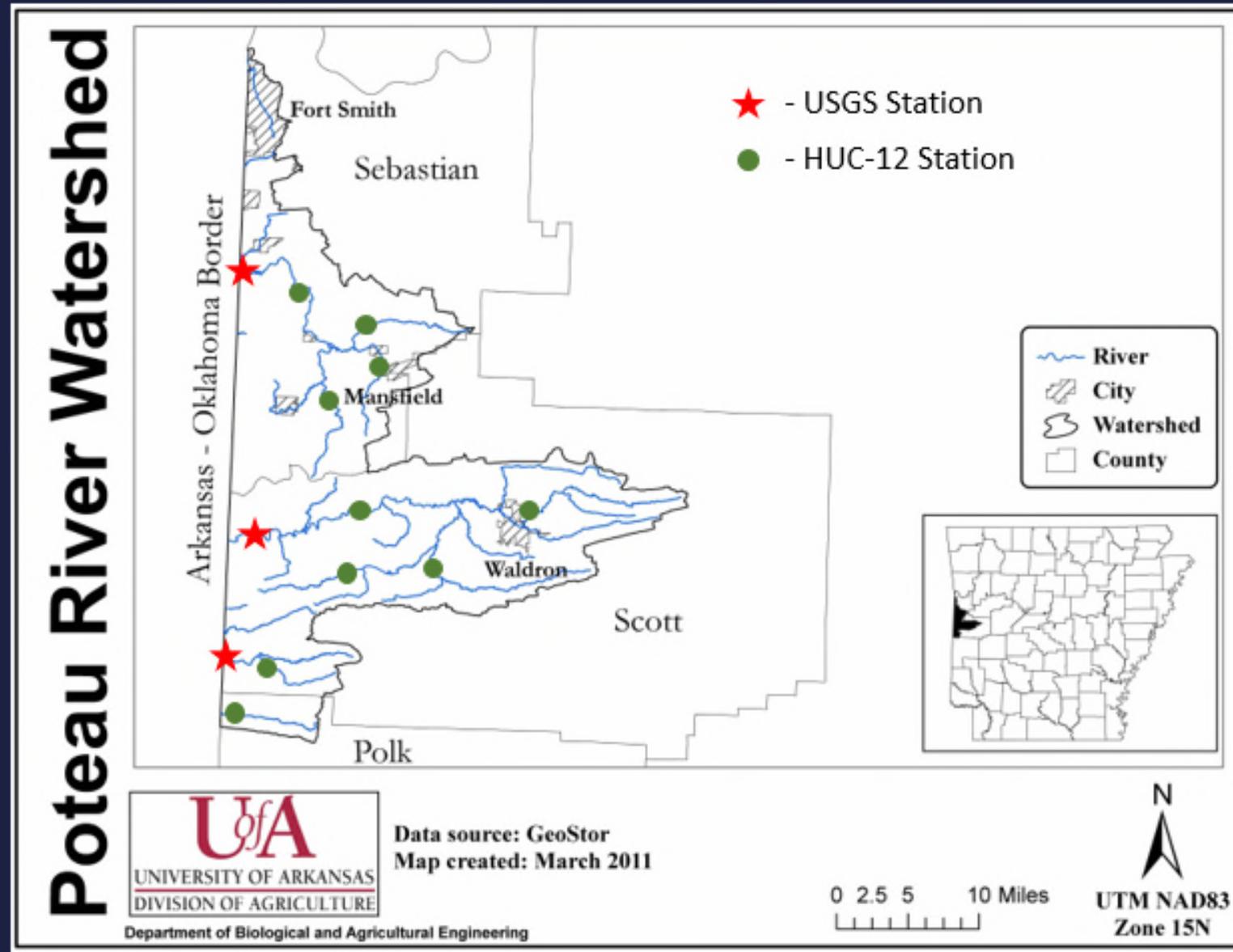


Rating Curve with Water Quality Sample Points



Total Suspended Solids versus Flow

Data at Small-Scale Watersheds



How much \$\$?

For data collection across 10 sites over 3 years:

	<u>Total Cost</u>
• USGS monitoring station	
- Purchase and installation	~\$250,000
- Operation and maintenance costs	~\$450,000
	~\$700,000
• SonTek monitoring station	
- Purchase and installation	~\$40,000
* SonTek acoustic Doppler current meters (3)	~\$27,000
* Base level HOBO water level loggers	~\$6,000
* Base level HOBO barometric pressure transducer	~\$3,000
* Equipment for SonTek stations and installing HOBOS	~\$3,000
- Operation and maintenance costs	~\$110,000
	~\$150,000

******Multiple small scale watersheds can be monitored using one SonTek. Additional sites would only require both HOBOS and equipment for Hobo and SonTek installation (~\$1,200 per site).**

Future Research

- Continue data collection and rating curve development across UPRW
- Calibrate and validate the Soil Water Assessment Tool (SWAT)
- Validate a SWAT model calibrated at the HUC-8/10 level with HUC-12 or smaller watershed data
- Prioritize subwatersheds for implementation of BMPs



Questions?

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