The Quarry Island Cove Nutrient Inactivation Project

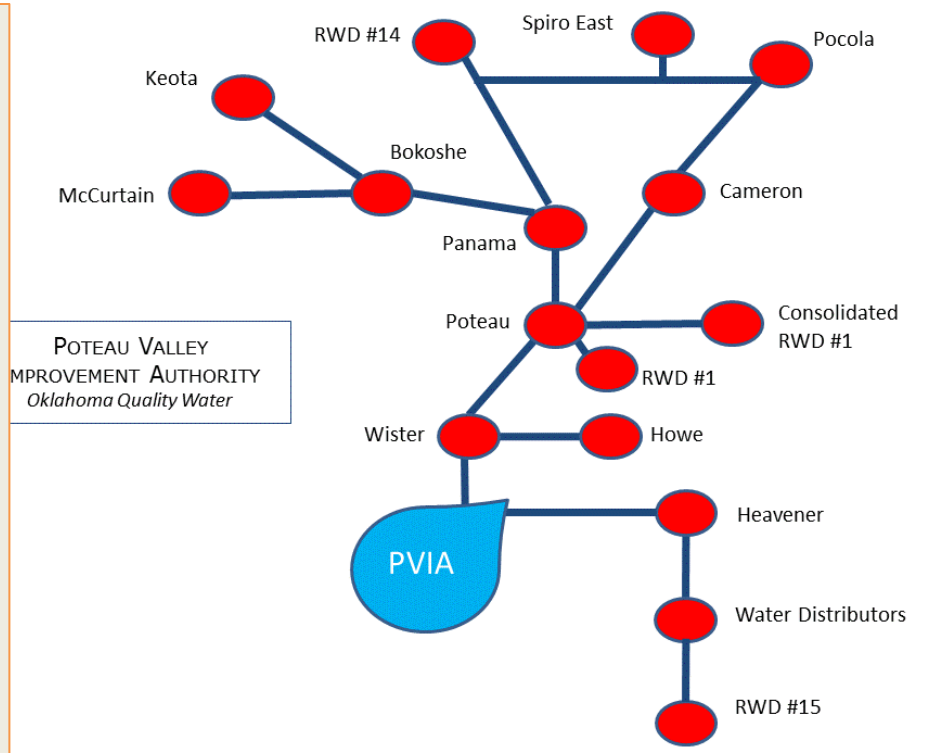
Steve Patterson

Bio x Design

OCLWA 2015, Stillwater, OK, April 8-9, 2015

Acknowledgements:

- Poteau Valley Improvement Authority
- HAB Aquatic Solutions
- US Army Corps of Engineers, Tulsa District
- Oklahoma State Parks
- Oklahoma Department of Wildlife Conservation
- Oklahoma Department of Environmental Quality



'Do not drink' water advisory across Toledo area

Scenes like this were common this morning as area residents traveled all over in search of bottled water.
THE BLADE/ JETTA FRASER Enlarge | Buy This Photo

Published: Saturday, 8/2/2014 - Updated: 5 months ago

Toledo-area water advisory expected to continue through Sunday as leaders await tests; water stations to remain open

Microcystin found in samples; boiling not recommended

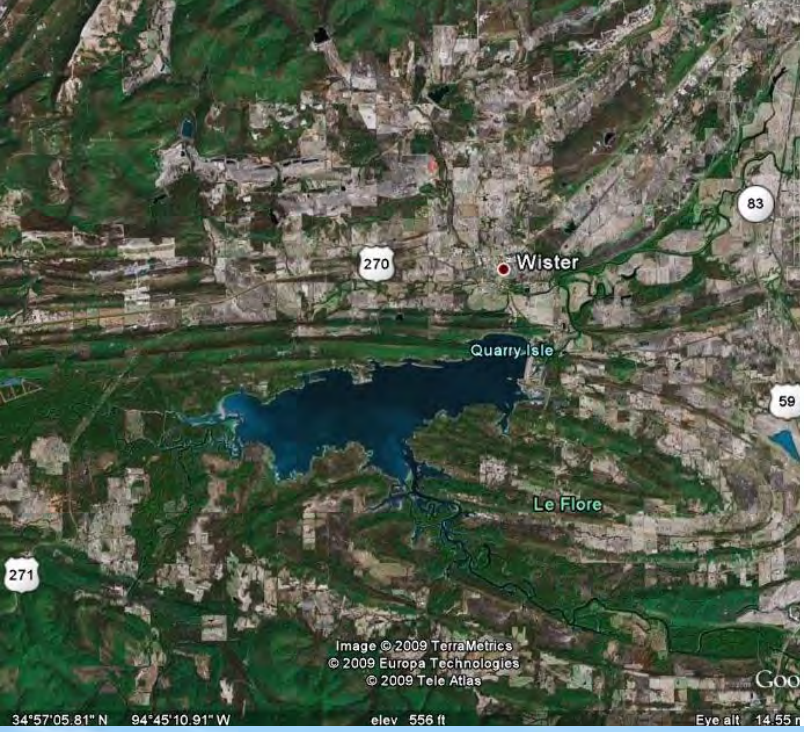
Lake Erie August 2014

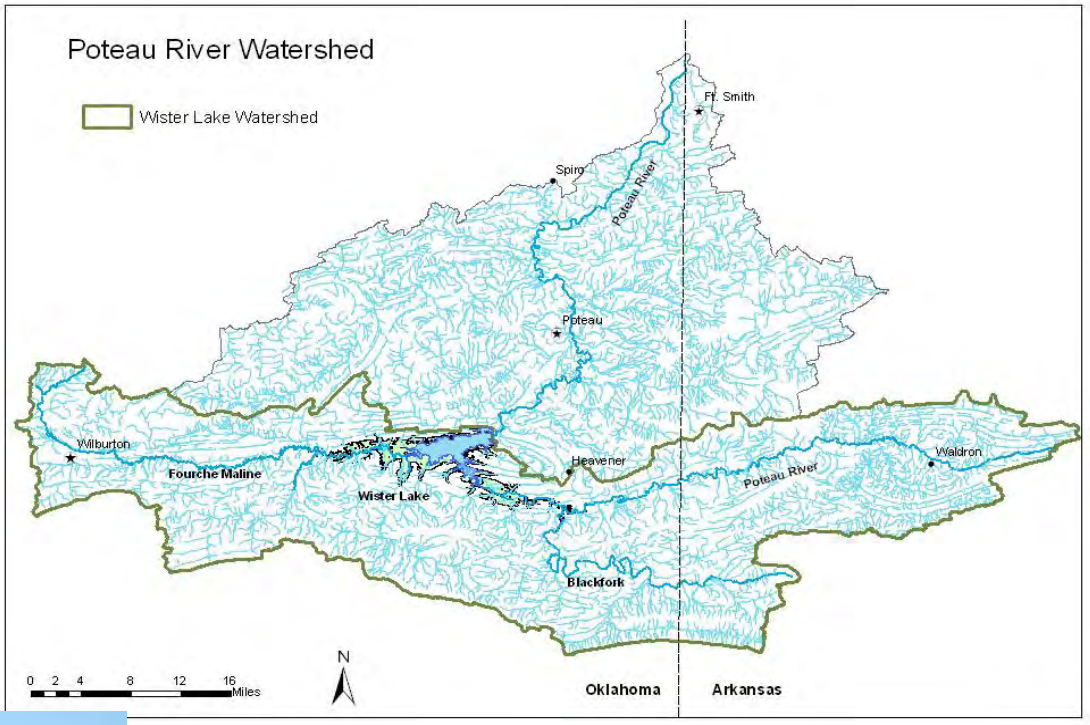
Lake Wister Cyanobacteria

	1/14/2014	3/10/2014	4/15/2014	5/19/2014	6/16/2014	7/7/2014	7/30/2014	8/6/2014
Taxa	(cells/ml)	(cells/ml)	(cells/ml)	(cells/ml)	(cells/ml)	(cells/ml)	(cells/ml)	(cells/ml)
Total (cells/ml)	73,680	6,200	516,510	321,172.9	381,082.0	96,673.3	385,758.0	62,890.3
Microcystin (µg/l)	<0.15*	<0.15*	<0.15*	<0.15*	<0.15*	<0.15*	0.249	Not Detected

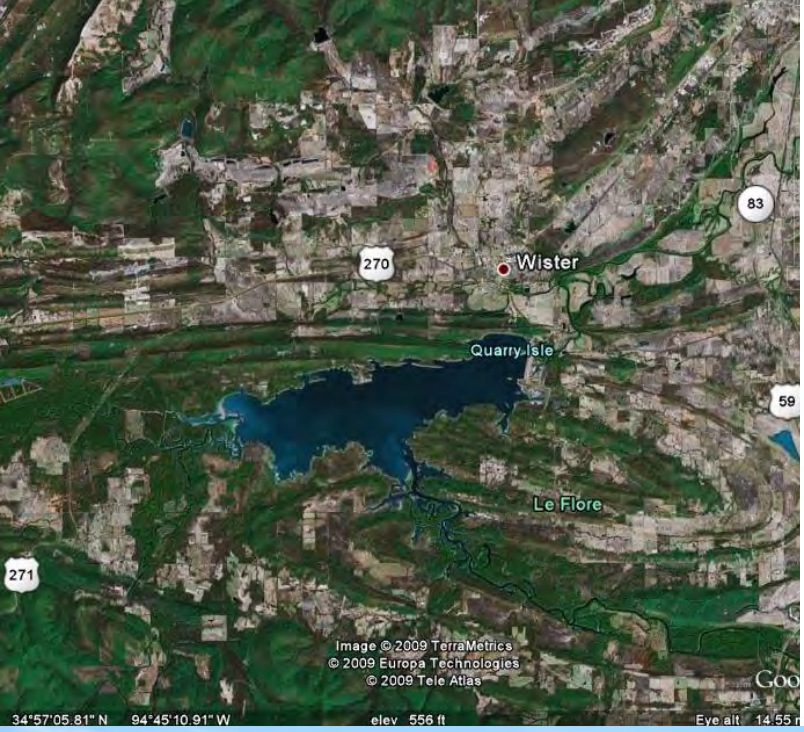
State of Oklahoma threshold for issuing advisories:
> 100,000 cell/ml
and
> 20 µg/l microcystin

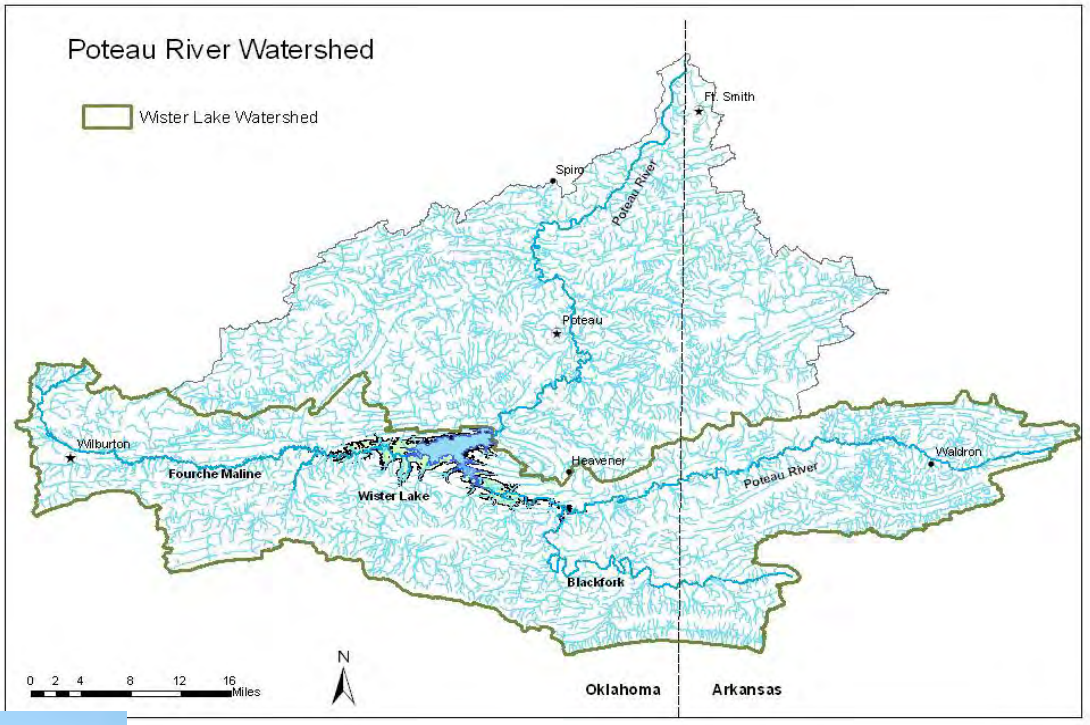
	WHO Guidance	
Relative Probability of Acute Health Effects	**Cyanobacteria (cells/mL)**	**Microcystin-LR (µg/L)**
Low	<20,000	<10
Moderate	20,000-100,000	10-20
High	**100,000-10,000,000**	**20-2,000**
Very High	>10,000,000	>2,000





Beneficial Use	Status	Cause
Public and Private Water Supply	**Not Supporting**	Chlorophyll-a
Warm Water Aquatic Community (Fish & Wildlife Propagation)	**Not Supporting**	Turbidity pH
Aesthetic	**Not Supporting**	Total Phosphorus Color
Fish Consumption	**Not Supporting**	Mercury
Agriculture	**Supporting**	





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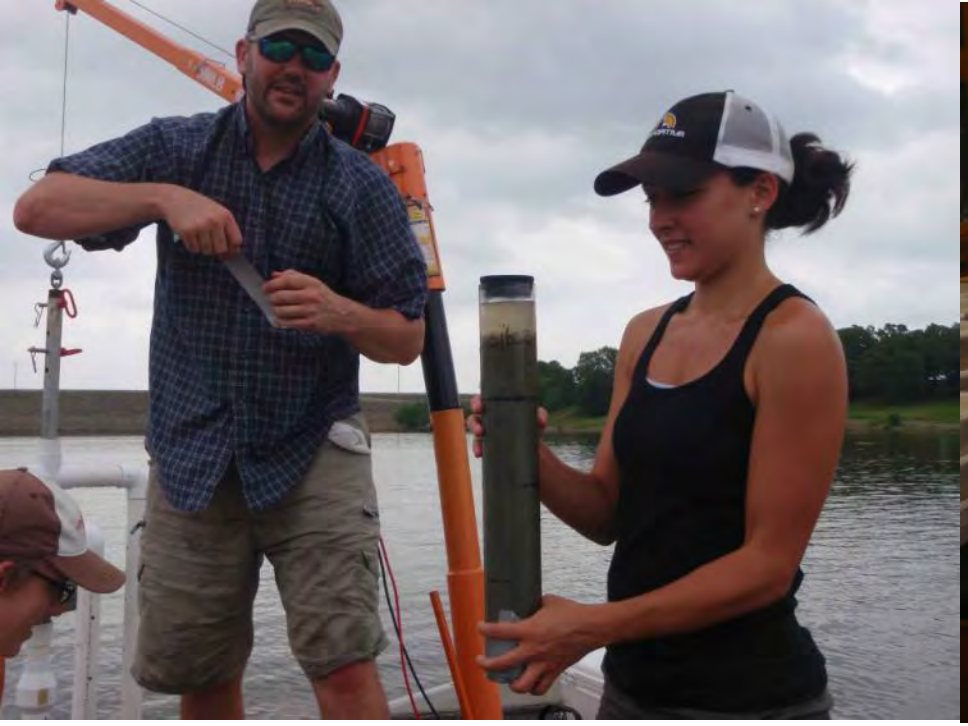
Disinfection by-products



Internal loading:

3.3 mg/m2/day – anoxic conditions
~ 1 mg/m2/day - oxic

Haggard, Scott, & Patterson. 2012.
Lake & Reservoir Management.

Why alum?

- Aluminum phosphate bond permanent under normal conditions
  - Unlike iron-bound P
- Decades of P loading to lake sediments
- Alum used safely every day in water treatment around the world

- Will also clear the water column—remove cyanobacteria, algae, and sediment

- Other flocculants possible: polymers, clays, engineered clays (Phosloc TM)

Short-term objectives

- Clear the water column—remove cyanobacteria, algae, and sediment
- Remove phosphorus from the water column
  - By reducing algal and phosphorus concentrations in the water column, reduce DBP precursors and ultimately reduce DBPs downstream in treated water

Long-term objectives

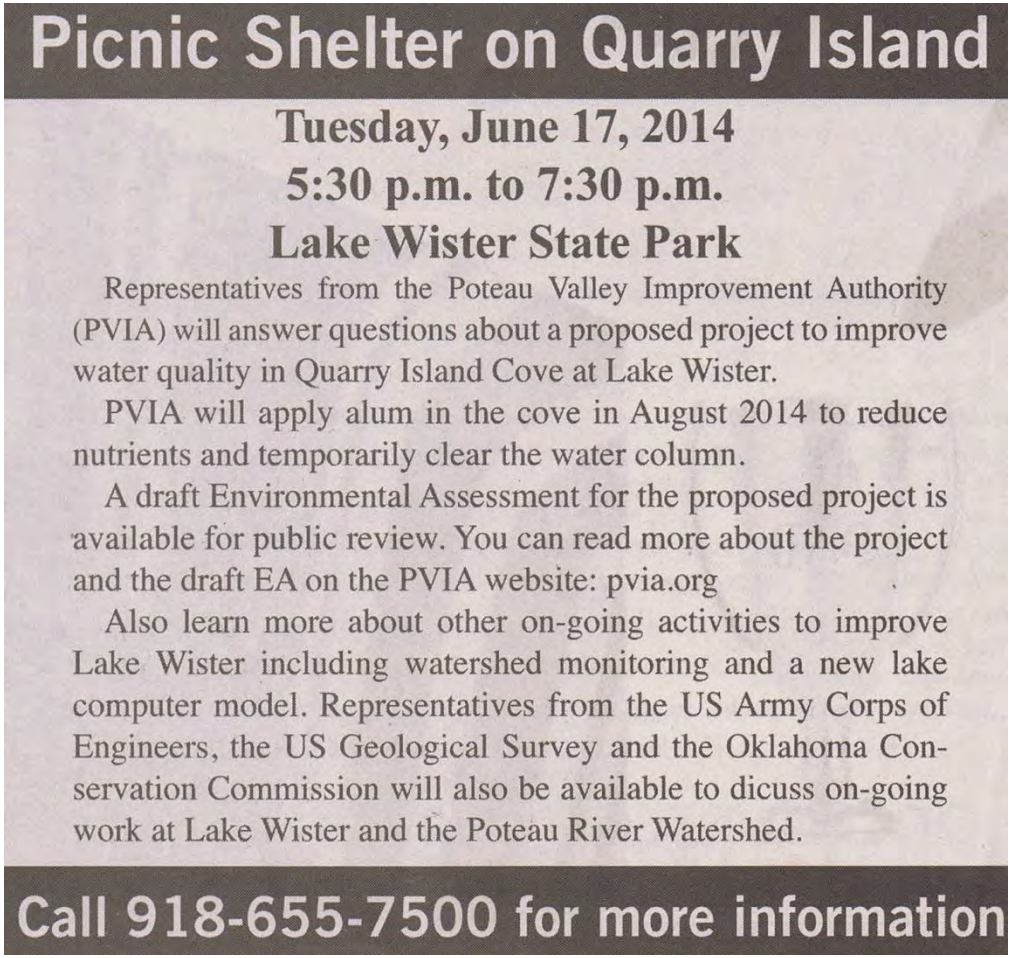
- Reduce internal loading (reduce phosphorus flux from lake sediments to the water column)
- Demonstrate that alum can be applied safely in the lake



- Extensive inter-agency and environmental review

- Initial meeting with USACE
- State-wide interagency meeting
- EA Pre-coordination
- EA Public Notice
- Public Meeting

- Primary safety concerns—pH and alkalinity
- Addressed by adding buffer—sodium aluminate



Picnic Shelter on Quarry Island

Tuesday, June 17, 2014
5:30 p.m. to 7:30 p.m.
Lake Wister State Park

Representatives from the Poteau Valley Improvement Authority (PVIA) will answer questions about a proposed project to improve water quality in Quarry Island Cove at Lake Wister.

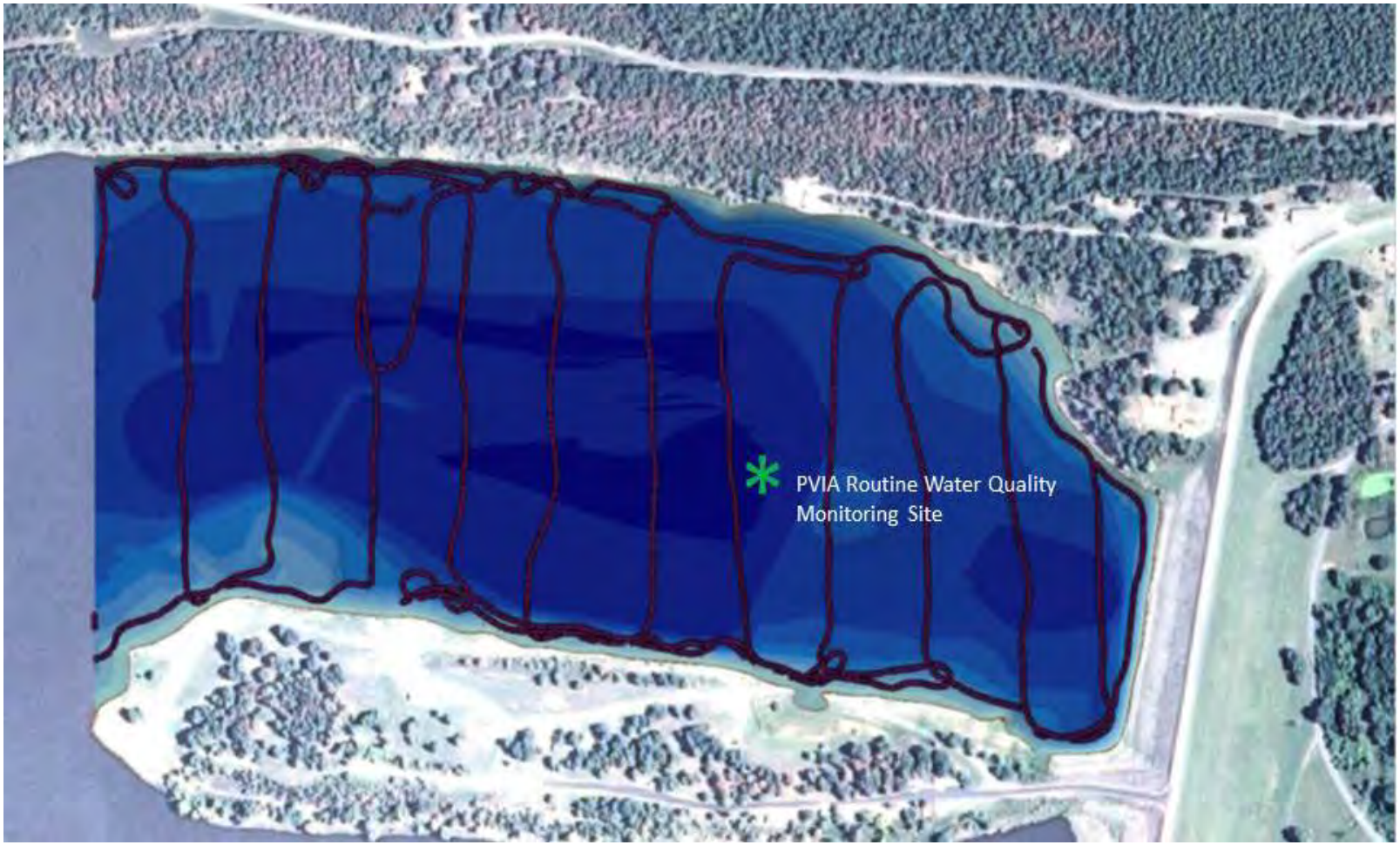
PVIA will apply alum in the cove in August 2014 to reduce nutrients and temporarily clear the water column.

A draft Environmental Assessment for the proposed project is available for public review. You can read more about the project and the draft EA on the PVIA website: pvia.org

Also learn more about other on-going activities to improve Lake Wister including watershed monitoring and a new lake computer model. Representatives from the US Army Corps of Engineers, the US Geological Survey and the Oklahoma Conservation Commission will also be available to dicuss on-going work at Lake Wister and the Poteau River Watershed.

Call 918-655-7500 for more information

Quarry Island Cove Treatment Area




HAB

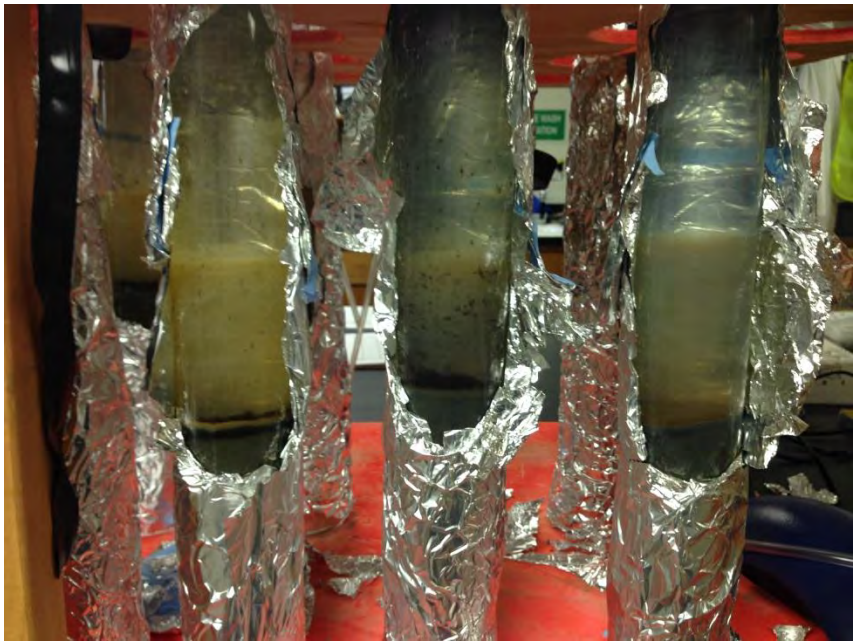
Short-term results

- Water column transparency increased only slightly (ca. 15cm secchi; 5 NTU turbidity)
- Cyanobacteria (blue-green algae) concentrations reduced over 80% (from 385,000 cells/ml to 63,000)
- PVIA THM's ranged from 36 to 84.5 (80 is limit) (Aug. 20 sample date)

Long-term results

- Sediment cores: diffusive flux
  - Pre-alum 3 mg/m2/day P
  - post-alum 0.5 to 0.8 mg/m2/day
  - under anoxic conditions

Wister sediment cores in the University of Arkansas lab



- Acknowledgements: Dr. Brian Haggard, Brina Smith—Univ. of Arkansas

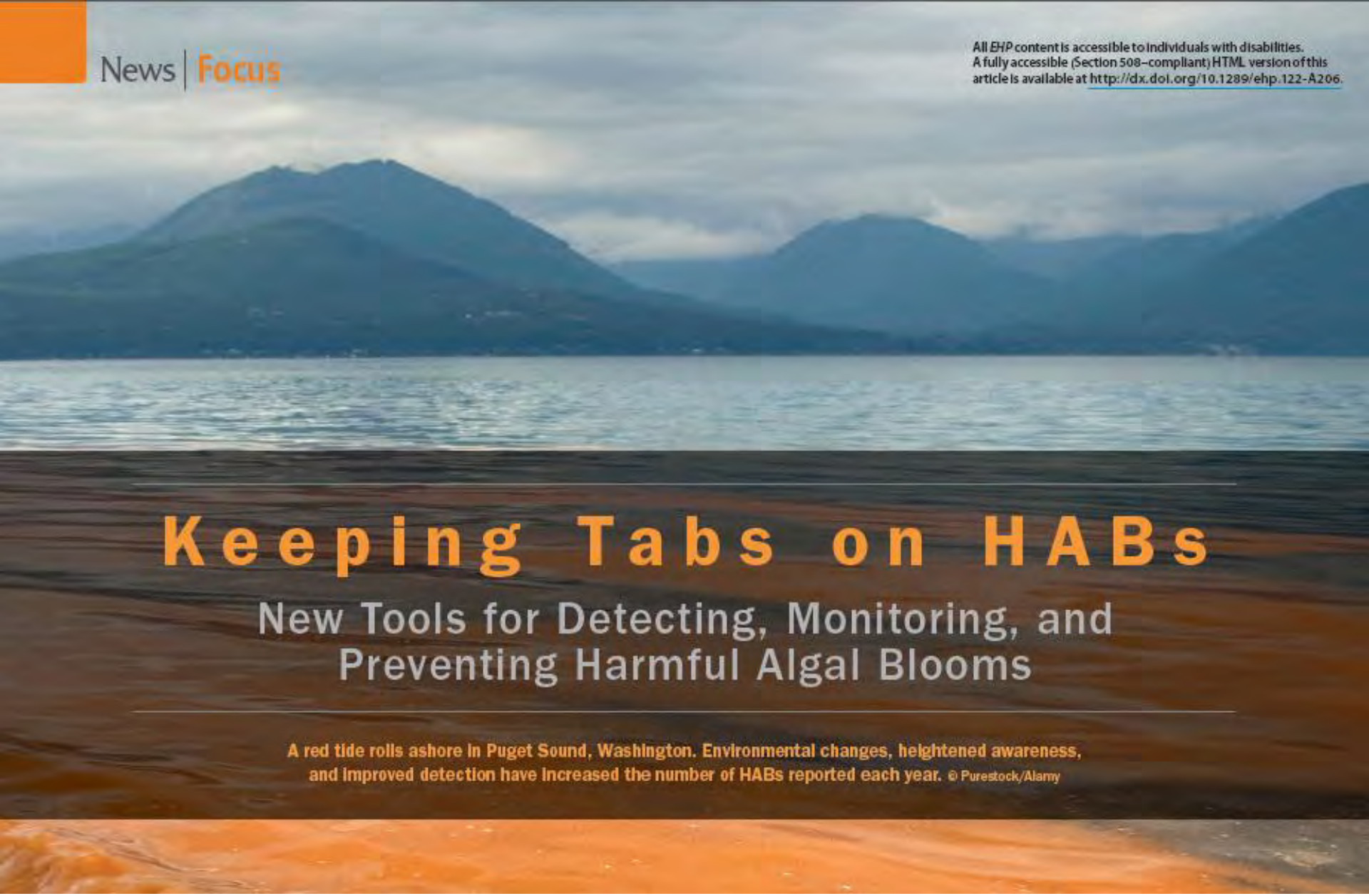
- Sediment cores: Mobile P

	Before alum	After alum
Total mobile P per m2 in 10 cm (mg)	1,560	766
Total Al-P per m2 in 10 cm (mg)	10,631	12,045

- Acknowledgements: Dr. Thad Scott, Erin Grantz—Univ. of Arkansas

Next?

- Do it again
- EA allows repeat applications over 5 years
- Regionally-- potential for HAB amelioration in coves



Keeping Tabs on HABs

New Tools for Detecting, Monitoring, and Preventing Harmful Algal Blooms

A red tide rolls ashore in Puget Sound, Washington. Environmental changes, heightened awareness, and improved detection have increased the number of HABs reported each year. © Purestock/Alamy

Environmental Health Perspectives 122(8), August 2014

Questions?

GPS application track in the cove