

# Multi-Instrument Stream Surveys with Continuous Data for Better Groundwater/Surface Water Understanding in Wisconsin

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Dave Hart (WGNHS), Mike Cardiff (UW-  
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AWRA Conference, March 2018

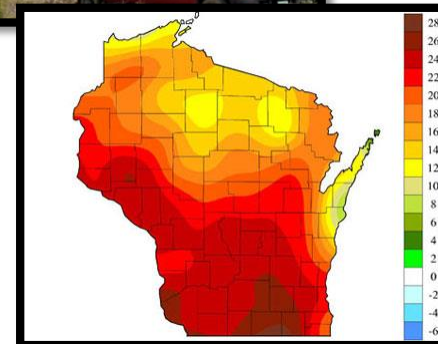
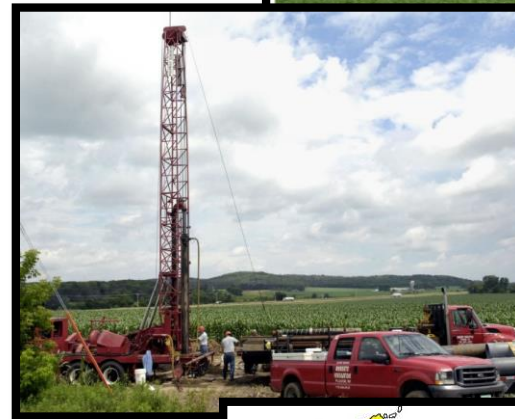


# Acknowledgments



# Presentation Outline

- **Project Motivations and Objectives**
- Study Area and Field Plan
- Data Collection Methods
- Preliminary Results, Waubesa Wetlands
- Future Work/Conclusions



**Projected Change in  
the Frequency of  
90°F Days Per Year  
from 1980 to 2055**

# Project Motivations

- Models are of increasing demand for natural resource decision makers
- Data must support these models and is often expensive and time and labor intensive

## Legislators turn attention to dried-up lakes, rivers

By RON SEELY [rseely@madison.com](mailto:rseely@madison.com) 608-252-6131 Sep 26, 2009



## Farms' Thirst for Water Roils Wisconsin's Central Sands

Big farms' thirst for water is causing conflict in Wisconsin, where land owners and environmentalists worry that high-capacity wells are depleting lakes and streams and hurting water quality.

April 29, 2017, at 9:33 a.m.

f t i n u g



In this April 21, 2017 photo, Cris Van Houten explains how the shoreline of Huron Lake, has receded over the years in Oasis, Wisc. Van Houten and other central Wisconsin lake property owners insist a proliferation of high-capacity wells are draining the region's lakes. (AP Photo/Todd Richmond) The Associated Press

AP

By TODD RICHMOND, Associated Press

### ENVIRONMENT

## The vanishing lakes of Wisconsin's central sands

Many locals blame high capacity wells. In 1950 there were fewer than 100 in the region; today there are more than 3,000

November 12, 2015 5:04AM ET

by Ryan Schuessler · [@RyanSchuessler1](#)

**Editor's note:** This is part two of a three-part series examining industry's effects on Wisconsin's water resources. *Part one* looks at the politicization of the Department of Natural Resources. *Part three* explores agriculture's effect on Kewaunee County's drinking water.

WAUSAHA COUNTY, Wis. — For the Trudell family, Lake Huron in north-central Wisconsin is a little slice of paradise.

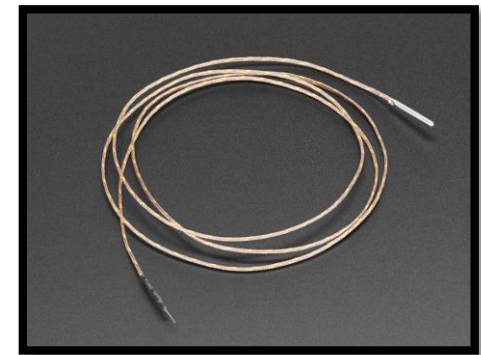
But the Trudells can hardly recognize the lake they have spent summers on since 1988. It has lost about 11 feet of water since 2000, said Dan Trudell, and water levels are continuing to drop. It's a fate Huron shares with other lakes and streams in Wisconsin's Central Sands region — a six-county area north of Madison. Some residents and researchers are pointing to the proliferation of high capacity wells — largely used to irrigate crops in the area — as the cause.

Among the waterways that are threatened is the Little Plover River, a renowned trout stream that was listed as one of America's most endangered rivers in 2013. The nonprofit organization American Rivers, which identifies the most endangered rivers in the United States each year, cited groundwater extraction as a contributing factor in the Little Plover's decline.

In Wisconsin a well is considered high capacity if it can pump at least 70 gallons of water per minute — about 100,000 gallons a day. In 1950 there were fewer than 100 high capacity wells in the Central Sands. Today there are more than 3,000, or nearly half of all those in the state. Within 5 miles of Lake Huron alone, there are 200, according to Trudell. There are 940 high capacity wells in Wausau County, which encompasses Lake Huron, according to the state's

# Project Objectives

1. Develop methodology for rapid and accurate data collection on streams
  - Data processing and quality assurance
2. Better represent groundwater/surface water interaction through groundwater model improvement



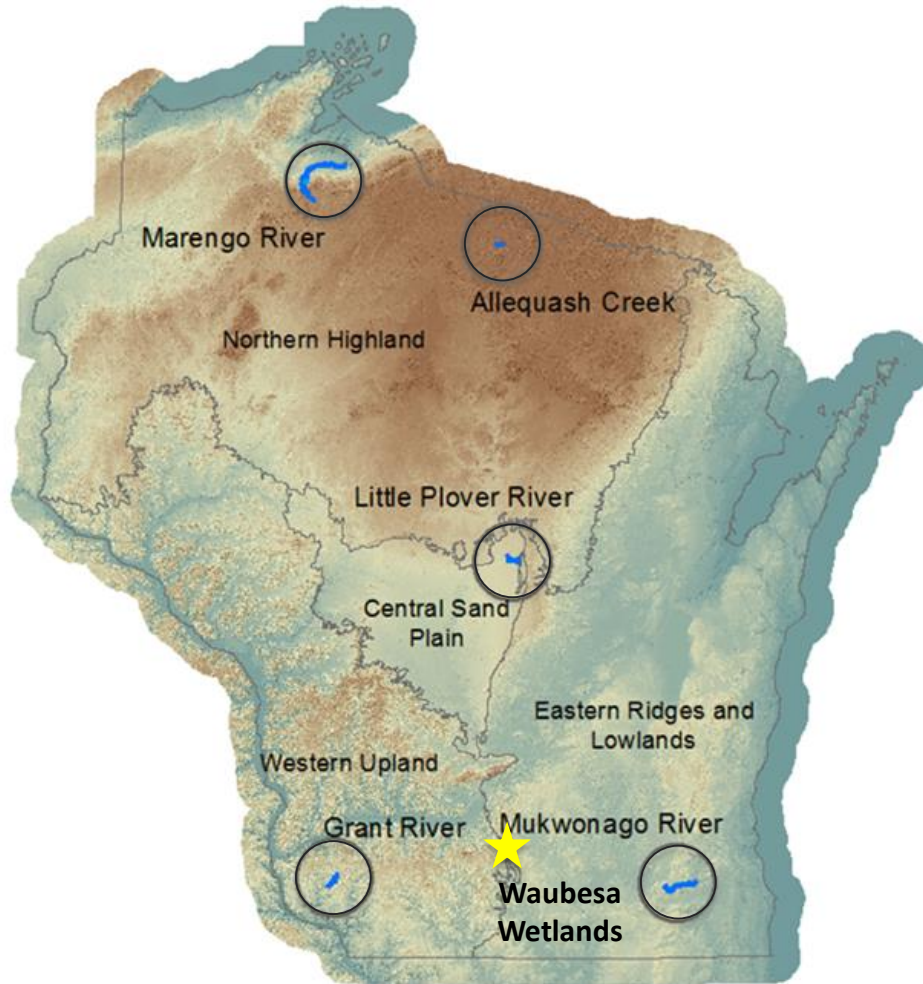
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# Study Areas & Field Plan



- Study areas represent different physiographic regions of WI
- Low order streams selected
- Data will be collected at spring and late summer flow conditions

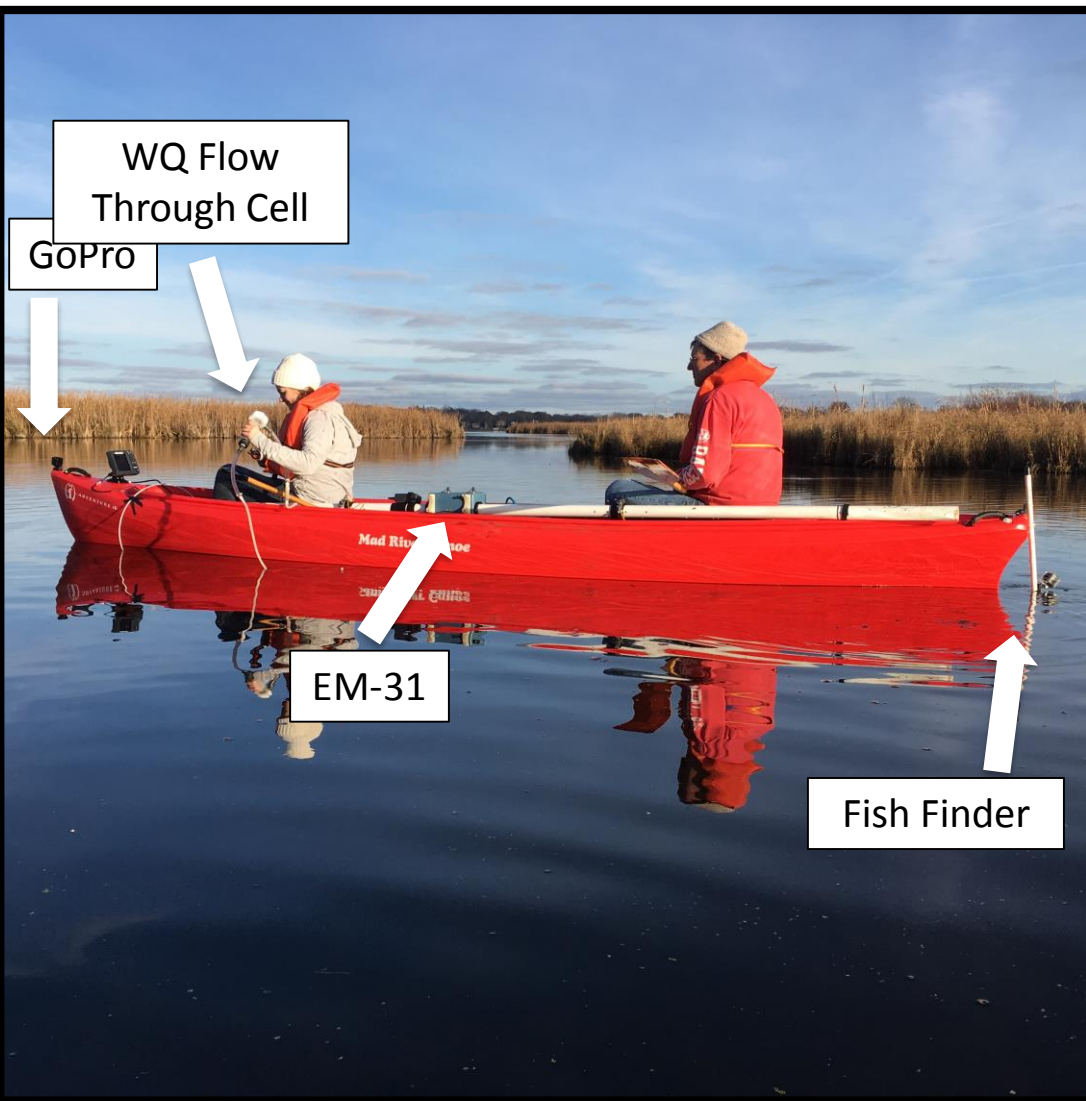
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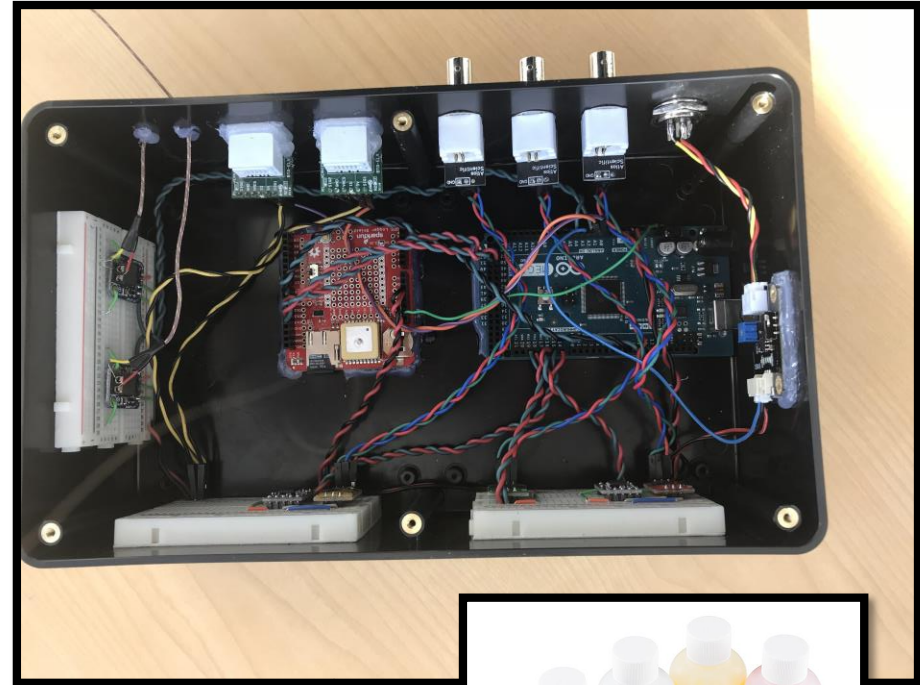
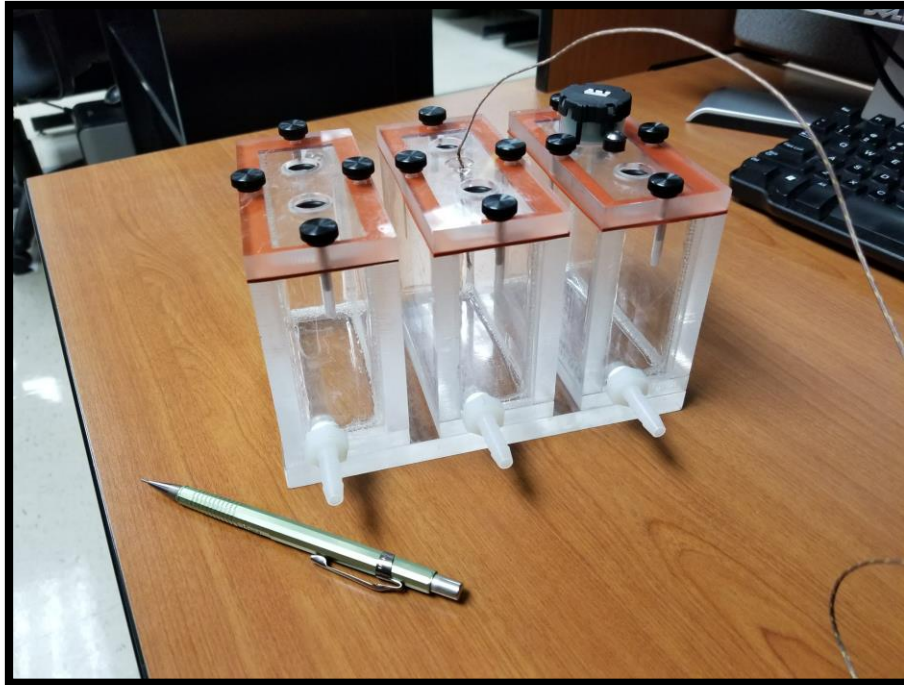


# Data Collection Methodology



- Geophysical (ground conductivity, ground penetrating radar, depth)
- Water Quality (temperature, pH, specific conductance, nitrate, chloride, turbidity, dissolved oxygen)
- Ecological (video)
- Location and Elevation (Real Time Kinetic GPS)

# Water Quality Data Collection

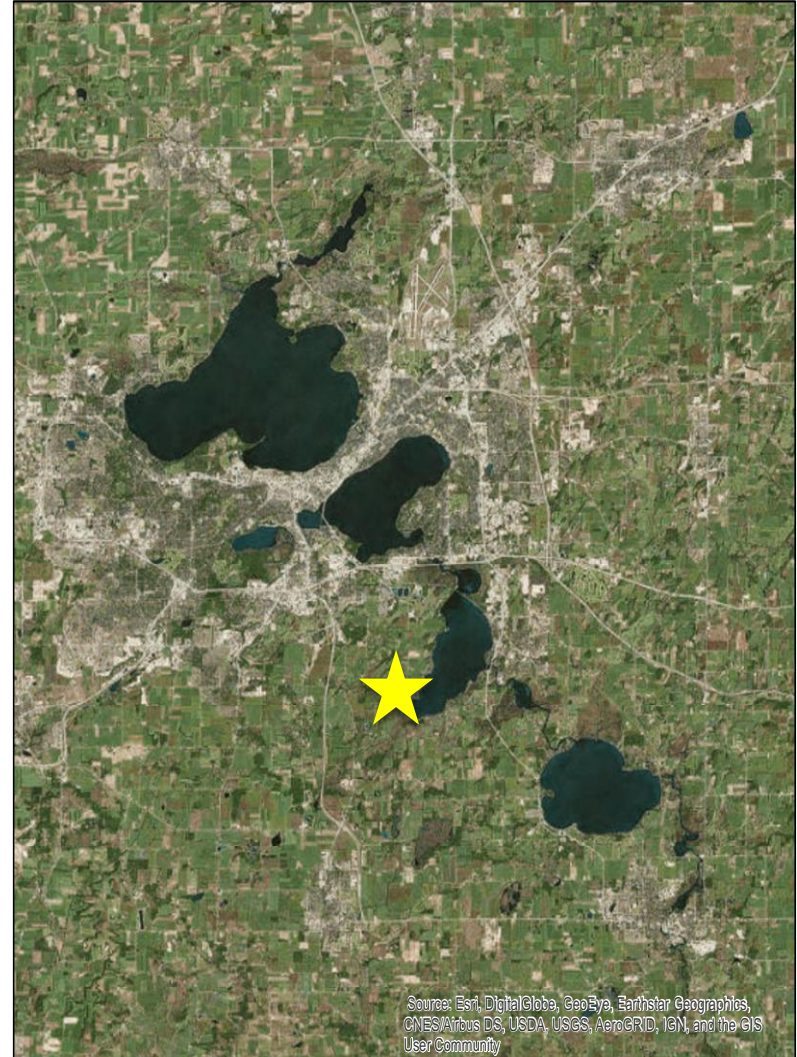


Susie Richmond and Prof. Dante Fratta, UW-Madison



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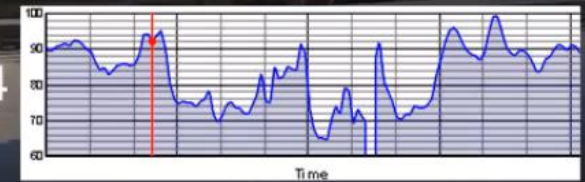
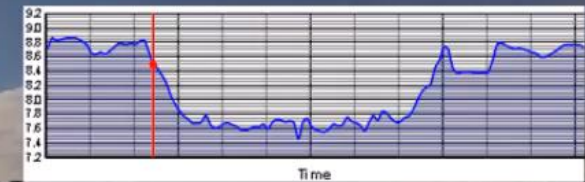
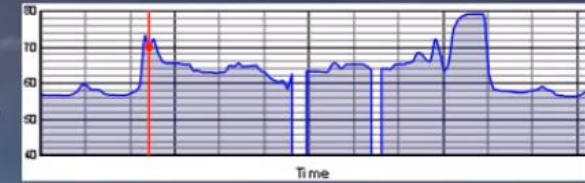
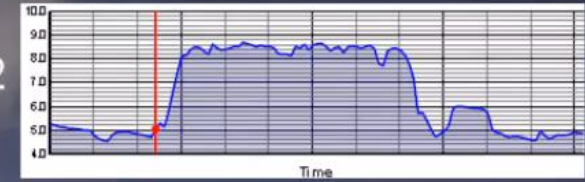


Temp [C] 5.02

Spec. Cond [mS/m]  
69.87

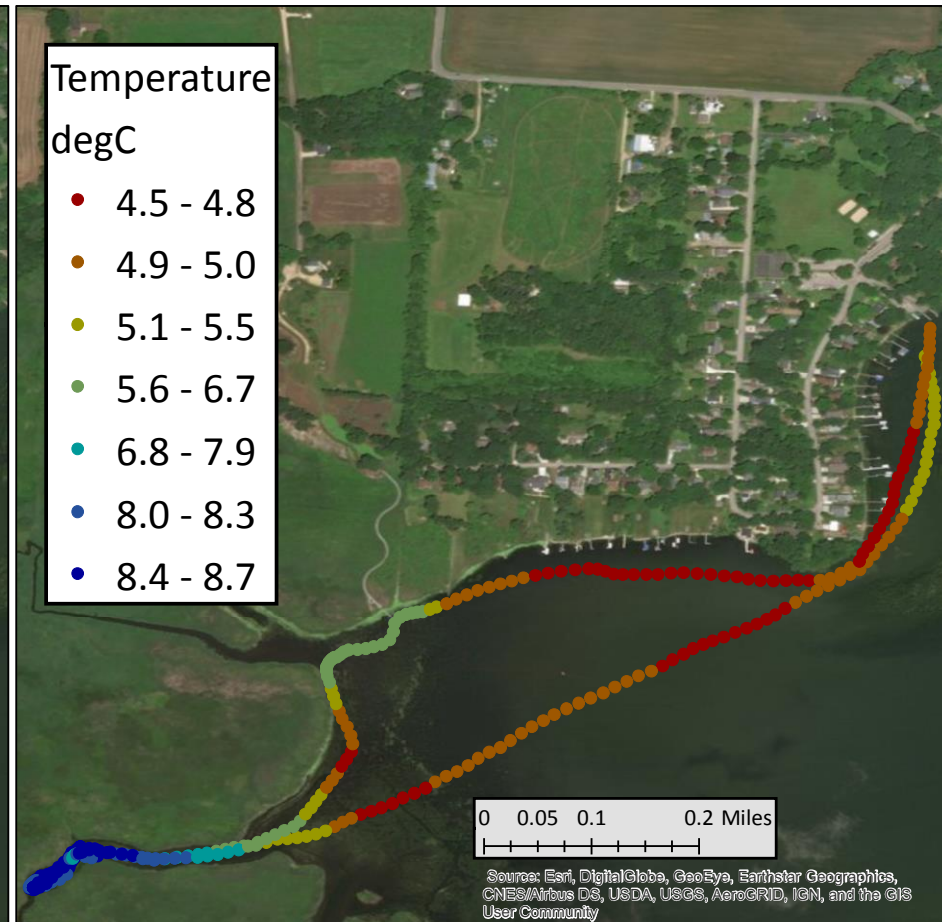
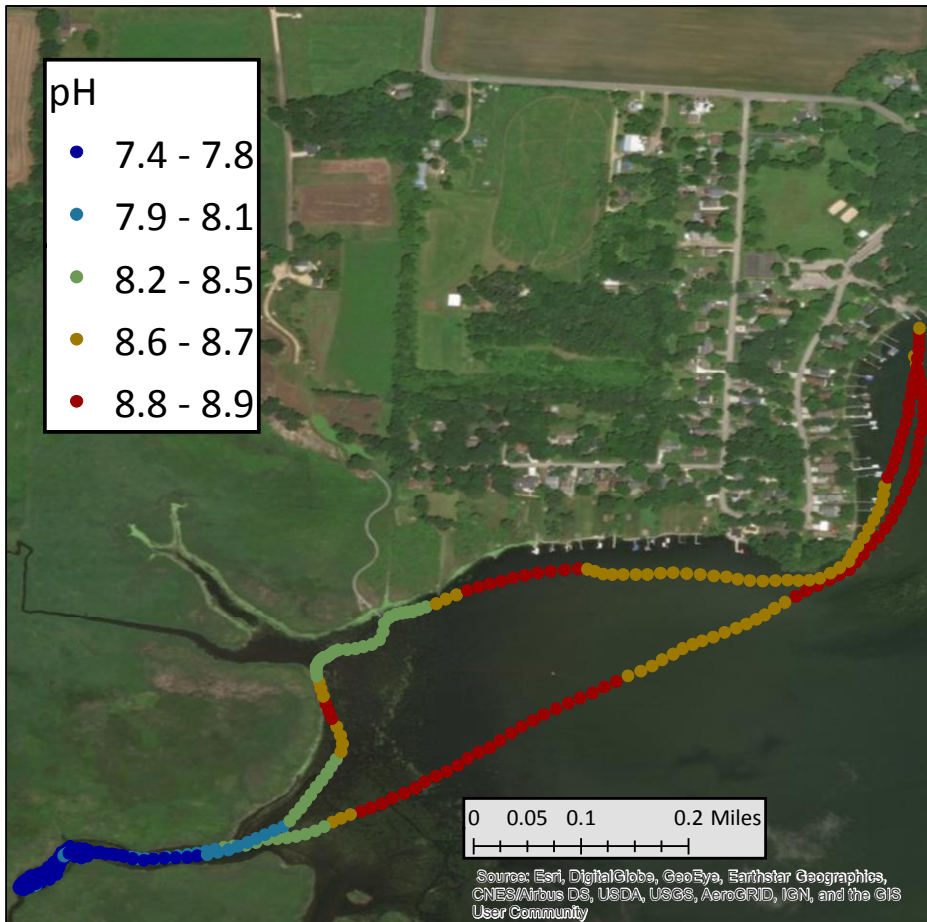
pH 8.48

DO [% sat.] 92.04

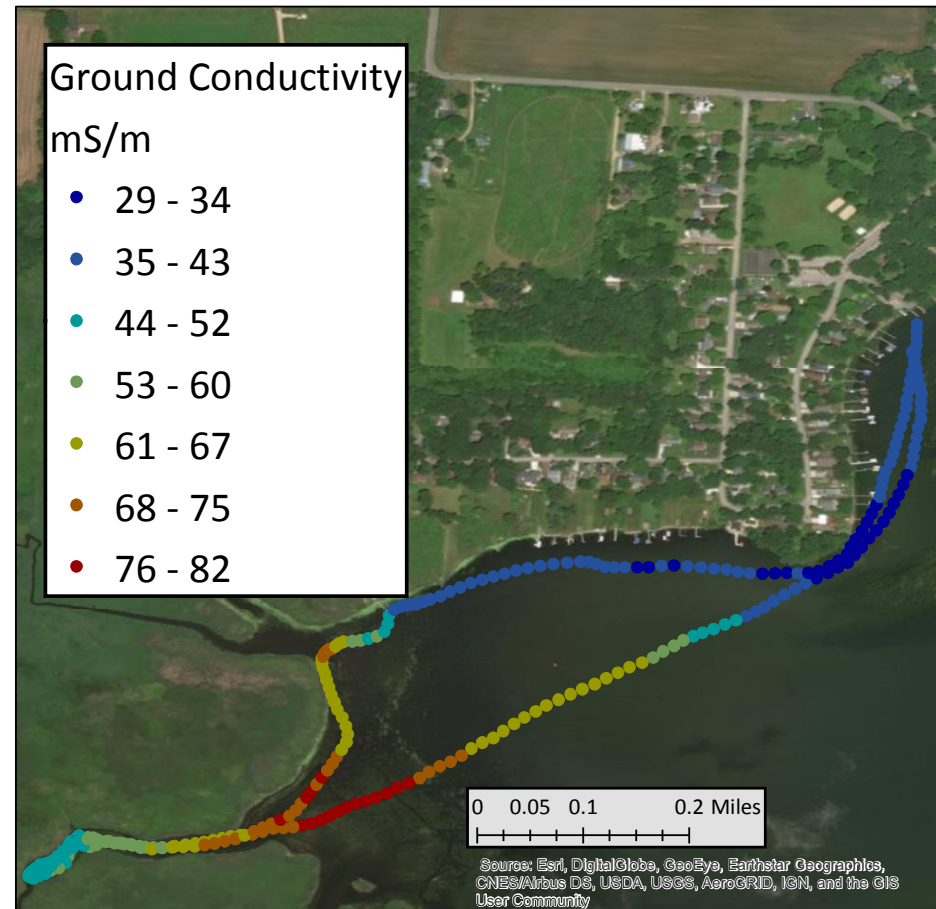
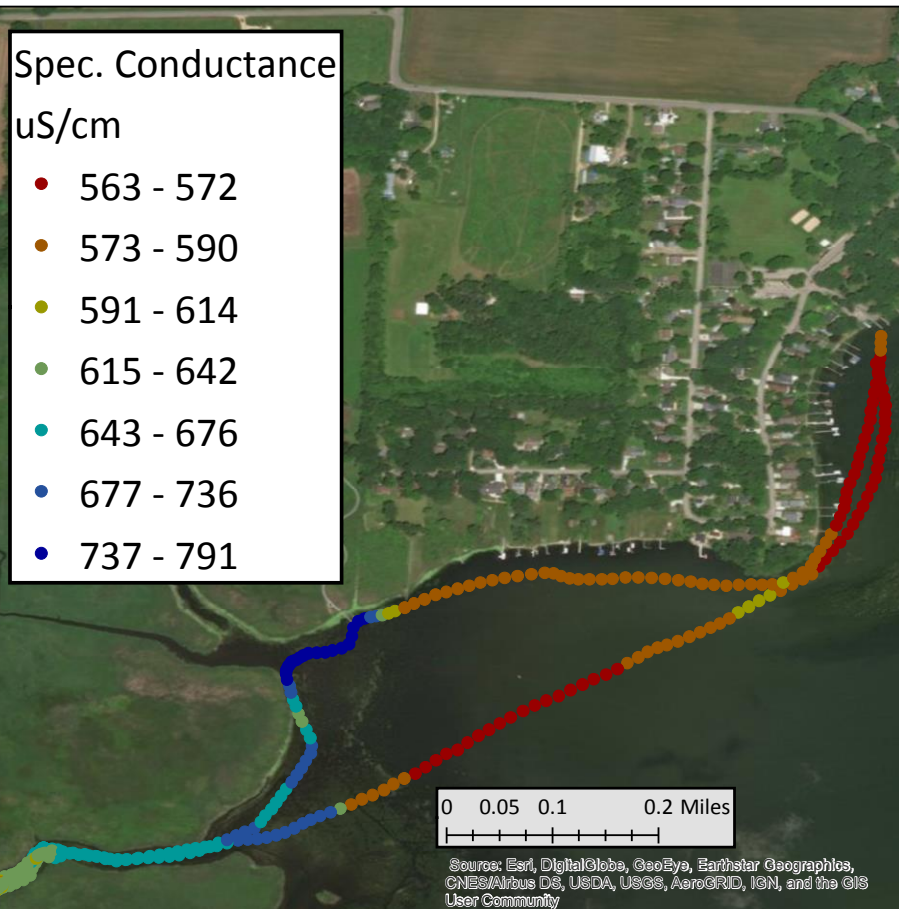


Depth [ft] 3.65

# Mapped Data, Waubesa Wetlands, Nov. 2017

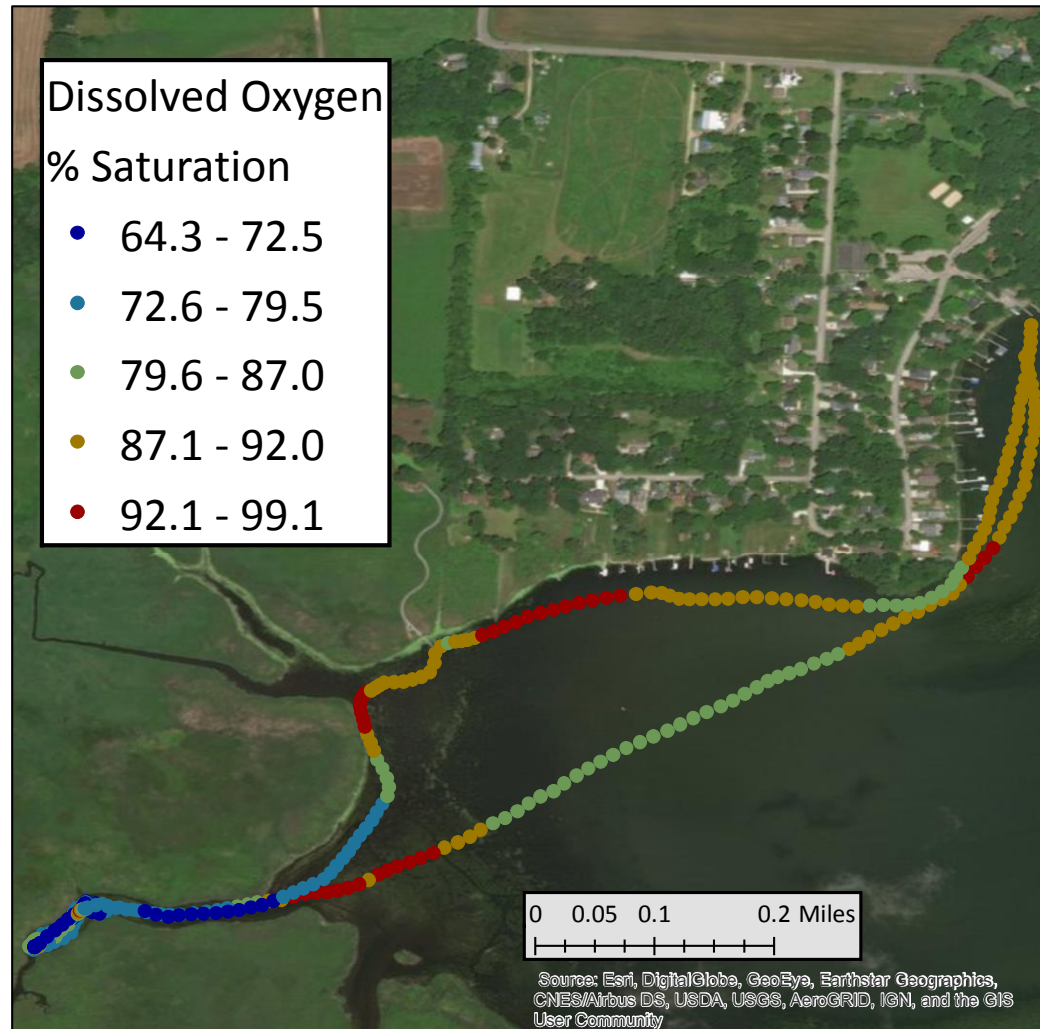


# Mapped Data, Waubesa Wetlands, Nov. 2017



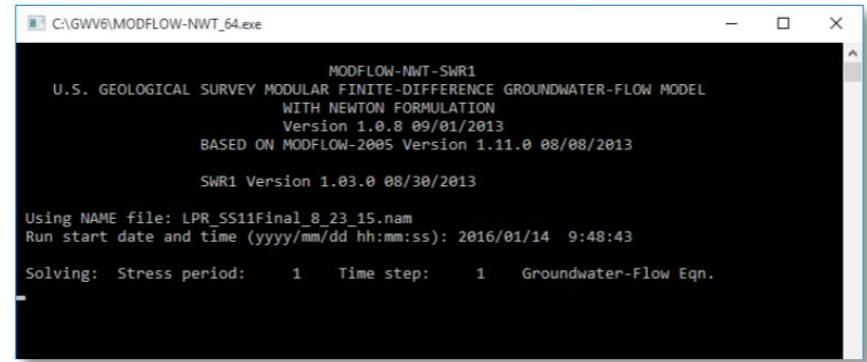


# Mapped Data, Waubesa Wetlands, Nov. 2017



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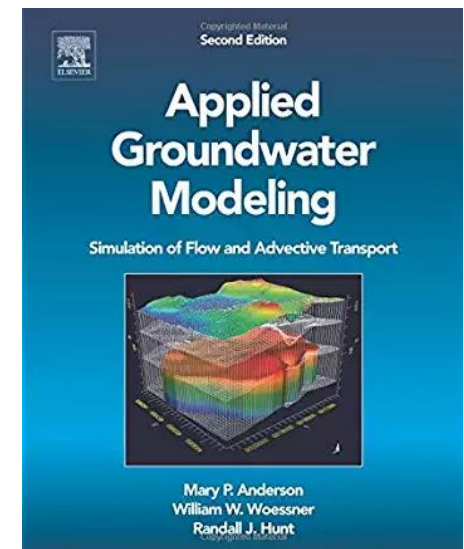
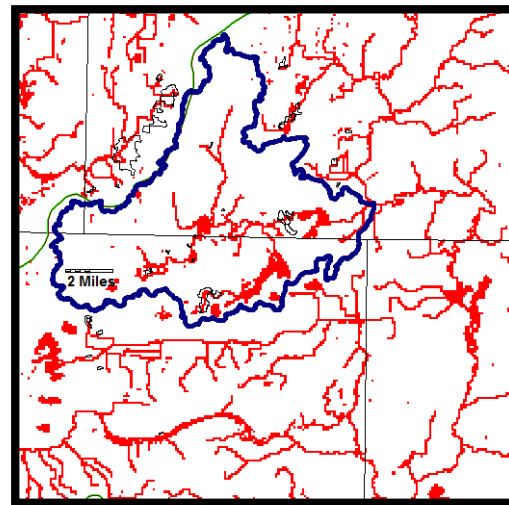
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C:\GWV6\MODFLOW-NWT_64.exe

MODFLOW-NWT-SWR1
U.S. GEOLOGICAL SURVEY MODULAR FINITE-DIFFERENCE GROUNDWATER-FLOW MODEL
WITH NEWTON FORMULATION
Version 1.0.8 09/01/2013
BASED ON MODFLOW-2005 Version 1.11.0 08/08/2013

SWR1 Version 1.03.0 08/30/2013

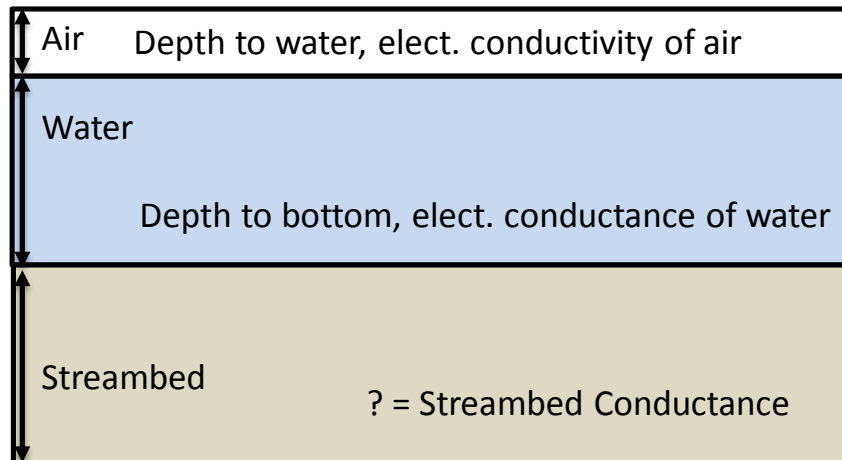
Using NAME file: LPR_SS11Final_8_23_15.nam
Run start date and time (yyyy/mm/dd hh:mm:ss): 2016/01/14 9:48:43

Solving: Stress period: 1 Time step: 1 Groundwater-Flow Eqn.
```

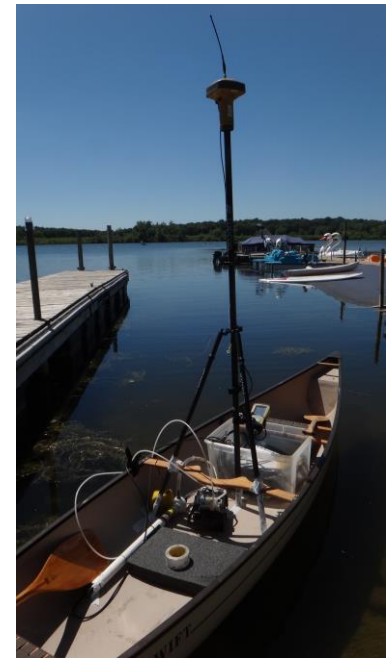


# Data Applications: Qualitative Methods

- Incorporate data directly into groundwater models
  - Streambed conductance from 3-layer system (McNeill, 1980)

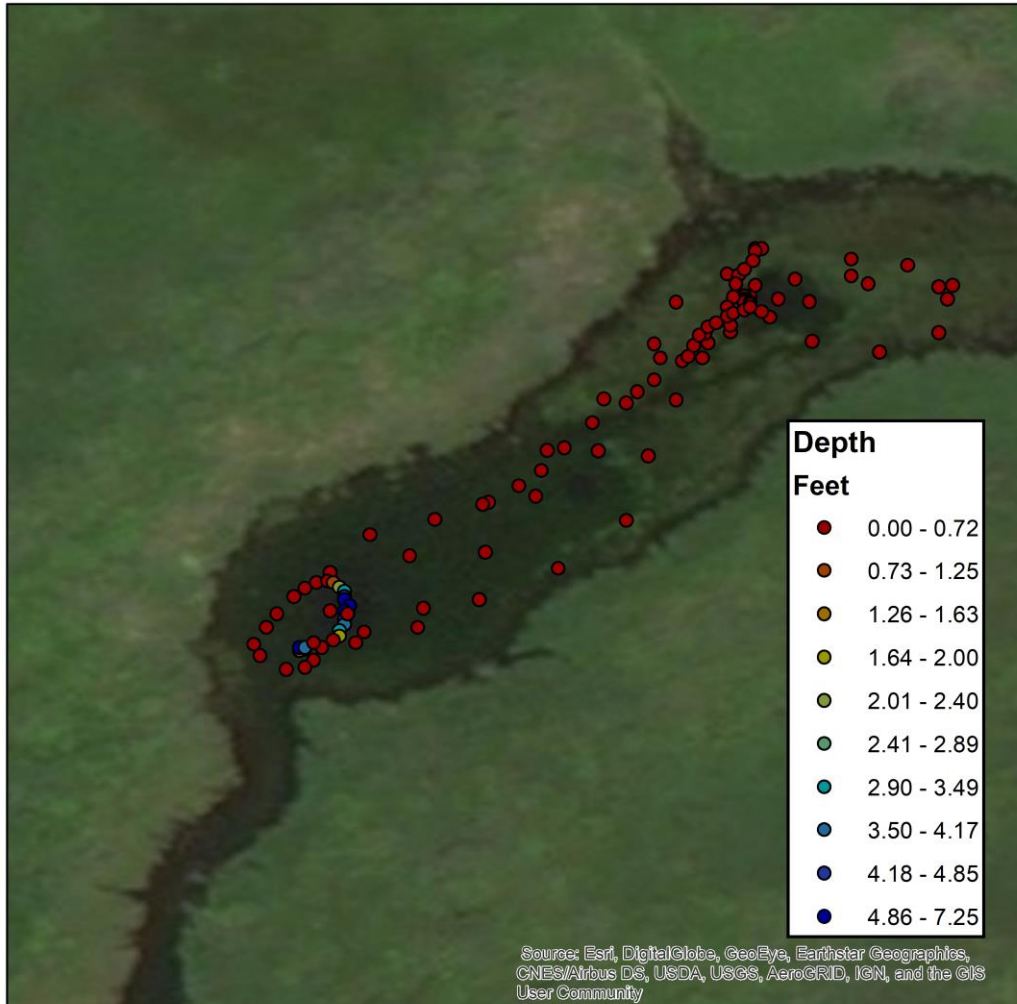


- Stream location and elevation from RTK GPS





# Data Application: Quantitative Methods



- Model Validation
  - Locations of groundwater recharge and discharge
- Overall improved understanding of anthropogenic influence

Questions?

