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Lake Ogletree Watershed Monitoring Program:
A Data-driven Approach to Reservoir and Watershed Management

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Alabama Water Resources Conference
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Lake Ogletree Watershed Monitoring Program:
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Presentation Outline

- Lake Ogletree & Watershed Overview
- Past Monitoring
- Today's Water Quality Concerns
- New Monitoring Strategy
- Future Directions

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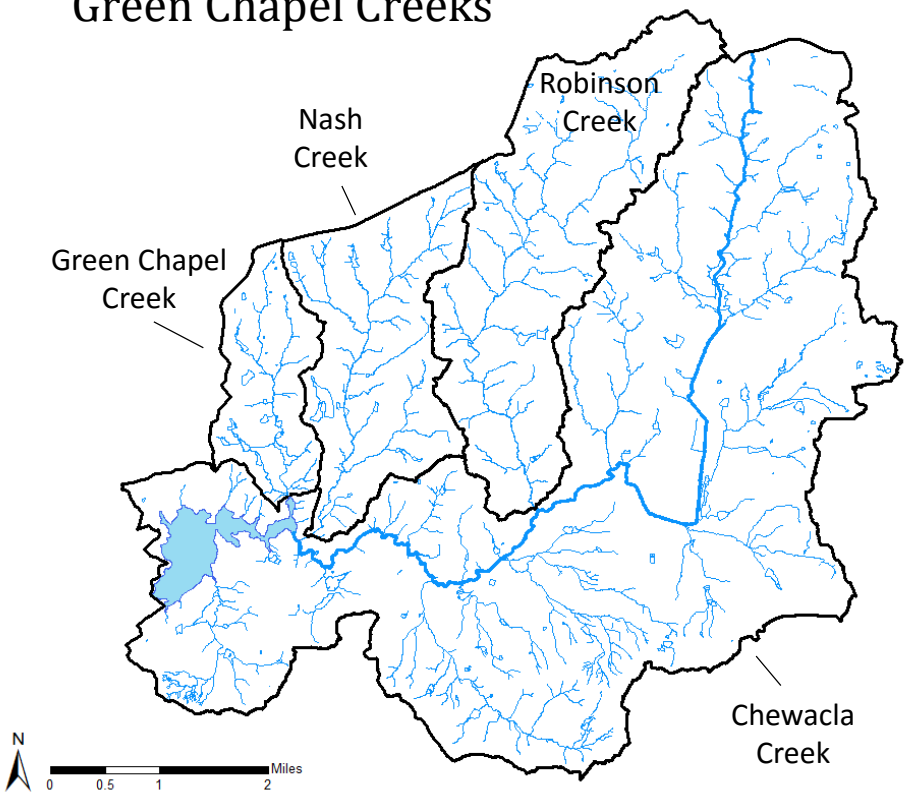
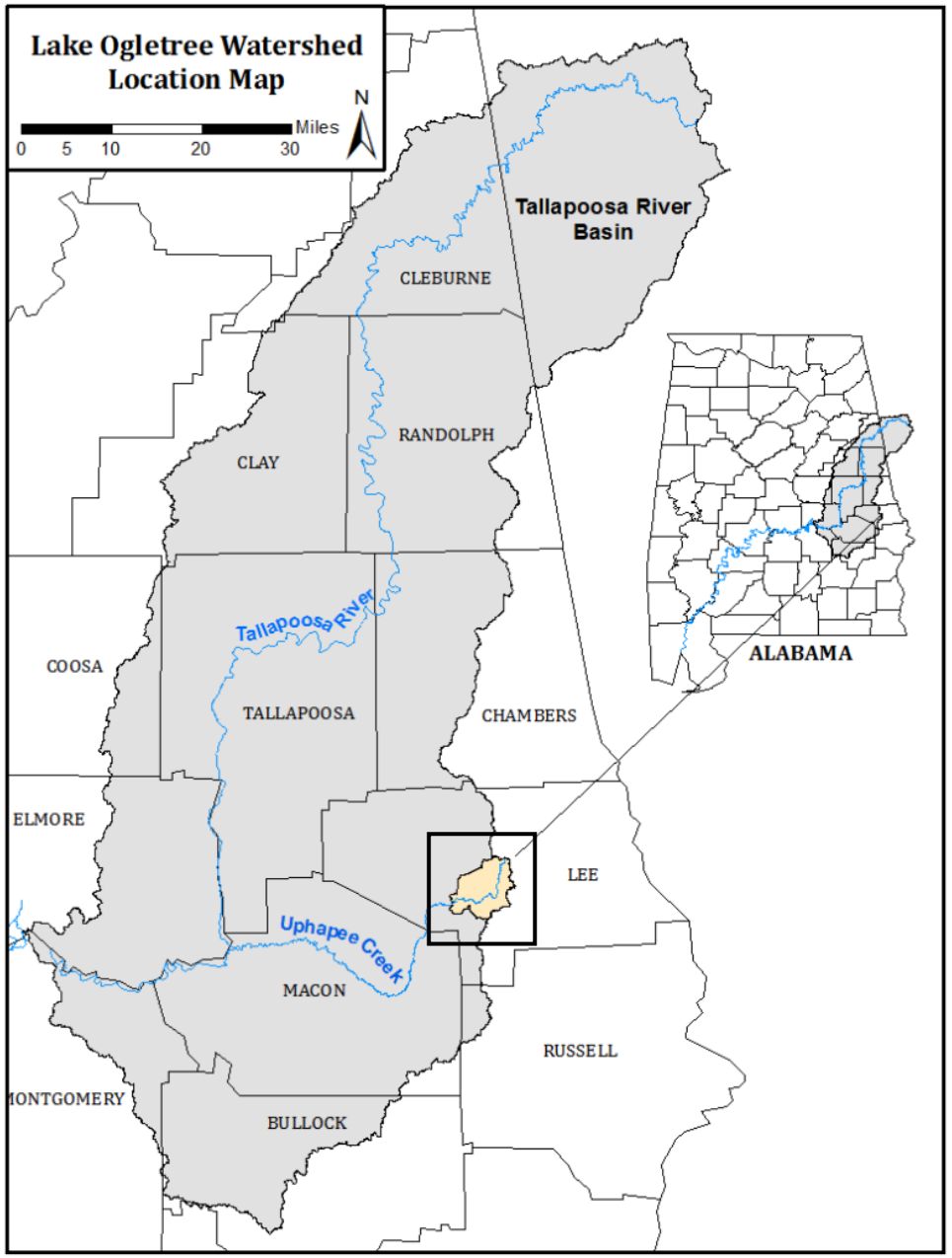
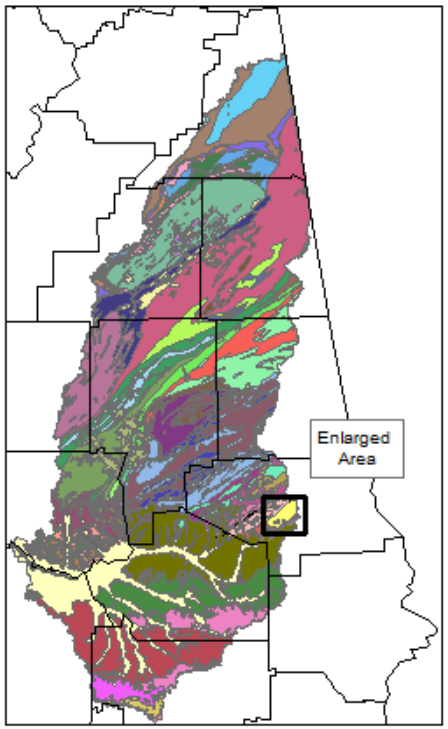
Lake Ogletree Watershed

- Lower Tallapoosa River Basin
- Drains both the Piedmont and Coastal Plain provinces
- Watershed area = 32 mi^2
- Drained by Chewacla, Robinson, Nash, & Green Chapel Creeks





Lake Ogletree Watershed Geology



EXPLANATION

Geologic Formation

- Kt - Tuscaloosa Group
- bm - blastomylonite
- pc - Chewacla Marble
- ph - Hollis Quartzite
- pm - Manchester Schist
- wh - Halawaka Schist
- wwm - Whatley Mill Gneiss

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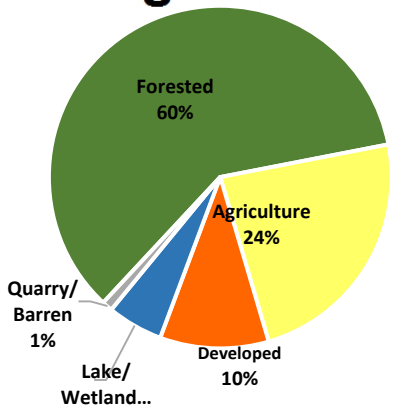
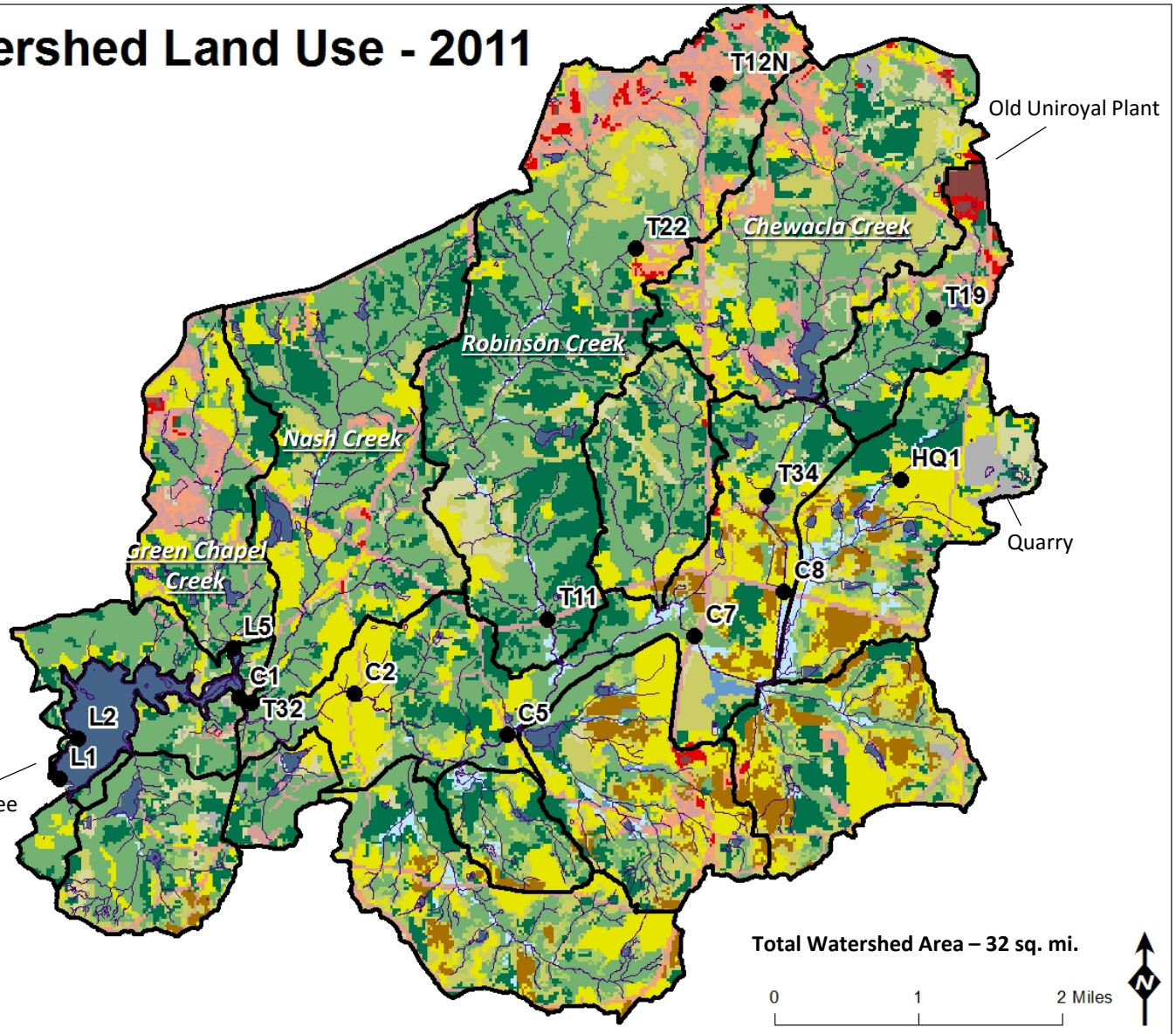
Lake Ogletree Watershed Land Use - 2011



EXPLANATION

- Sampling Locations
- Open Water - 3%
- Developed, Open Space - 6%
- Developed, Low Intensity - 3%
- Developed, Medium Intensity - 1%
- Developed, High Intensity - 0.25%
- Barren Land - 1%
- Deciduous Forest - 32%
- Evergreen Forest - 17%
- Mixed Forest - 2%
- Shrub/Scrub - 9%
- Herbaceous - 4%
- Pasture/Hay - 16%
- Cultivated Crops - 3.5%
- Woody Wetlands - 2%
- Emergent Herbaceous Wetlands - 0.25%



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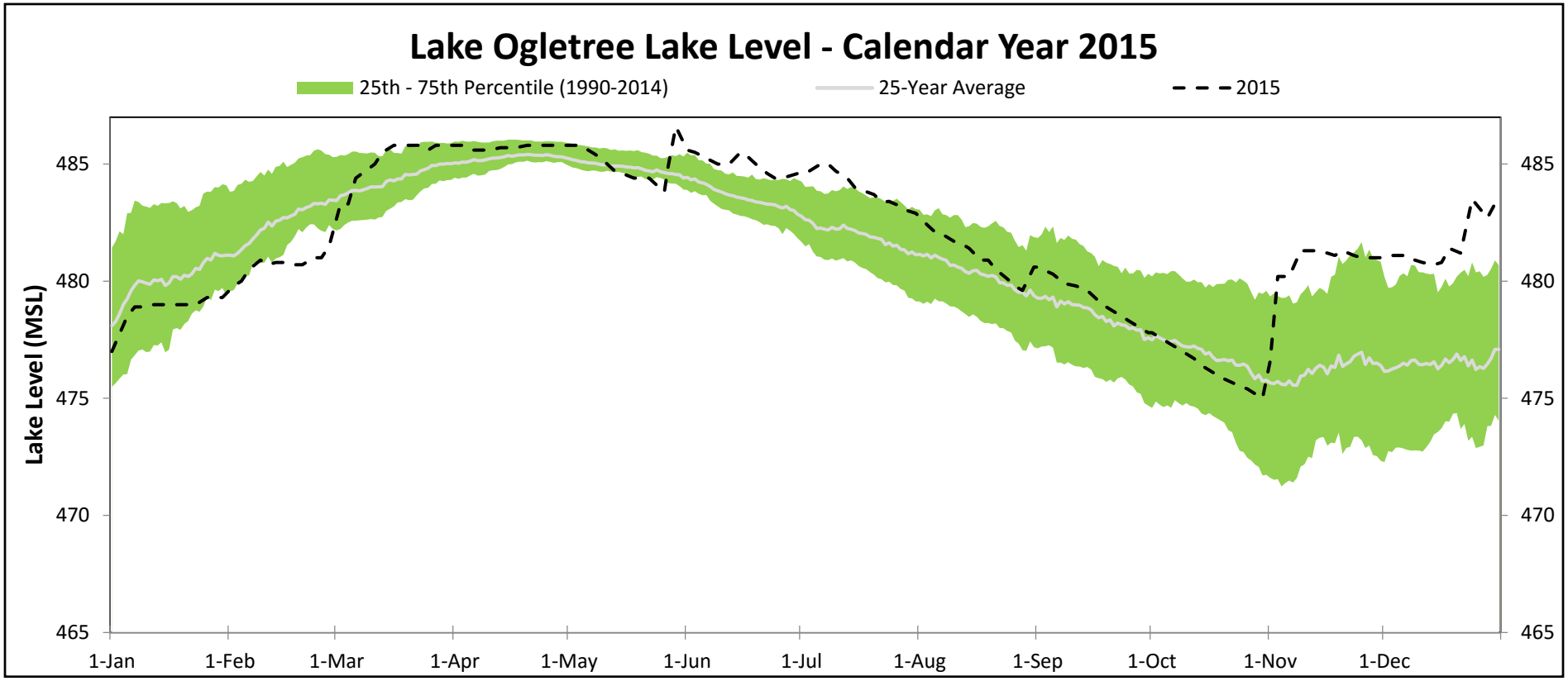
Lake Ogletree

- Built in 1941 by Alabama Power by impounding Chewacla Creek
- 300 acres at full pool
- Usable capacity of 1.5 billion gallons
- Full pool elevation of 486 ft. MSL
- Average YTD withdrawal 4.1 MGD



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Lake Ogletree

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Past Water Quality Issues

- 1974
  - Taste and odor issues in the drinking water persisted from January to May
  - A study was conducted for 2 years after the event to determine the source of taste & odor
  - The primary contributor was found to be *Streptomyces* bacteria producing the compound geosmin
  - TP and Nitrate values were also relatively high in Chewacla Creek and Lake samples
  - Fecal coliform levels in the Lake were also above normal
  - Animal waste from a nearby dairy cattle operation was the likely cause of the episode
- Annual Spring and Fall taste and odor episodes
  - Powdered Activated Carbon system is used to remove odorous compounds
  - Carbon system has historically been activated when raw water temperature reaches 20 degrees Celsius
- Sedimentation
  - Periodic dredging of the lake forebay

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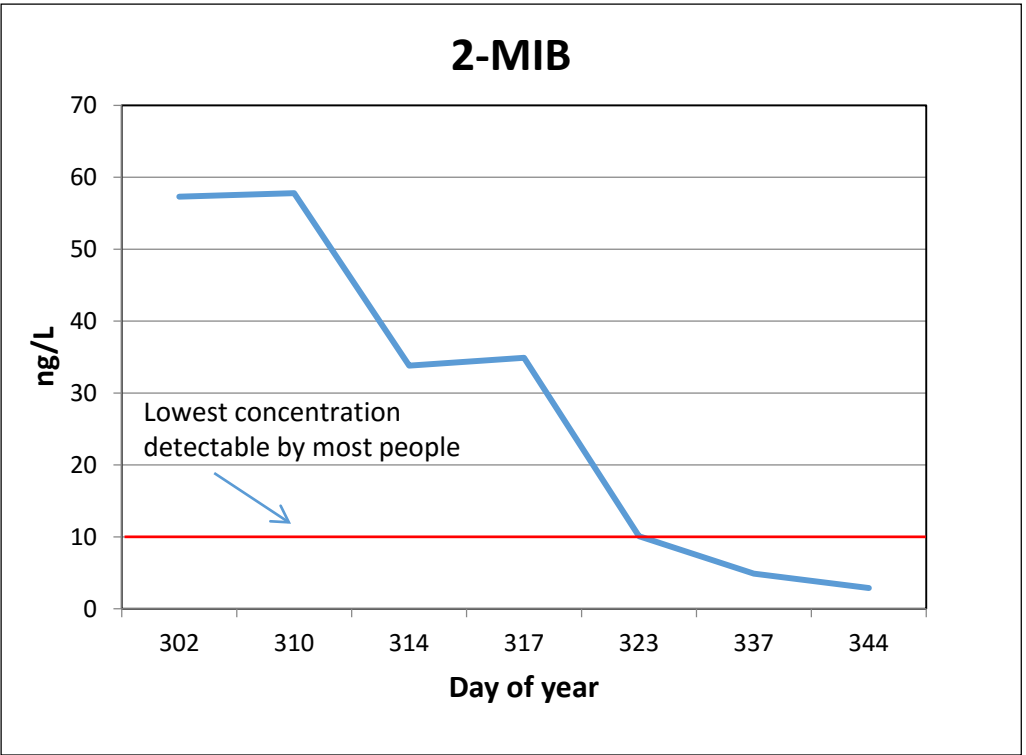
Past Water Quality Issues

- Fall 2014
  - Construction was nearing completion for the new raw water intake structure
  - Numerous customer complaints for “earthy” flavor in the drinking water
  - Consulted Dr. Will Blevins and Dr. Alan Wilson for assessment (thanks guys!)
  - 2-MIB concentrations were found to be high
  - Carbon system was activated at the plant and hydrants were flushed to remove older water



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Previous Monitoring (since the 1970's)

- Monitoring and previous studies were led by Dr. Will Blevins (Auburn University and later Suncrest Labs)
- 15 Sites throughout the Ogletree watershed
  - 3 Sites on Lake Ogletree
  - 7 Sites on Chewacla Creek
  - 3 Sites on Robinson Creek
  - 1 Site on Nash Creek
  - 1 Site at the Opelika Quarry outfall
- 6 samples per year collected every 2 months
  - Nutrients
    - TKN, NO3-NO2, Ammonia-N, PO4, TP
  - Bacteria
    - E. Coli, fecal coliform
  - Chlorophyll A
  - Physical-Chemical parameters
    - Turbidity, pH, Specific Conductance, Dissolved Oxygen, Temperature
- 4 samples per year collected during the growing season
  - Ca, Mg, K, P, Cu, Fe, Mn, Zn, B, Al, Cd, Cr, Pb, Na, Ni
- Data were presented in 2 reports per year

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Previous Monitoring (since the 1970's)

Shortfalls of this strategy:

- Reports and data were received months after sampling was performed
- Interval between samples was typically 60 days, sometimes more
- There was a disconnect between monitoring and the treatment process

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Current Water Quality Concerns

- Taste & Odor
- Algal blooms and related toxins
- Lake quantity and water use
- Watershed development

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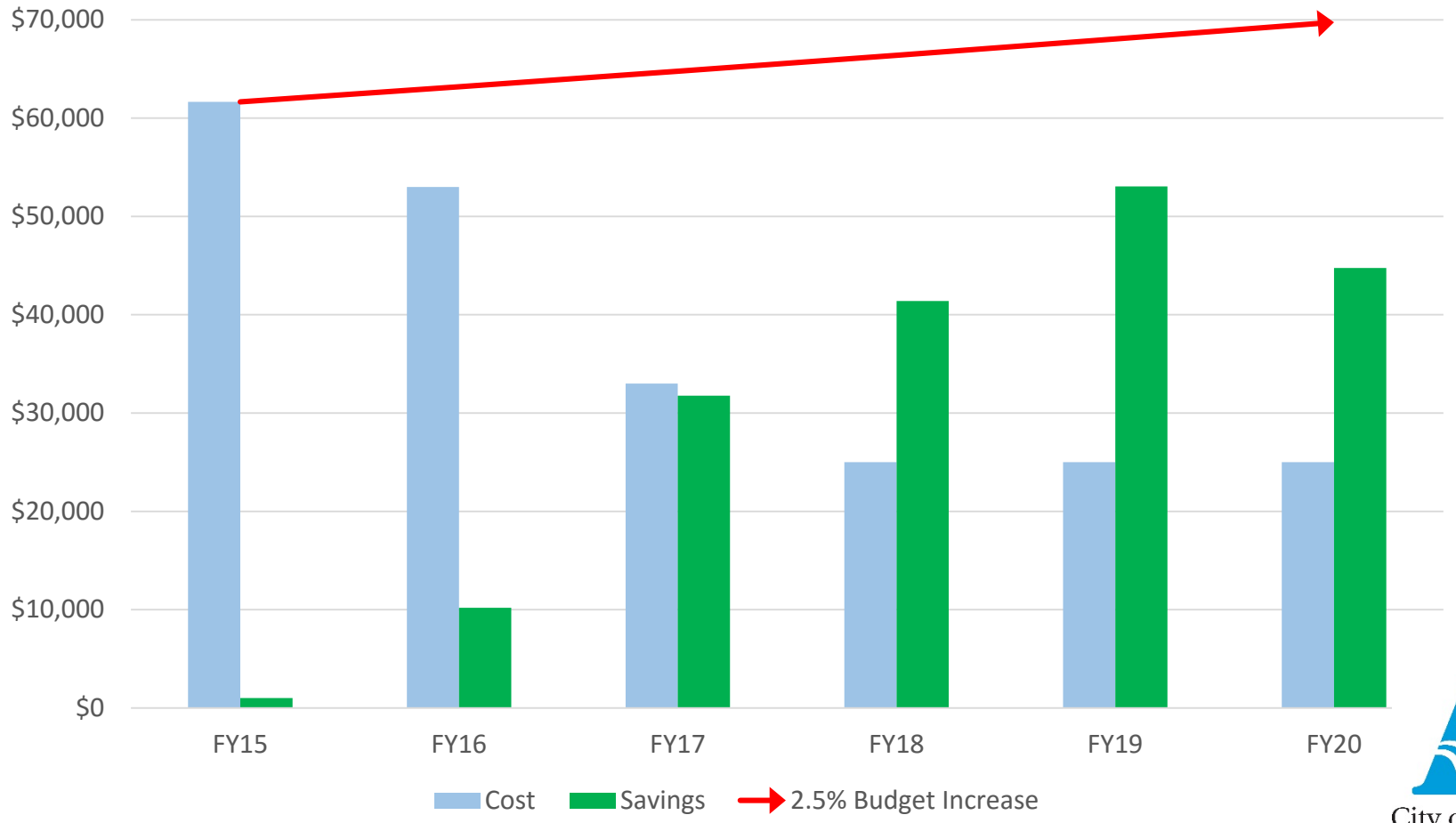
New Monitoring Strategy

- A multi-phase approach that provides a comprehensive near real-time evaluation of the conditions in the watershed and lake, while also providing a **cost-saving advantage.**

$170,000 projected savings over the next 5 years



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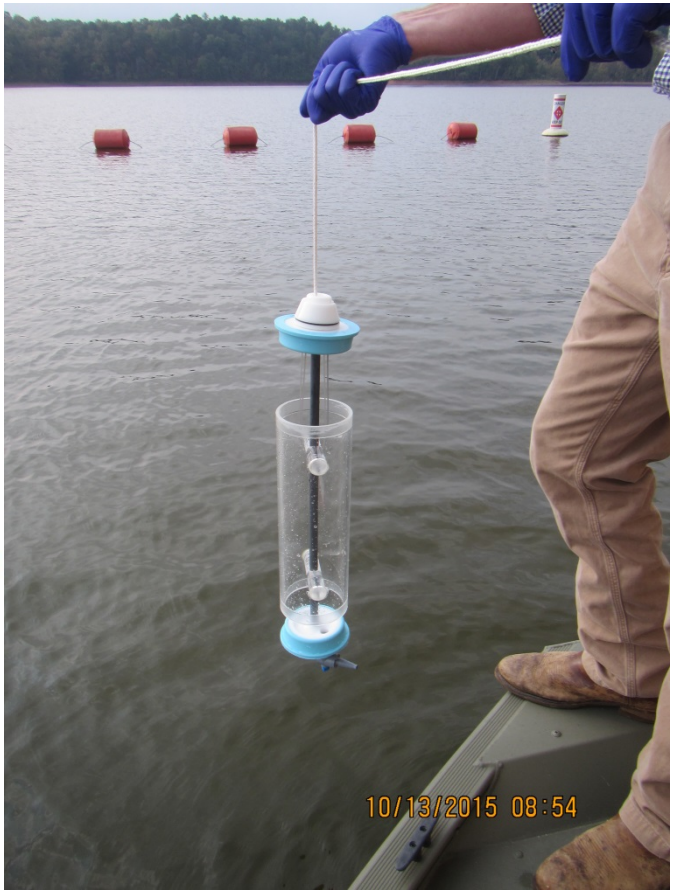
New Monitoring Strategy

- Continue watershed sampling as previously conducted by Dr. Blevins
  - Conduct discrete depth sampling at the intake instead of surface sampling
    - Kemmerer Sampler
  - Wear gloves – (C'mon Dan)
  - Add QA/QC field blanks to identify contamination of samples
  - Follow USGS cleaning protocol for sampler

- Use a handheld water quality instrument for basic parameters when sampling
  - YSI ProPlus
  - Measure temperature, pH, conductivity, dissolved oxygen
  - USGS calibration protocol



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New Monitoring Strategy

- Conduct biweekly watershed reconnaissance
  - Measure basic physical/chemical parameters at sampling sites
    - Temperature, pH, Conductivity, Dissolved Oxygen, Turbidity
    - Visual inspection at lake and tributary sites for pollution, algal blooms, sedimentation, etc.
    - Become more aware of ongoing activities in the watershed (e.g. urban development)

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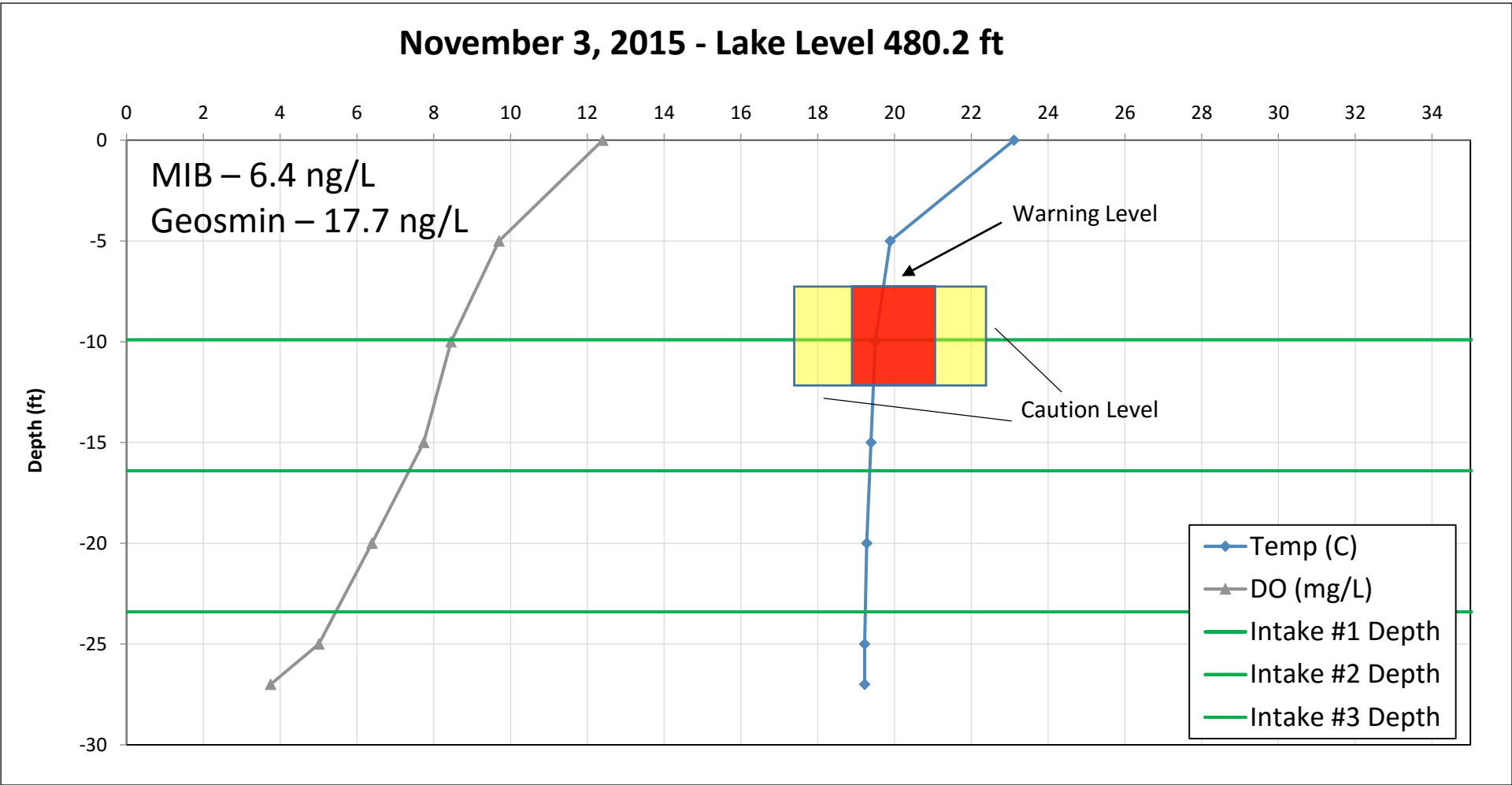
New Monitoring Strategy

- Conduct biweekly 2-MIB & Geosmin sampling at the Lake Intake and both Raw and Finished water at the Water Plant
- Depth profiles to monitor temperature and dissolved oxygen



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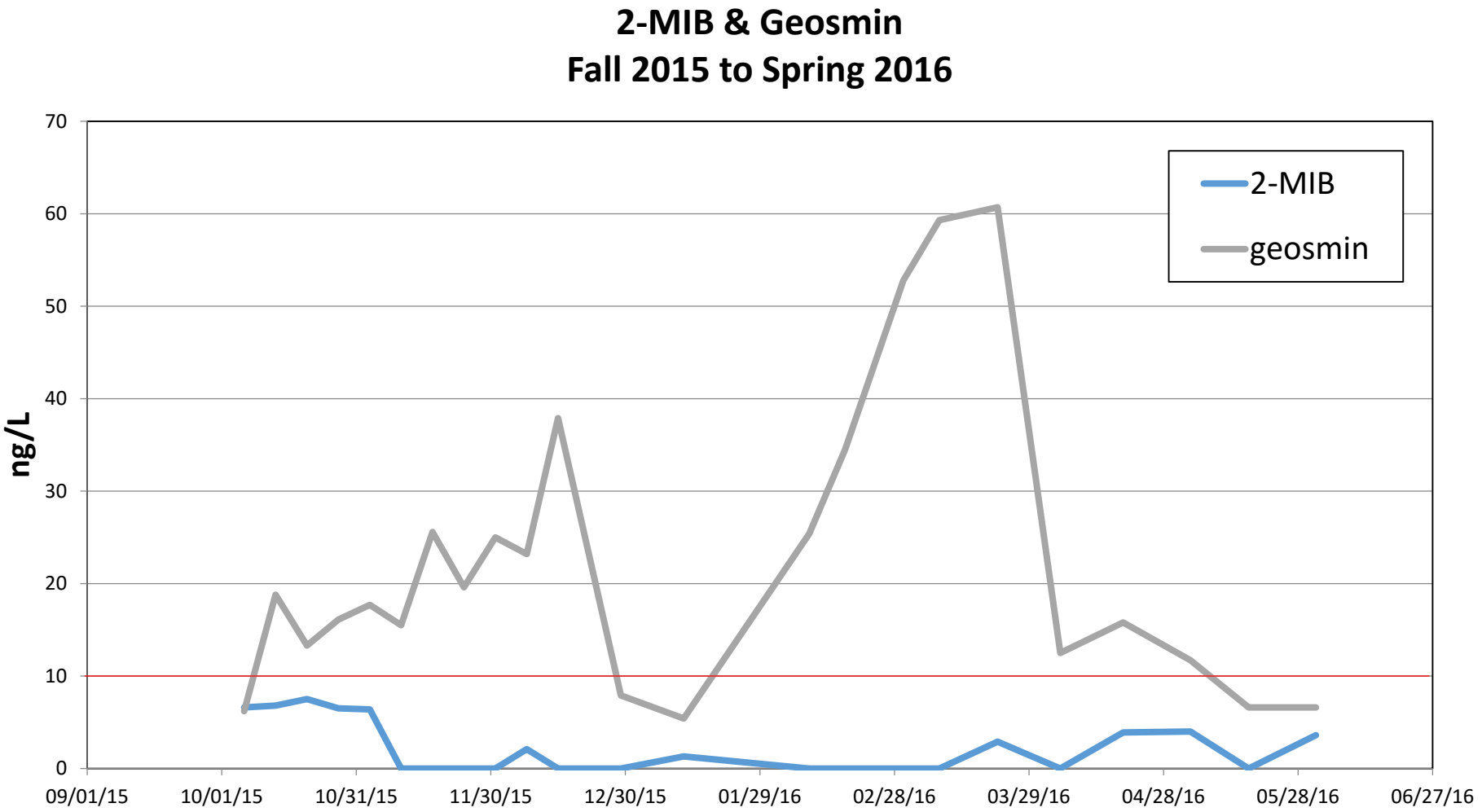

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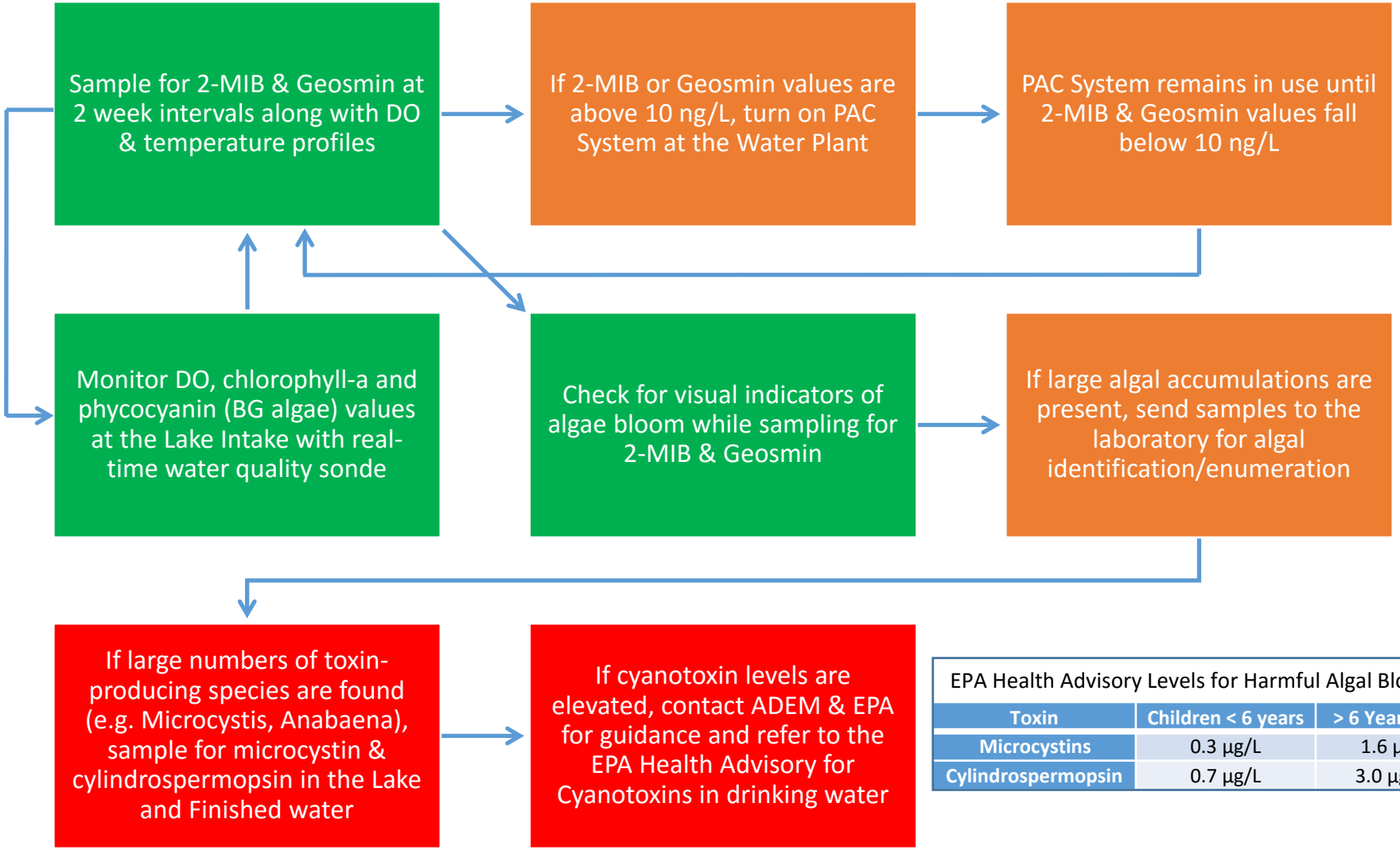
New Monitoring Strategy

- Data-driven Decision Support Chart - Based on "EPA Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water, June 2015"



EPA Health Advisory Levels for Harmful Algal Blooms

Toxin	Children < 6 years	> 6 Years Old
Microcystins	0.3 µg/L	1.6 µg/L
Cylindrospermopsin	0.7 µg/L	3.0 µg/L

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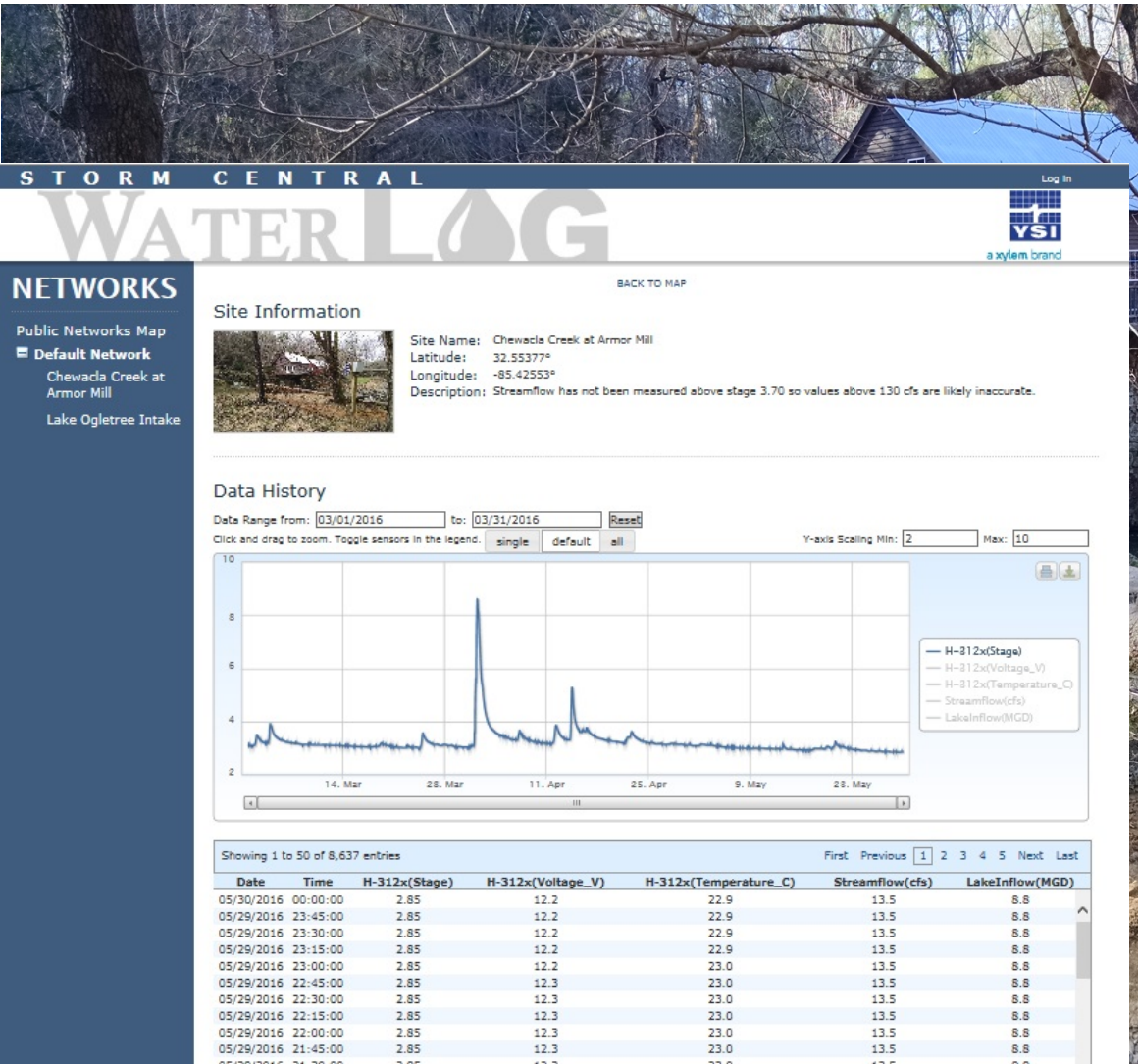
New Monitoring Strategy

- Streamgages



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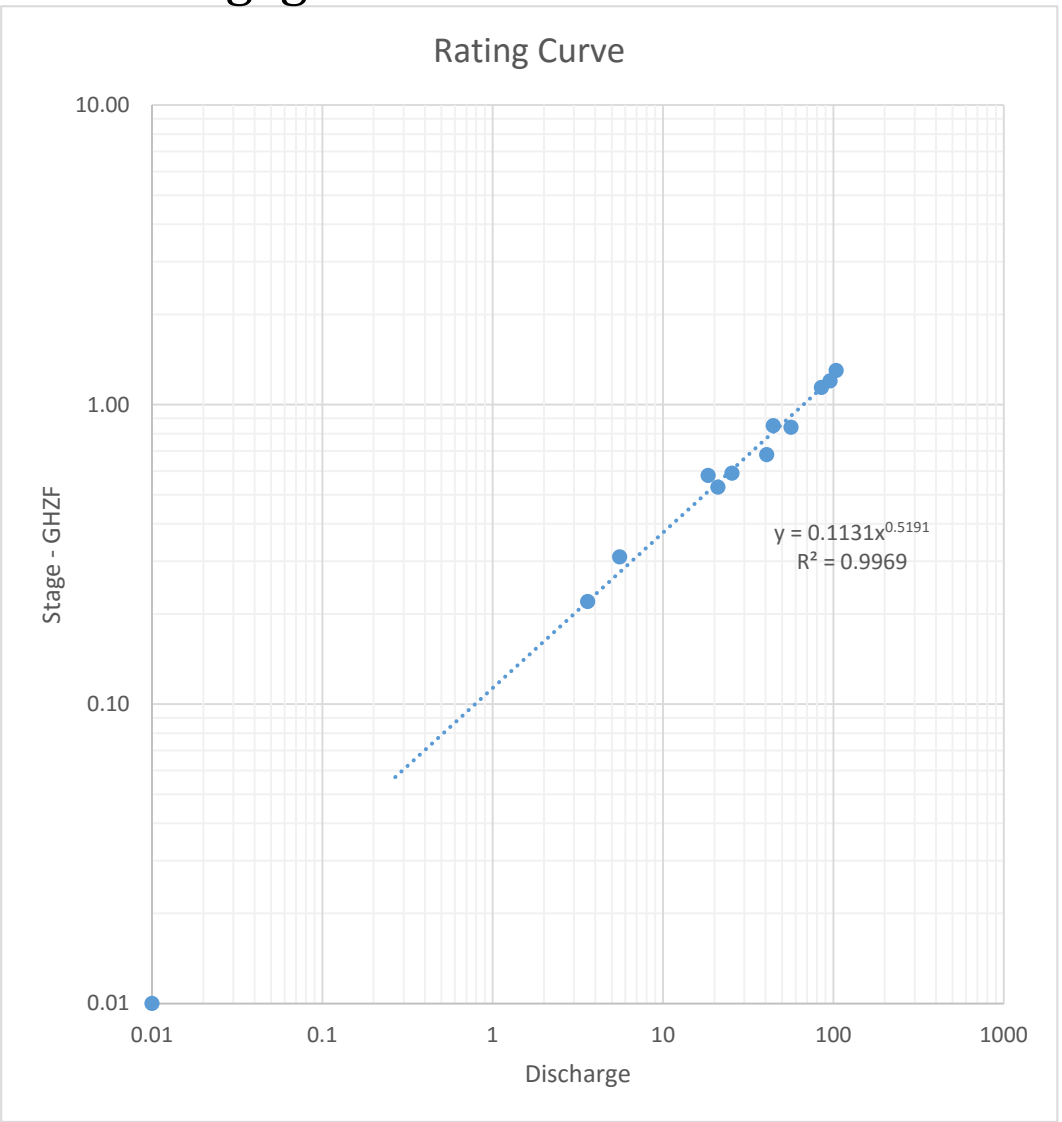

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New Monitoring Strategy

- Real-time, vertical profiling water quality sonde
  - YSI EXO2 multi-parameter sonde
    - Conductivity
    - Temperature
    - Dissolved Oxygen
    - pH
    - Depth
    - Chlorophyll
    - Phycocyanin (BG algae)

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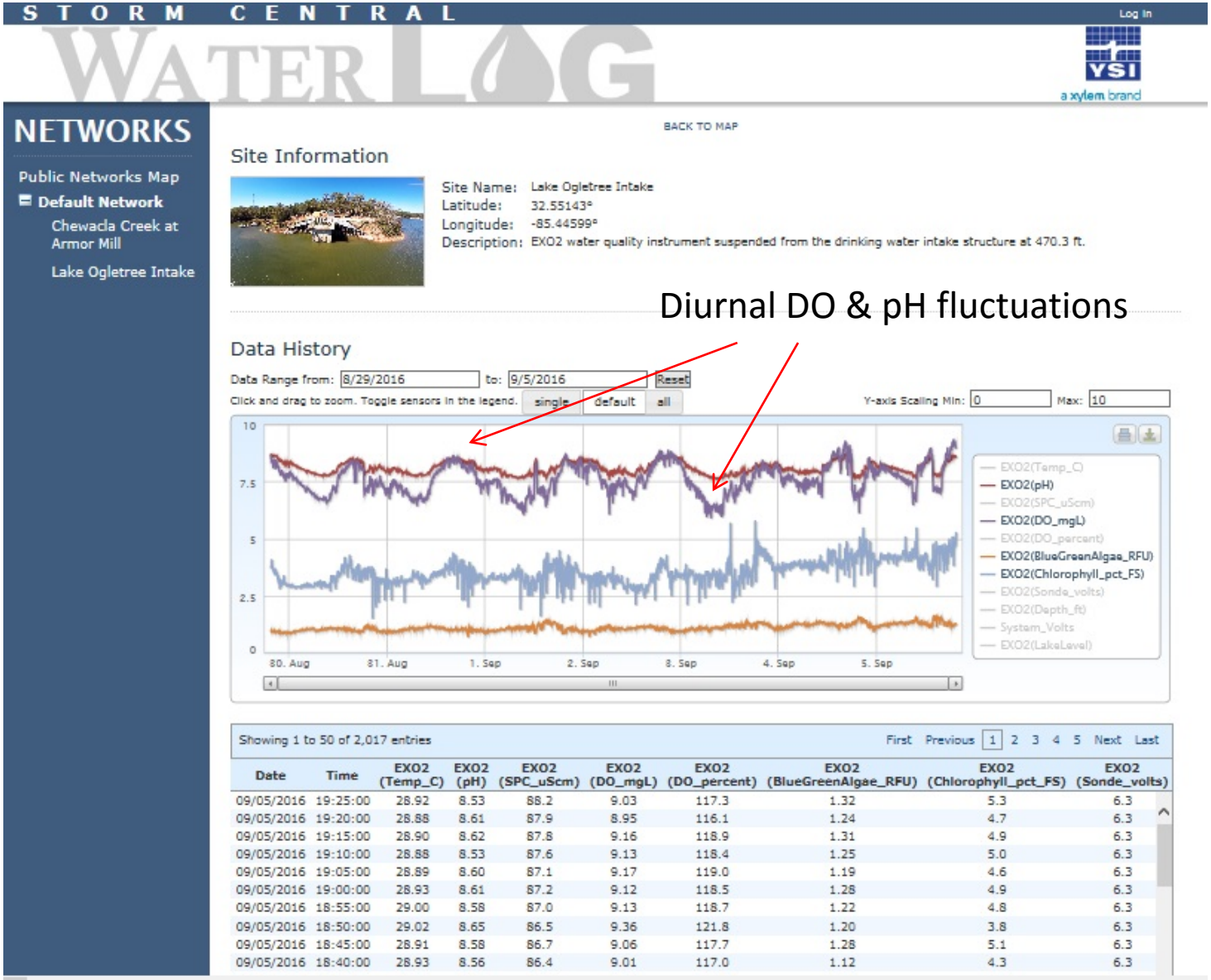
New Monitoring Strategy



Date	Time	EXO2 (Temp_C)	EXO2 (pH)	EXO2 (SPC_uScm)	EXO2 (DO_mgL)	EXO2 (DO_percent)	EXO2 (BlueGreenAlgae_RFU)	EXO2 (Chlorophyll_pct_FS)	EXO2 (Sonde_volts)
09/05/2016	19:25:00	28.92	8.53	88.2	9.03	117.3	1.32	5.3	6.3
09/05/2016	19:20:00	28.88	8.61	87.9	8.95	116.1	1.24	4.7	6.3
09/05/2016	19:15:00	28.90	8.62	87.8	9.16	118.9	1.31	4.9	6.3
09/05/2016	19:10:00	28.88	8.53	87.6	9.13	118.4	1.25	5.0	6.3
09/05/2016	19:05:00	28.89	8.60	87.1	9.17	119.0	1.19	4.6	6.3
09/05/2016	19:00:00	28.93	8.61	87.2	9.12	118.5	1.28	4.9	6.3
09/05/2016	18:55:00	29.00	8.58	87.0	9.13	118.7	1.22	4.8	6.3
09/05/2016	18:50:00	29.02	8.65	86.5	9.36	121.8	1.20	3.8	6.3
09/05/2016	18:45:00	28.91	8.58	86.7	9.06	117.7	1.28	5.1	6.3
09/05/2016	18:40:00	28.93	8.56	86.4	9.01	117.0	1.12	4.3	6.3

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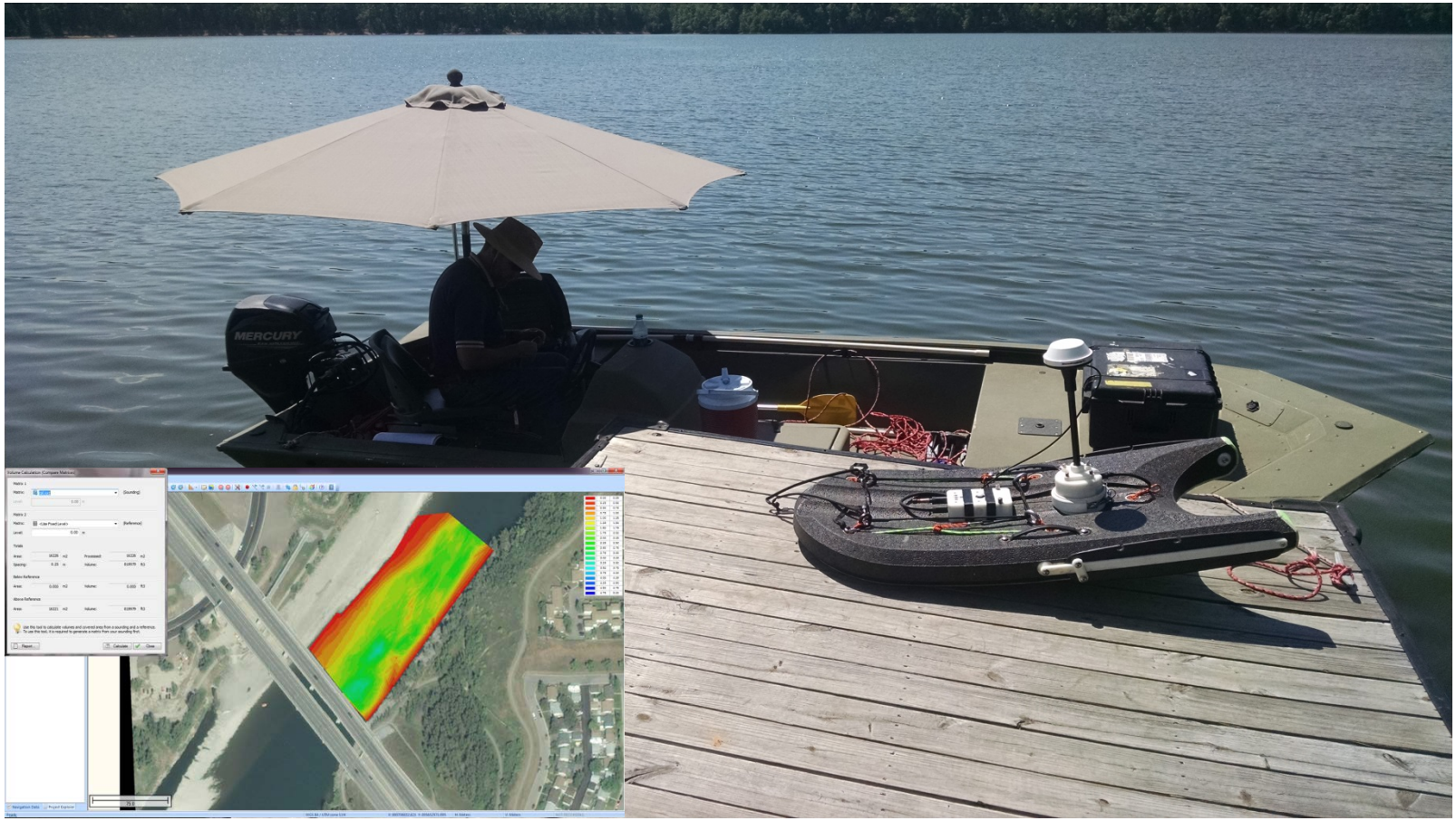
Future Directions

- Single-beam sonar
  - Survey the lake at 1-2 year intervals
  - Develop yearly stage-volume capacity tables
  - Better understand sediment inflow and storage



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Future Directions

- Digital Microscope
  - Identify and enumerate algae in-house
  - Help us determine if sampling for microcystin & cylindrospermopsin is needed
  - Email the difficult ones to the experts… thanks in advance Alan

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Questions???

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