



# **FISH LAKE SEPTIC LEACHATE ASSESSMENT**

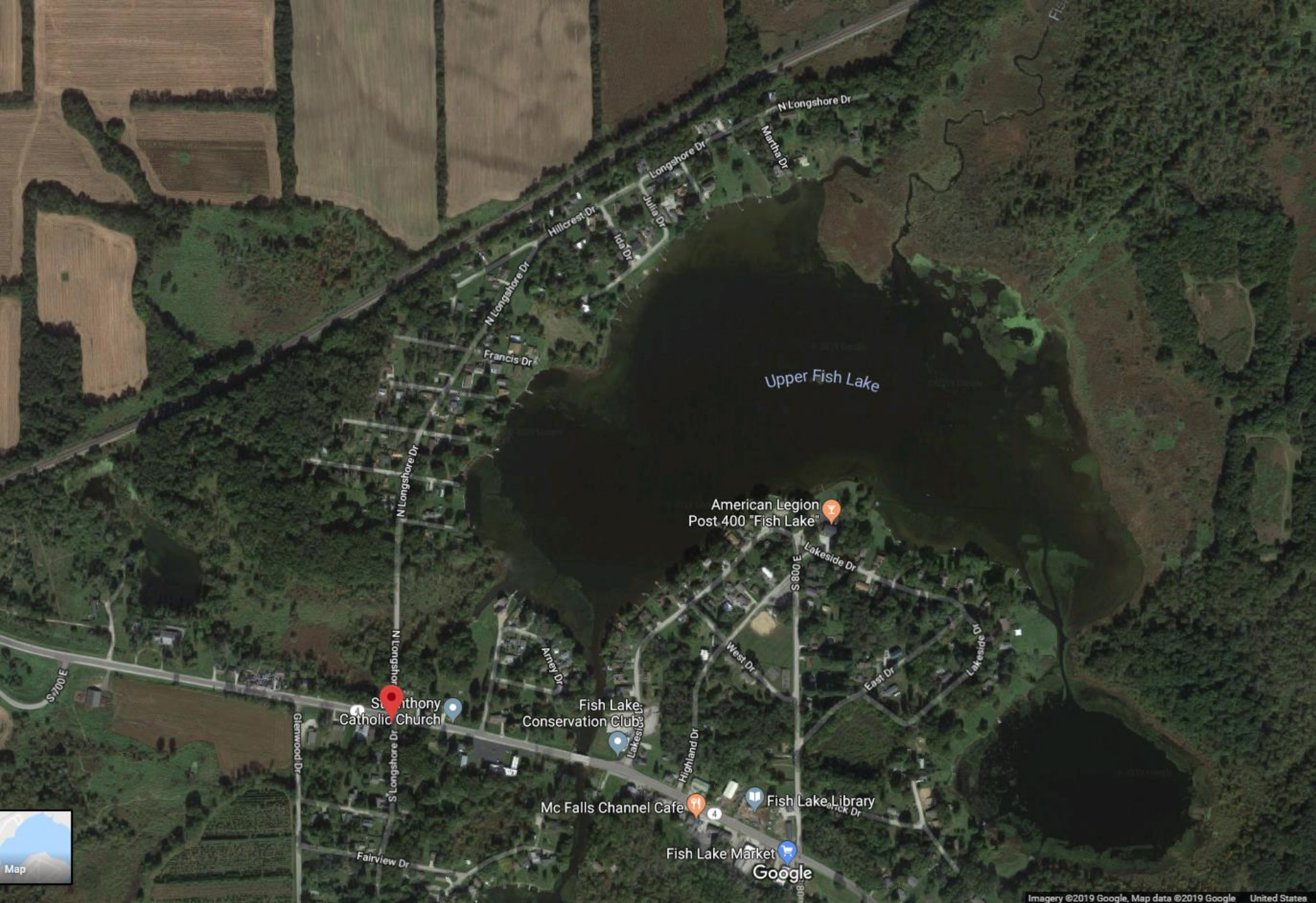
**2019 ILMA Conference**

**Jeff Boeckler – Northwater Consulting**

# FISH LAKE

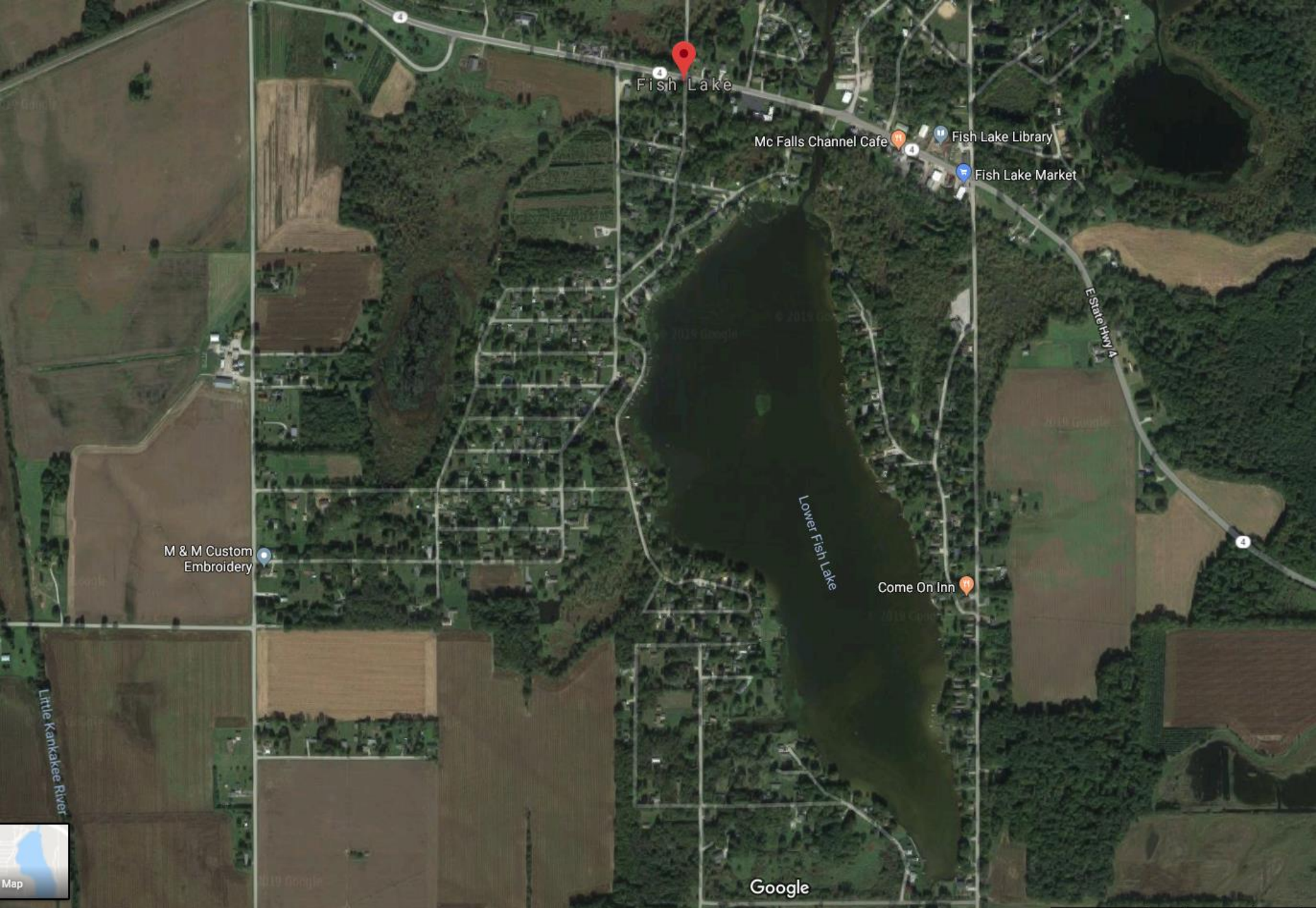
- Located in Northern Indiana – LaPorte County
  - 6,490 ac watershed in headwaters of Kankakee/Iroquois basin
- Includes 3 interconnected lakes
  - Upper Fish Lake
  - Mud Lake
  - Lower Fish Lake
  - 273 acres total





Imagery ©2019 Google, Map data ©2019 Google United States

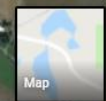
# UPPER FISH LAKE & MUD LAKE



# LOWER FISH LAKE

# FISH LAKE

- Developed shoreline
  - All homes on septic
- Organically rich
  - Excessive vegetation growth/highly organic sediment
  - Extensive wetland complex (watershed)
- Excellent water quality
  - Very low watershed loading
  - Few instances of high bacteria concentrations (isolated)
  - Low nutrients despite 2008 listing for phosphorus
  - Low turbidity



Google

# PREVIOUS WORK

- 2015 - lake and watershed diagnostic study
- 2016-2017 - “muck study”
- 2017-2018 - sediment removal plan
- 2018 - septic leachate assessment
- Ongoing – active vegetation management
- 2019 – selective dredging

# STUDY PURPOSE

A scenic view of a residential waterfront community. In the foreground, a body of water with lily pads is visible. A dock with a pontoon boat is on the left. In the middle ground, a row of houses with porches and driveways is situated along the water's edge. A white pickup truck is parked on a driveway to the right. The background is filled with lush green trees under a clear blue sky.

- Assess occurrence and extent of septic leachate
- Determine if septic systems are negatively impacting water quality
  - Bacteria
  - Nutrients
  - Detergents
- Address resident concerns relating to septic systems

# PRIMARY CONCLUSIONS

- No widespread, concentrated, or localized human bacterial contamination is occurring from septic leachate in the lake chain
- Treated septic leachate is likely entering the lake through shallow groundwater flow however there is no evidence of any measurable impacts to water quality





# STUDY ELEMENTS

- Septic Indicators – what did we sample or look for?
  - Optical Brightening Agents – fluorometry
  - Organics – dissolved organic content (F/DOC ratio)
  - Bacteria – *E. coli* and DNA source tracking
    - Cost considerations
  - Nutrients – nitrate and phosphorus
  - Conductivity, DO, pH

# STUDY ELEMENTS

- Study Area
  - Upper, Lower, and Mud Lake
- Data Collection
  - Sampling occurred on 2 occasions
    - 2 days - July 8<sup>th</sup> and 9<sup>th</sup>
    - 2 days – October 7<sup>th</sup> and 8<sup>th</sup>



# PROCEDURES

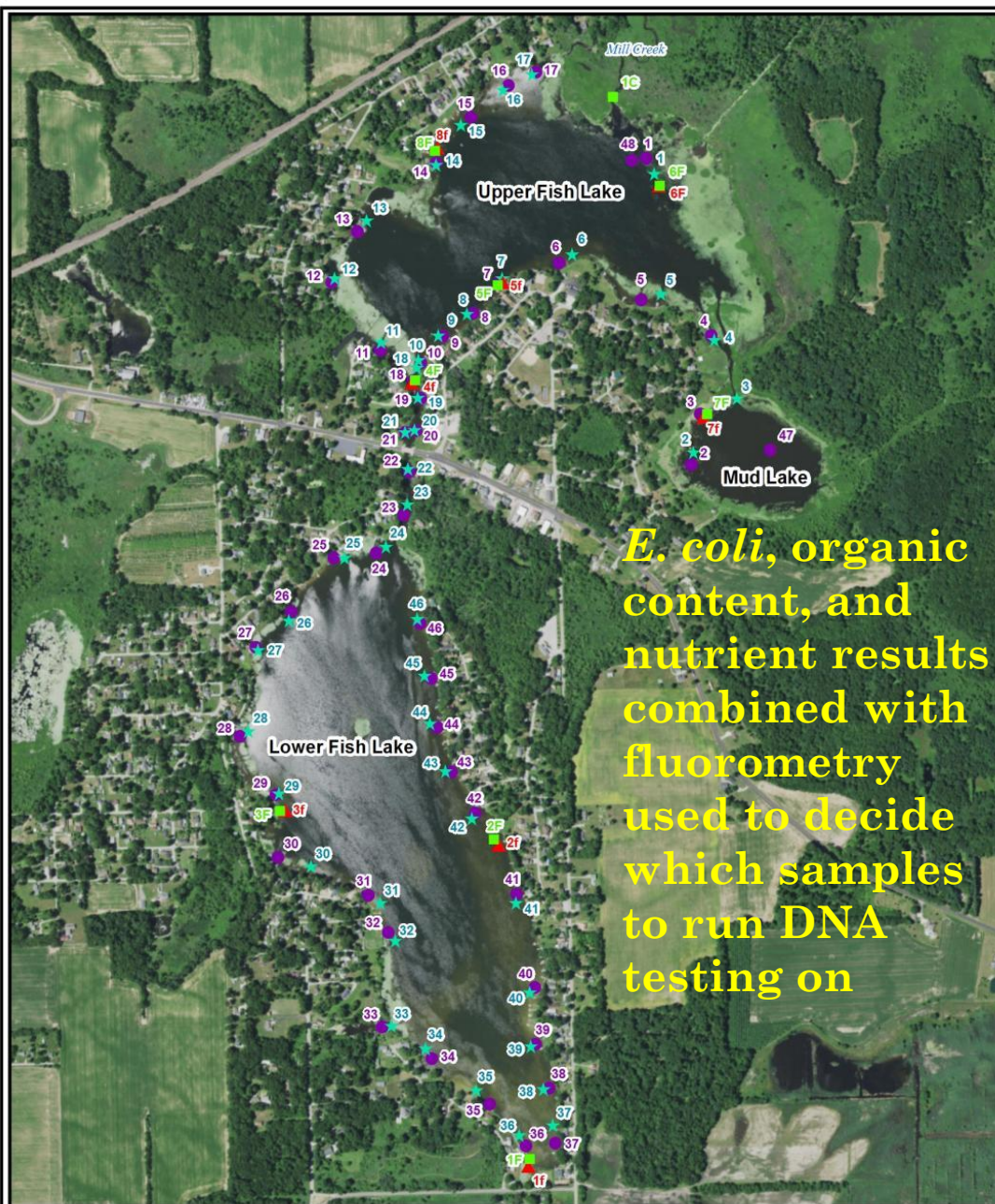
- fluorometry and general water quality parameters collected day 1
- Water quality samples collected on day 2
- Samples taken near shore, 1 foot from lake bottom



# PROCEDURES

- Equipment cleaned at each site
- Samples sent to accredited laboratories
  - Springfield, IL and Florida (DNA testing)
  - Quality control procedures adhered to





*E. coli*, organic content, and nutrient results combined with fluorometry used to decide which samples to run DNA testing on

**Legend**

- Water Quality (Oct 2018)
- Fluorometry (Jul 2018)
- ▲ Water Quality (Jul 2018)
- ★ Fluorometry (Oct 2018)

**Fish Lake Sample Sites**

0      500      1,000      2,000      3,000      4,000  
Streams      Feet

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# RESULTS - OPTICAL BRIGHTENING AGENTS

## ○ July

- 48 locations
  - Relative Fluorometric Values (RFV): 62 Lower Fish Lake and 280 in Mud Lake

## ○ October

- 47 locations including Mill Creek
  - Relative Fluorometric Values (RFV): 68 Lower Fish Lake and 263 in Mud Lake

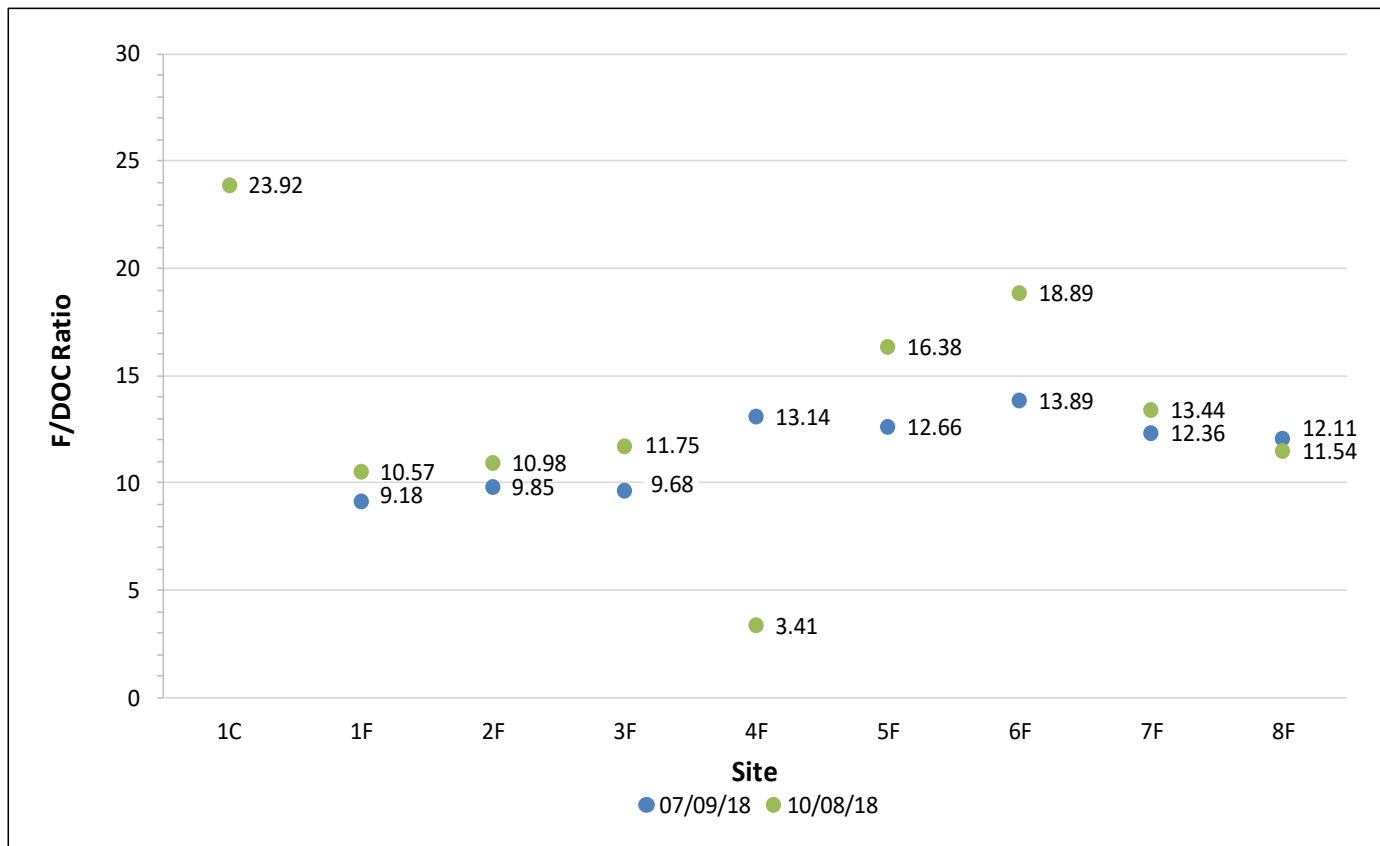
## ○ Results consistent and validate conclusions

- High values recorded in areas with high organic content



# RESULTS - ORGANICS – F/DOC RATIO

- Fluorometry/Dissolved Organic Carbon ratio calculated to correct for organic content
  - Threshold value of 22.7
  - 8 DOC samples in July – 9 in October
- Results validate conclusions – exception Mill Cr.



# RESULTS - *E. COLI* & DNA BIOMARKERS

## ○ July

- 7 locations
  - *E. coli* (MPN/100 mL): 1 Lower Fish Lake and 365 upper end of channel. All other sites below 24
  - Goose DNA detected at upper end of channel
  - Human DNA detected at reference site near Mill Creek

## ○ October




- 9 locations including Mill Creek
  - *E. coli* (MPN/100 mL): 5.1 Lower Fish Lake and 260 Mill Creek. All other sites below 42
  - No human or goose DNA detected







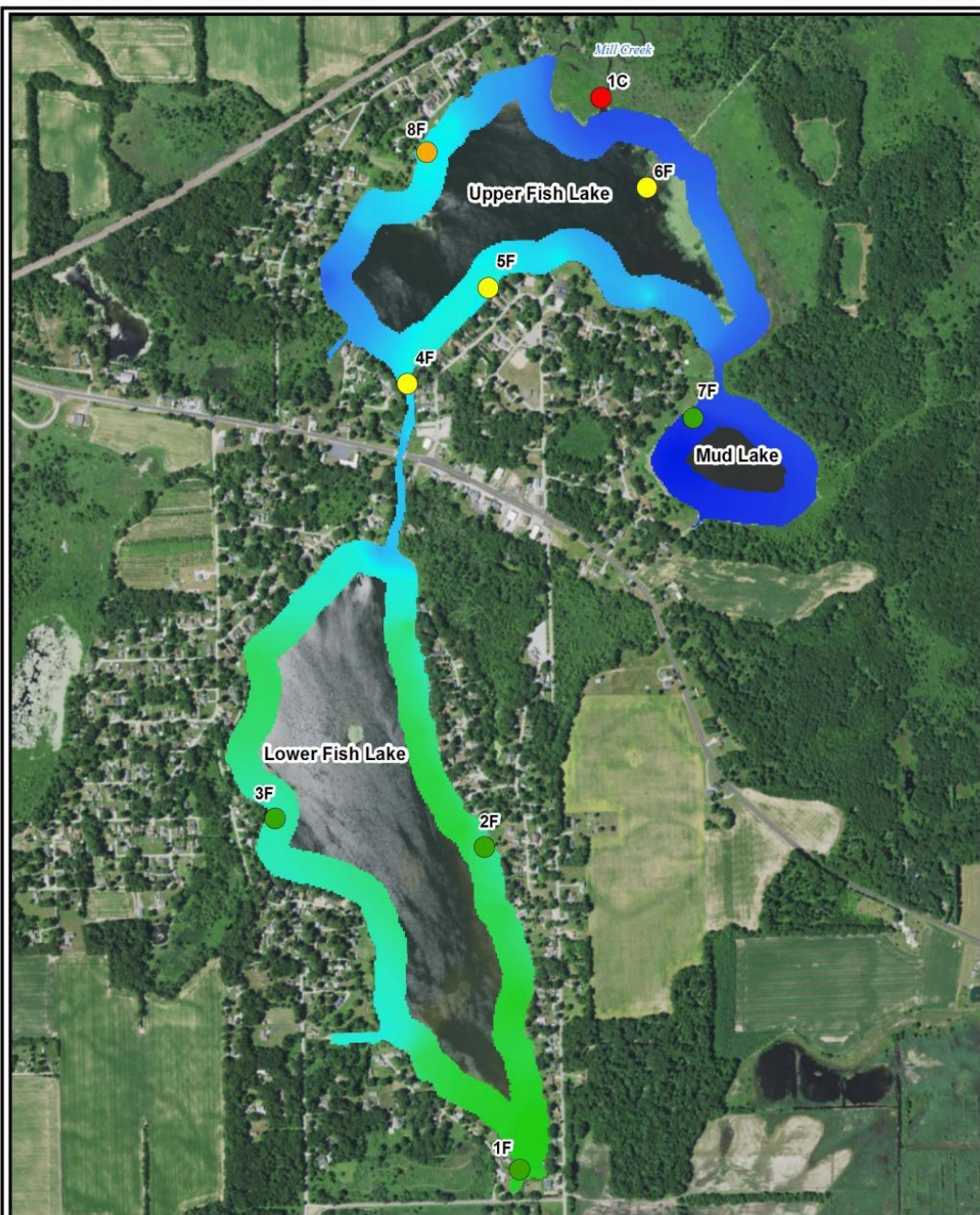
**Legend**

- |         |   |            |            |
|---------|---|------------|------------|
| E. coli |  | <b>RFV</b> | High : 277 |
|         |  |            | Low : 62   |
|         |  |            |            |



**Fish Lake  
Sample Results - July, 2018**

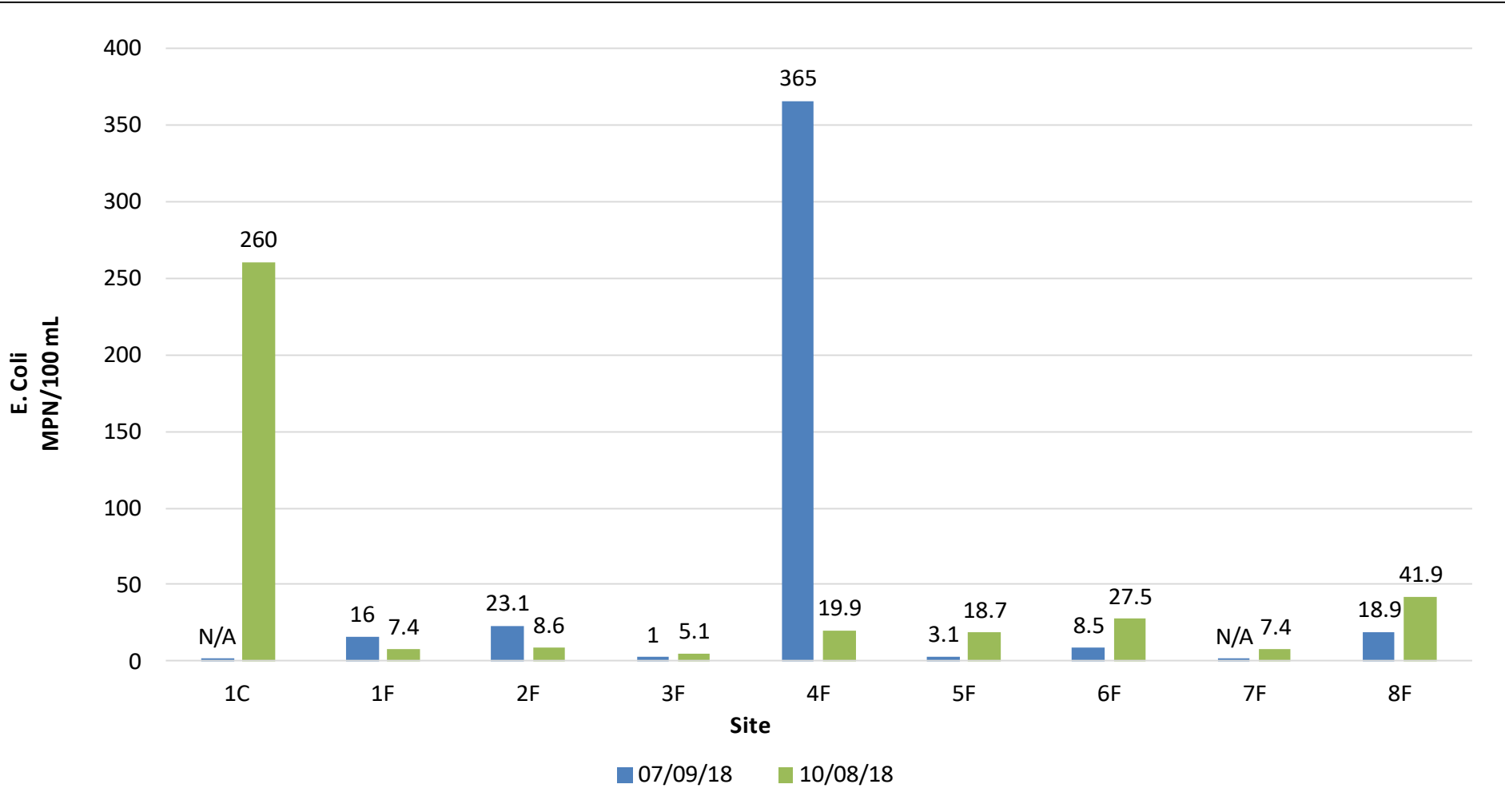




**Fish Lake**  
**Sample Results - October, 2018**

<b>Legend</b>	<b>RFV</b>		
<ul style="list-style-type: none"> <li><span style="color: green;">●</span> Low</li> <li><span style="color: yellow;">●</span> High</li> </ul>	<ul style="list-style-type: none"> <li><span style="color: orange;">●</span> High : 261</li> <li><span style="color: red;">●</span> Low : 68</li> </ul>	<ul style="list-style-type: none"> <li><span style="color: blue;">█</span> High : 261</li> <li><span style="color: green;">█</span> Low : 68</li> </ul>	<div style="text-align: center;"> <p>0    375    750    1,500    2,250    3,000 Feet</p> </div>

**NORTHWATER**  
CONSULTING



# NUTRIENTS

## ○ July

- Nutrients - 6 locations
  - No detectable results
- Conductivity
  - Stable across all sites

## ○ October

- 9 locations including Mill Creek
  - Only 1 detectable result – 0.744 mg/L Nitrate at Mill Creek
- Conductivity
  - Stable across all sites

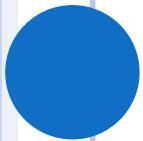
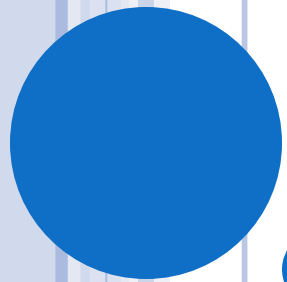
## ○ Results consistent and validate conclusions



## ADDITIONAL CONCLUSIONS

- Consistency of results in all indicators serves to validate conclusions
- One human DNA bacteria hit was near Mill Creek at reference site
  - May indicate watershed inputs
  - Mill Creek sampled in October - no DNA hits
  - Further investigation is needed to determine watershed contributions
- Primary source of bacteria in Fish Lake is likely animals and natural sources
  - Geese likely more seasonal and localized





**QUESTIONS???**