Missouri Stream Team
Volunteer Water Quality Monitoring Program
Cooperative Stream Investigation Projects

Background, Data Results and Future Recommendations
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Randy Sarver

Missouri Department of Natural Resources

Background:

The Missouri Stream Team, Volunteer Water Quality Monitoring (VWQM) Program is a cooperative program administered by the:

Missouri Department of Conservation **(MDC)**

Missouri Department of Natural Resources **(MoDNR)**

Conservation Federation of Missouri **(CFM)**

- The Stream Team Program began in **1989**
- The VWQM component began in **1996**
- The Cooperative Stream Investigations (CSI) component was added in **2006**.

Objectives of the CSI Program:

- Foster cooperation between agencies, volunteers, local government, private business, watershed groups, and universities in performing special water quality monitoring projects.

- Collect and analyze water samples according to United States Environmental Protection Agency (USEPA) approved, accepted methods (which are different than standard VWQM screening methods)

- Focus projects on monitoring non-point source pollution parameters, such as *Escherichia coli* (*E. coli*), chloride, total nitrogen, total phosphorus, discharge, and occasionally other parameters

- Promote citizen science - CSI data are treated as equivalent to professionally collected data; fitting the definition of citizen science

Requirements for CSI Project volunteers:

- VWQM Level 2 or Level 3 status, and have submitted consistent and credible data
- Commit to a 1 year project (original projects were multi-year; up to 5 years)
- Attend training for collection and handling of environmental samples, chain-of-custody use, and measurement of stream discharge using MoDNR standard operating procedures (SOP)
- Ship chemistry samples to The Department of Natural Resources, Chemistry Analysis Section via the overnight Department of Health courier service
- Deliver *E. coli* samples to cooperating partners for analyses

CSI Projects from 2006 - 2022:

- 30 projects initiated
- 29 projects completed
  - 22 - *E. coli* monitoring
  - 14 - chloride monitoring
  - 12 - discharge measurement
  - 4 - nutrients (total nitrogen, total phosphorus)
  - 2 - total suspended solids
  - 2 – hardness
  - 1 - ammonia-N
  - 1 - pH
  - 1- sulfate

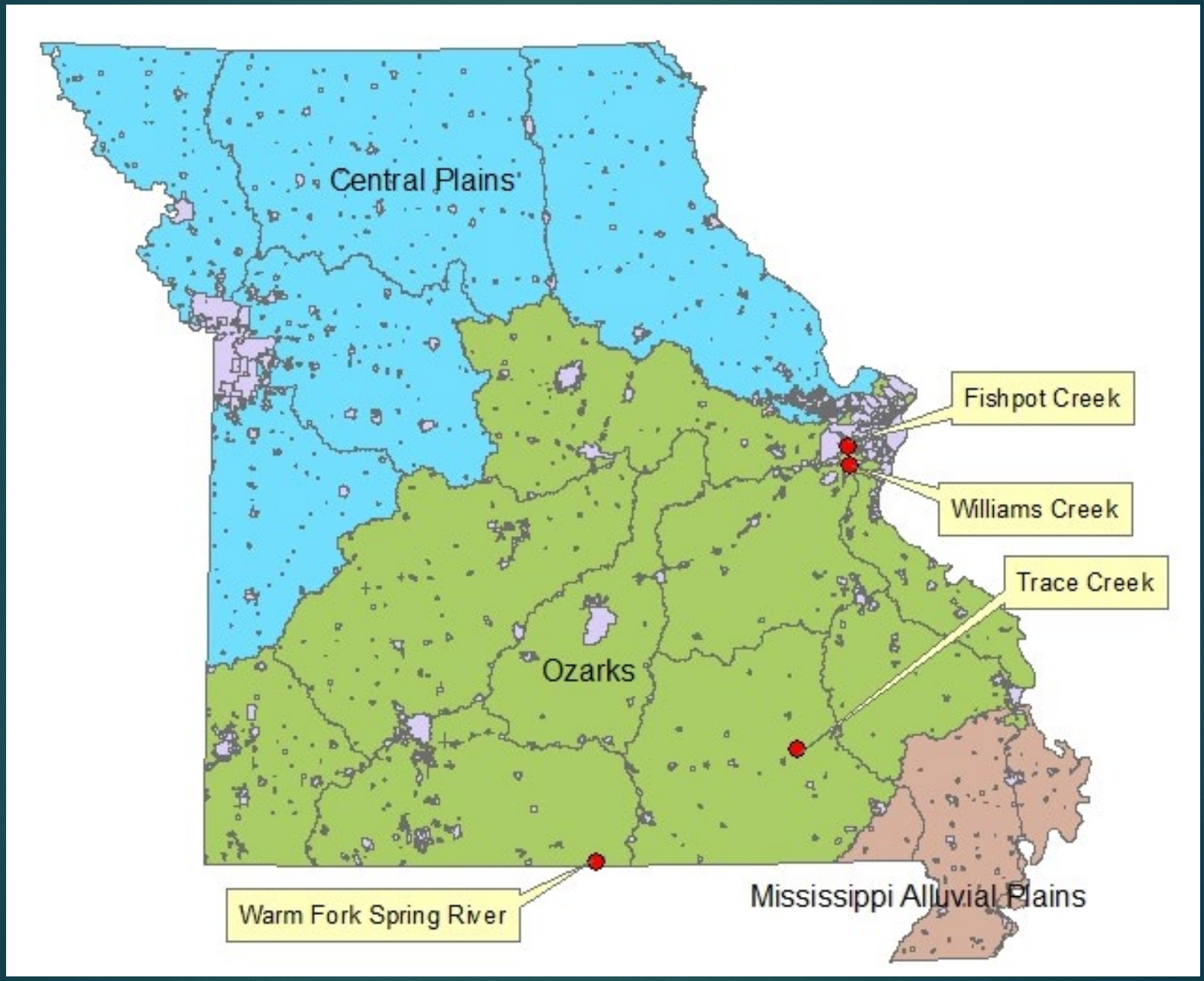
Data Use:

- Not used for enforcement purposes
- Results of all completed projects are available in the MDNR Water Quality Assessment (WQA) database
- Source tracking
- Most prevalent data use is for 303(d) or TMDL purposes:
  - Primary data for listing 7 Waterbody ID #s (WBID) as impaired [303(d)]
  - Primary data for delisting 2 WBID as impaired [303(d)]
  - Primary data for assessing 3 WBID as unimpaired
  - Post-TMDL monitoring for 5 WBID
  - Additional data for 303(d) assessments and TMDL load calculations for 21 WBID
  - Data not yet assessed for 11 WBID
  - 3 projects have been associated with 319 grants

Project QA/QC:

- Approved MoDNR Quality Assurance Project Plan (QAPP)
- Written and approved project plans
- Use MoDNR, Environmental Services Program SOPs
- At least one project audit
- *E. coli* samples – perform analyses within required holding time, collect 10% duplicate samples that meet standard method QC criterion for *E. coli* samples, analyze at least one positive control standard, analyze negative control for all sample sets
- Chemical samples – Ship iced samples to ESP lab for analyses, check against standard for field analyses (pH project) , collect 10% duplicate samples for relative percent difference QC comparison

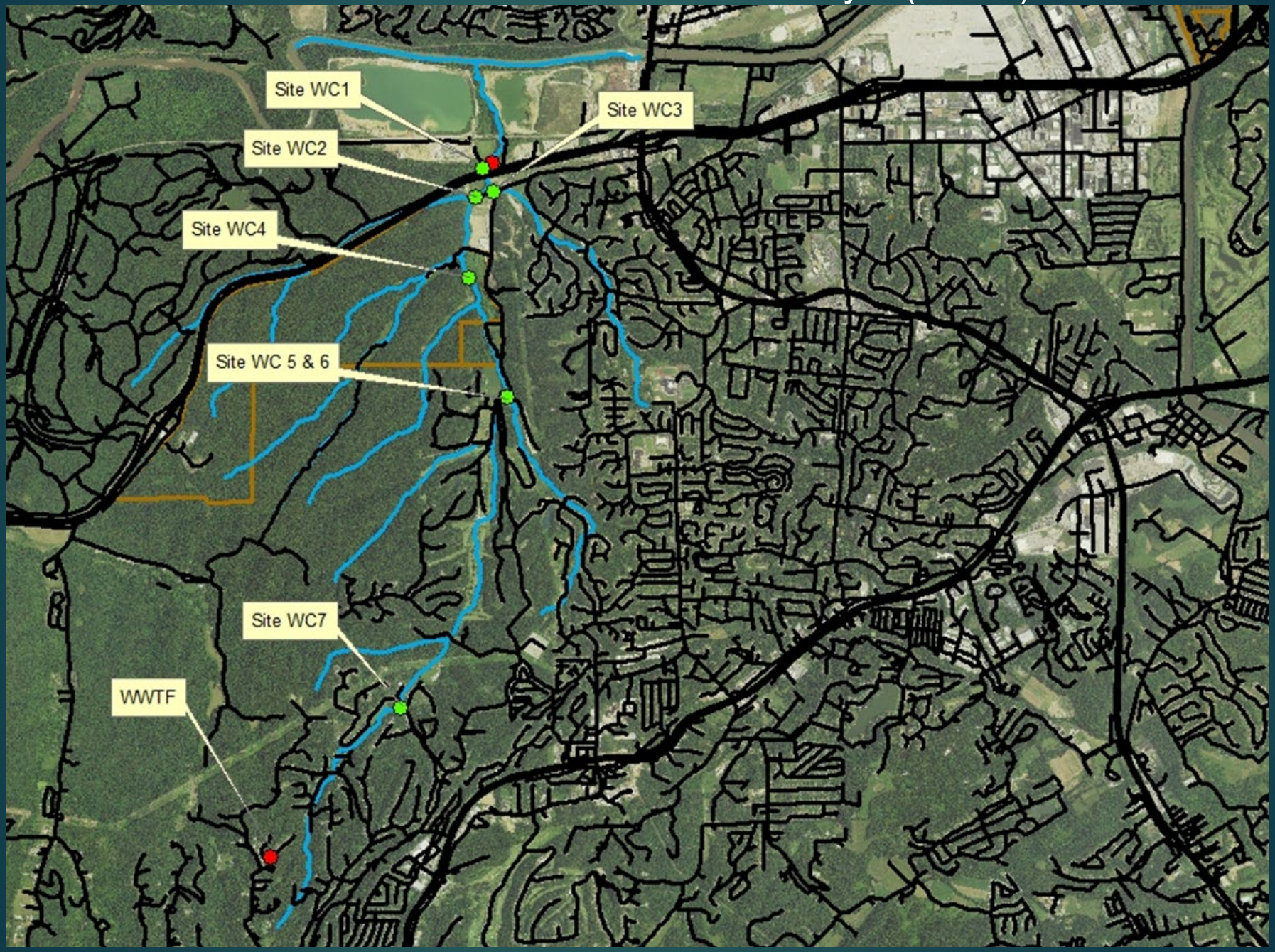
Project Result Examples



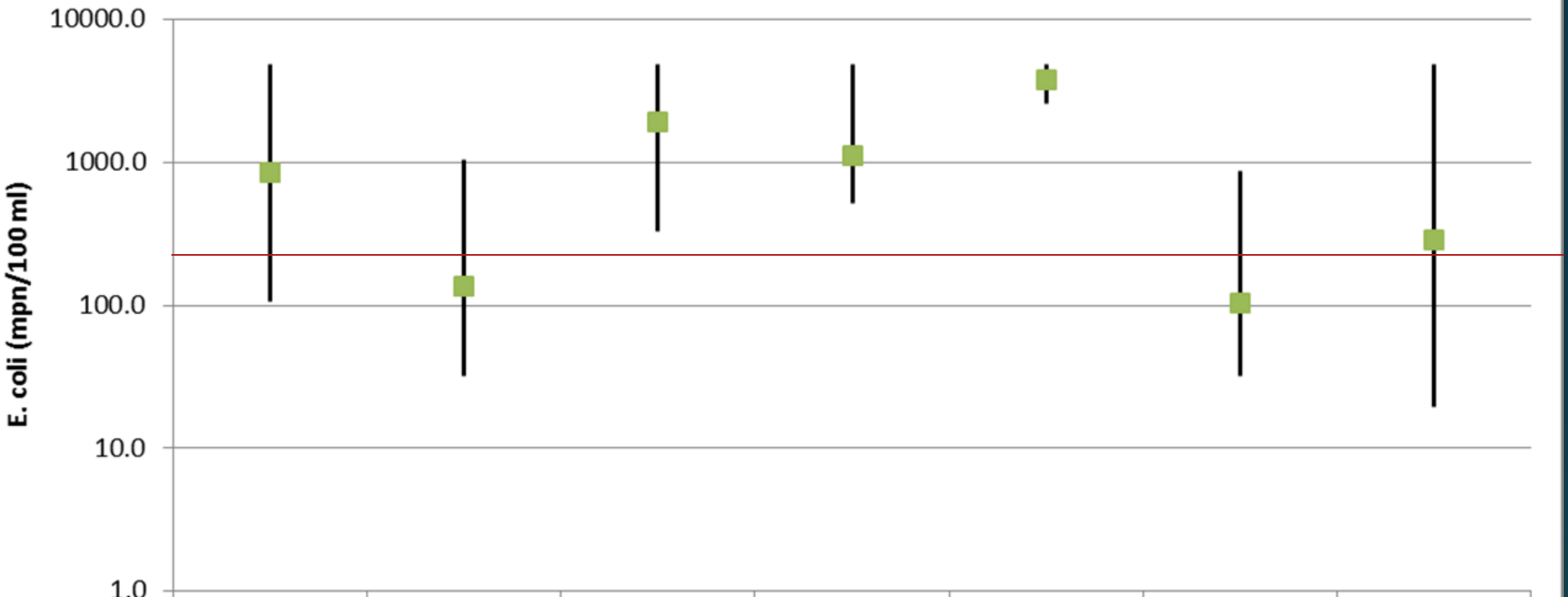
Williams Creek CSI Project - 2017

- Monitor *E. coli*
  - 303(d) list for *E. coli* in 2010

Williams Creek – St. Louis County – (*E. coli*)

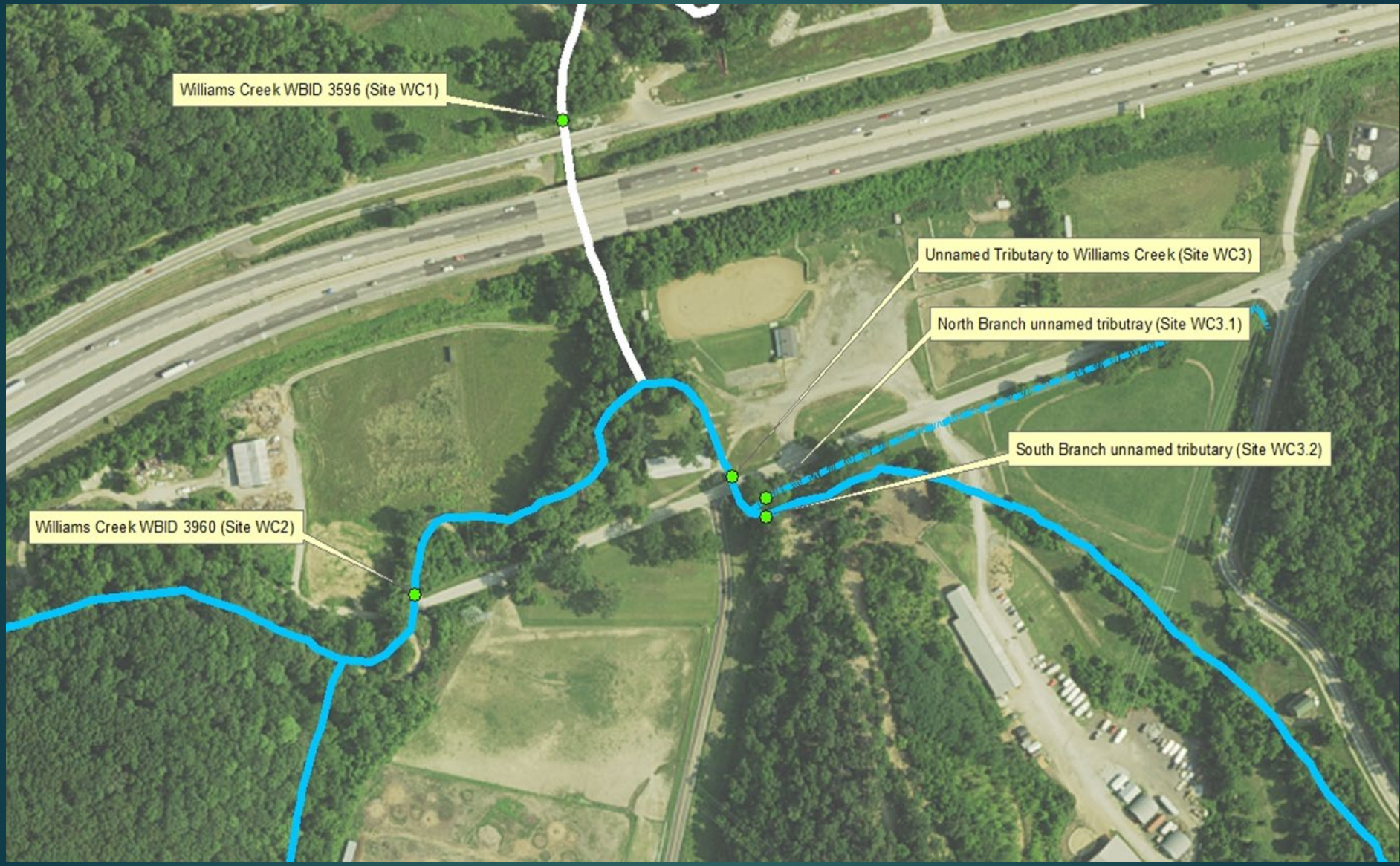


Williams Creek CSI Project
E. coli Data (Log_{10} Scale)
4/12/2017 - 10/10/2017



	WC1 (n=7)	WC2 (n=7)	WC3 (n=7)	WC3.1 (n=4)	WC3.2 (n=4)	WC4 (n=7)	WC7 (n=7)
Maximum	4839.2	1034.4	4839.2	4839.2	4839.2	870.4	4839.2
Minimum	107.4	32.2	332.8	522.6	2599.4	32	19.6
Geomean	852.4	135.1	1934.3	1110.0	3833.3	104.2	286.0

Williams Creek – Site 3



Williams Creek CSI Project
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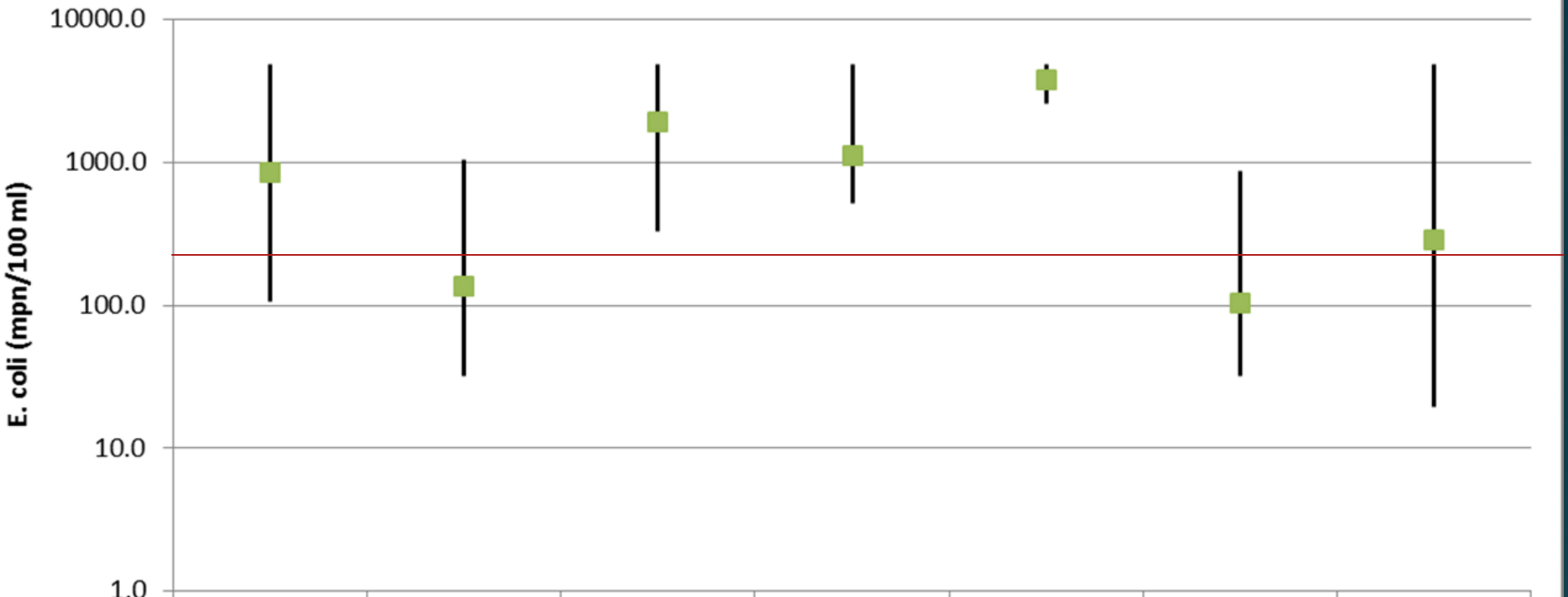

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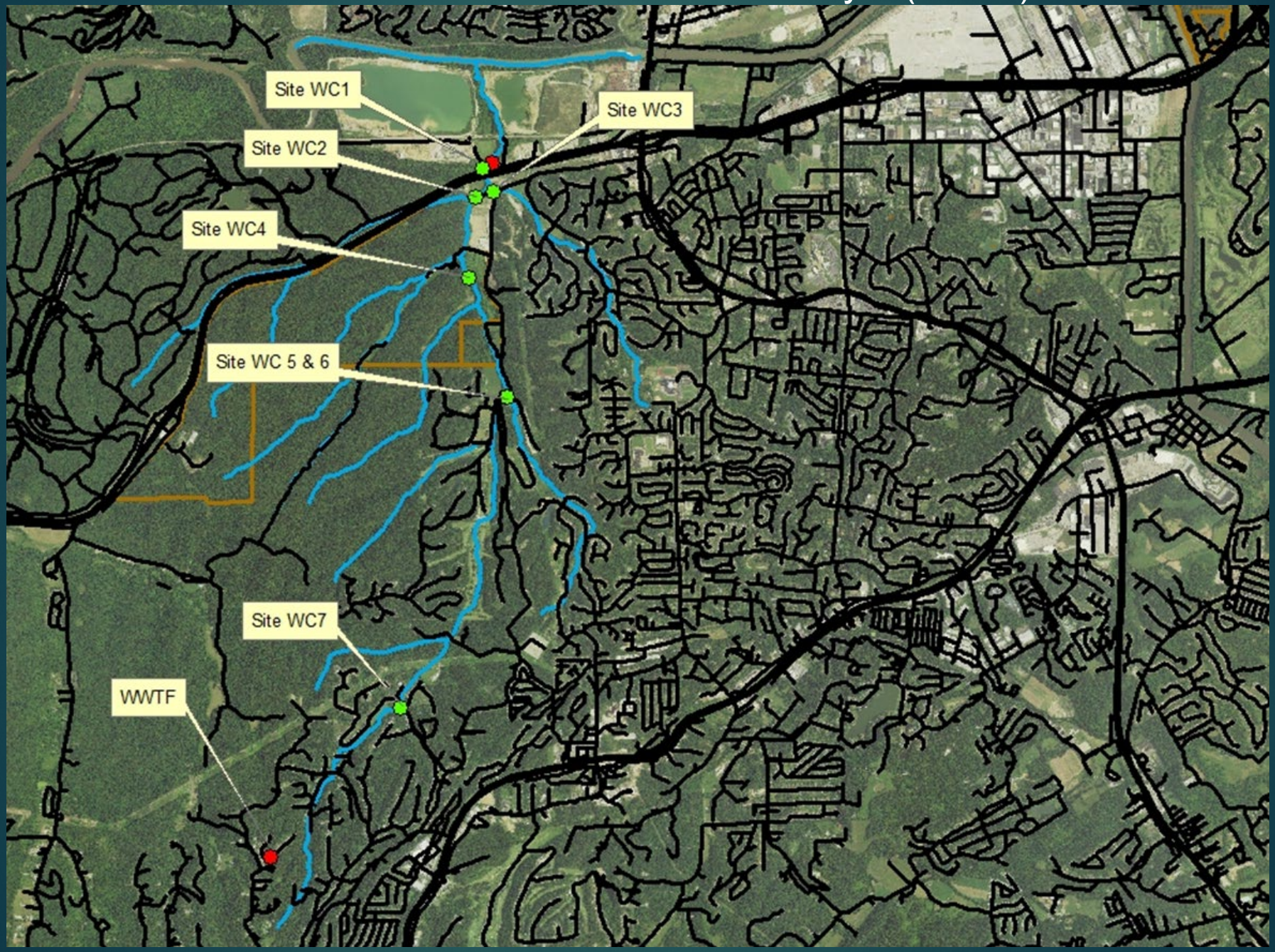
Williams Creek – St. Louis County – (*E. coli*)



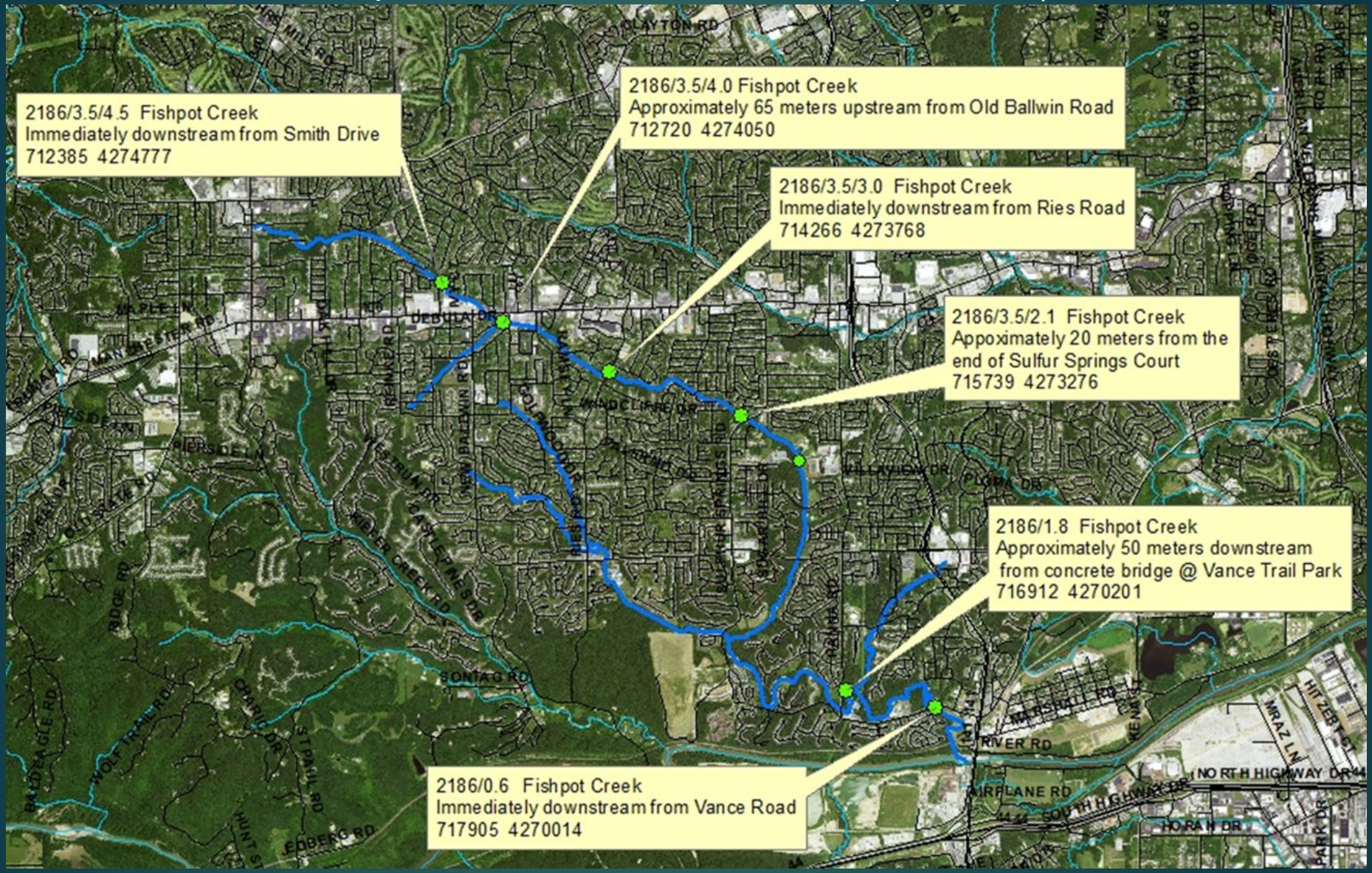
Williams Creek CSI Project - Results

- *E. coli* data used for 303(d) assessment
- *E. coli* hot spot located

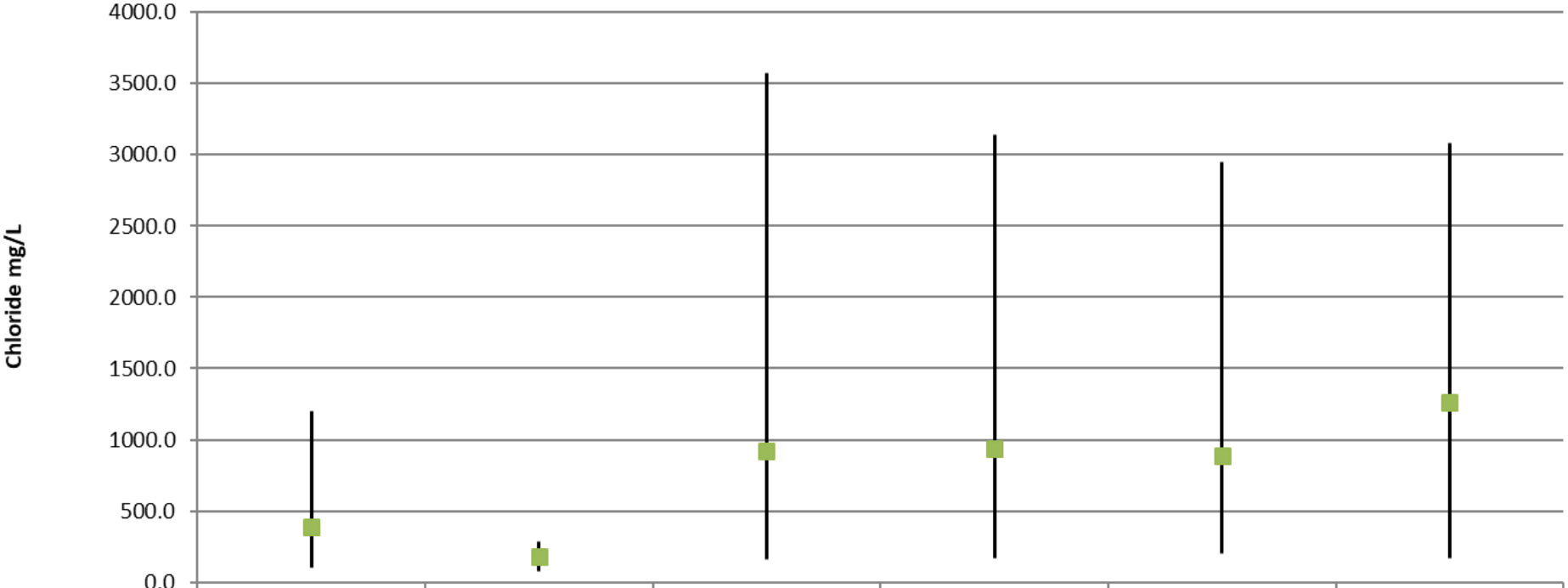
Fishpot Creek CSI Project – 2019/2020

- Monitor chloride
  - 303(d) list for chloride in 2012

Fishpot Creek – St. Louis County (chloride)

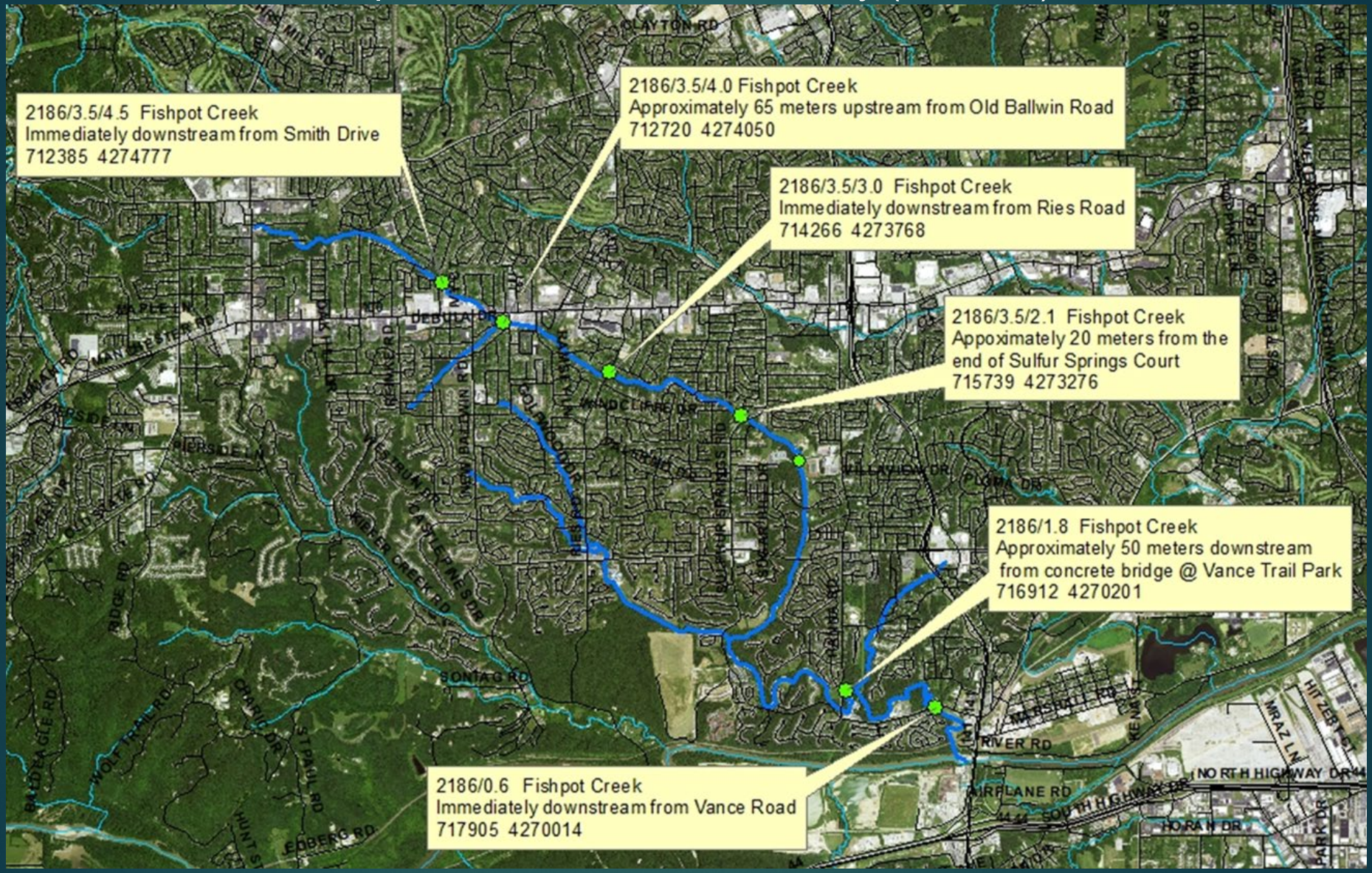


Fishpot Creek CSI Project
Chloride Data
12/05/2019 - 3/05/2020



	2186\0.6 (n=6)	2186\1.8 (n=6)	2186\3.5\2.1 (n=6)	2186\3.5\3.0 (n=6)	2186\3.5\4.0 (n=6)	2186\3.5\4.5 (n=6)
Maximum	1200.0	286.0	3570.0	3140.0	2950.0	3080.0
Minimum	98.2	80.3	159.0	165.0	205.0	167.0
Overall Average	389.9	178.3	922.4	939.4	890.4	1261.3

Fishpot Creek – St. Louis County (chloride)



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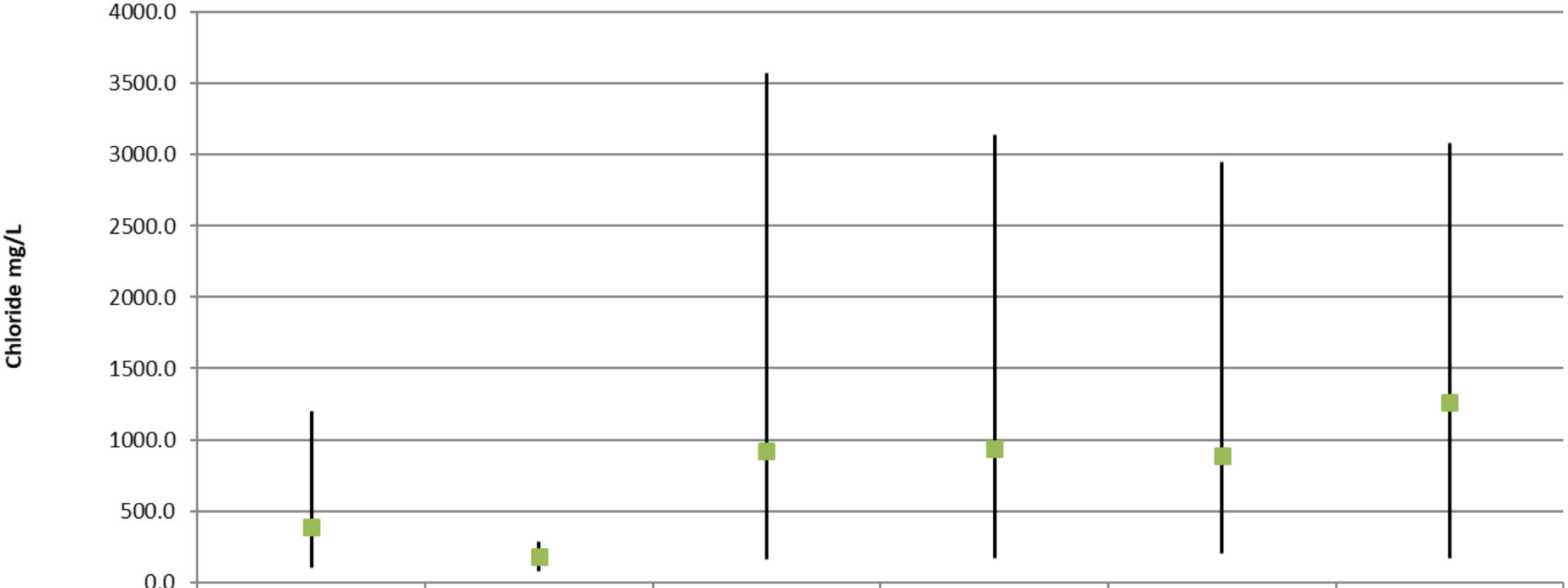

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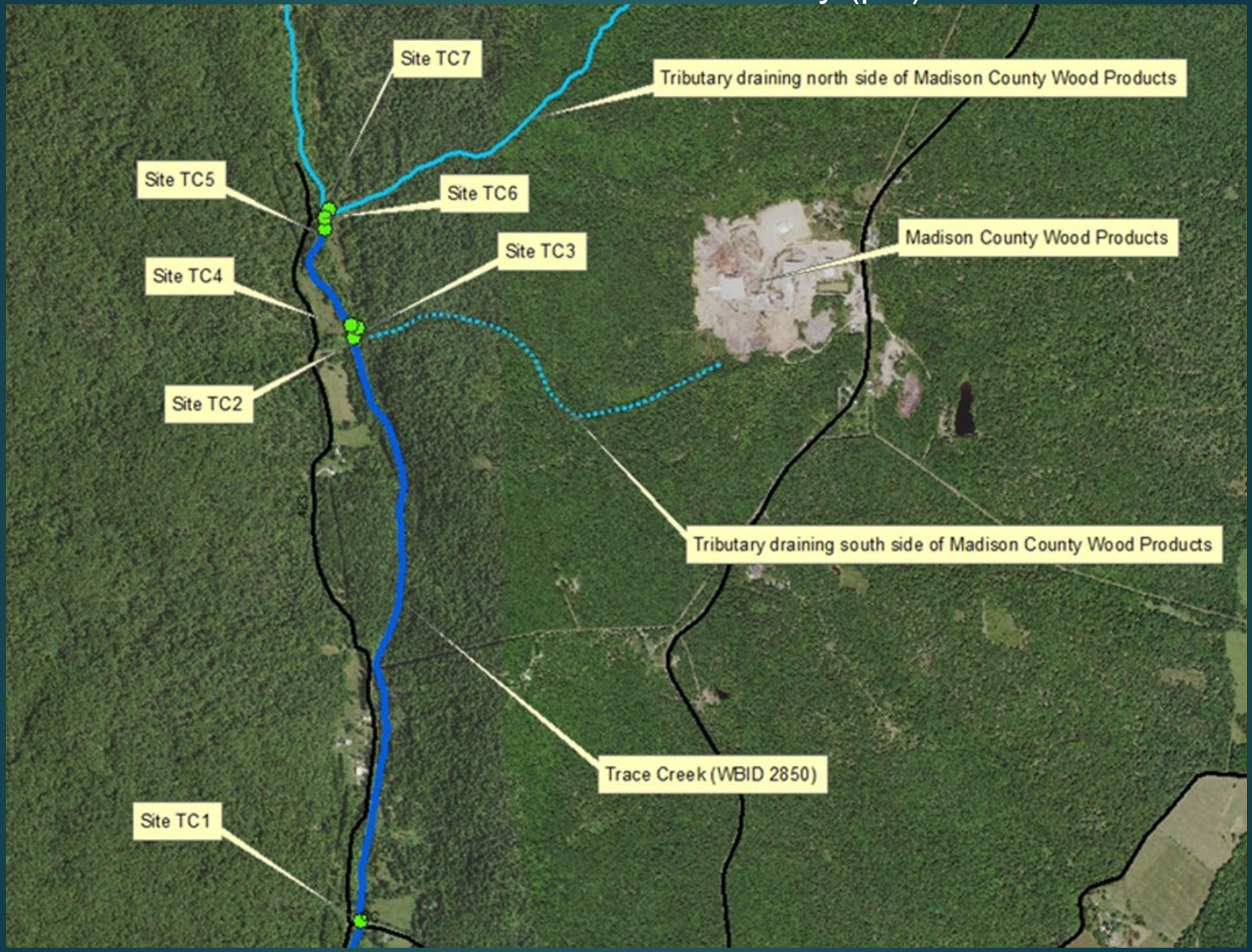
Fishpot Creek CSI Project - Results

- Chloride data will be used for 303(d) assessment data
- Hot spot located
- Lesson learned = don’t assume downstream chloride data is representative

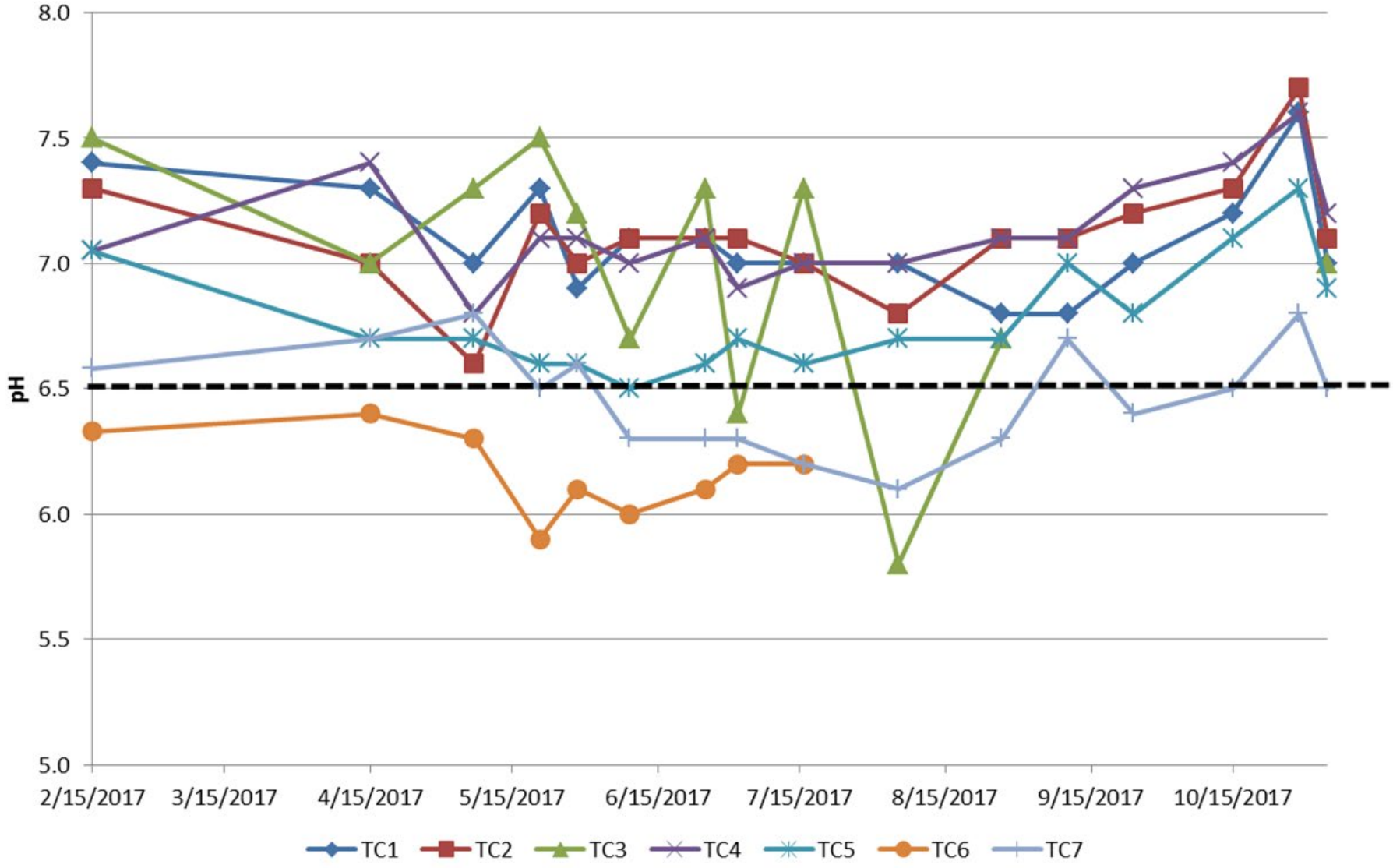
Trace Creek CSI Project - 2017

- 303(d) list for pH in 1998
  - TMDL approved in 2004

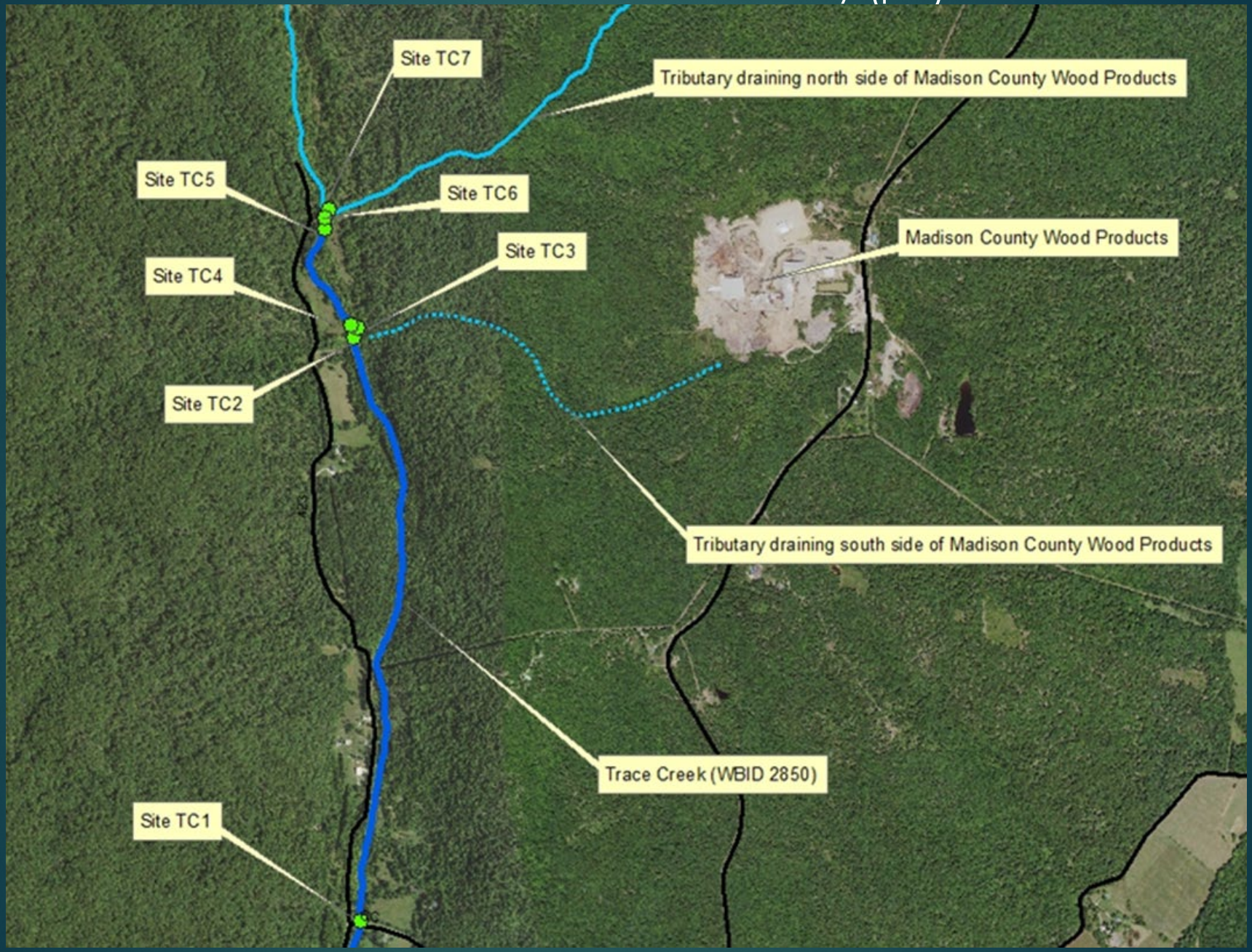
Trace Creek – Madison County (pH)



Trace Creek CSI Project - 2017



Trace Creek – Madison County (pH)



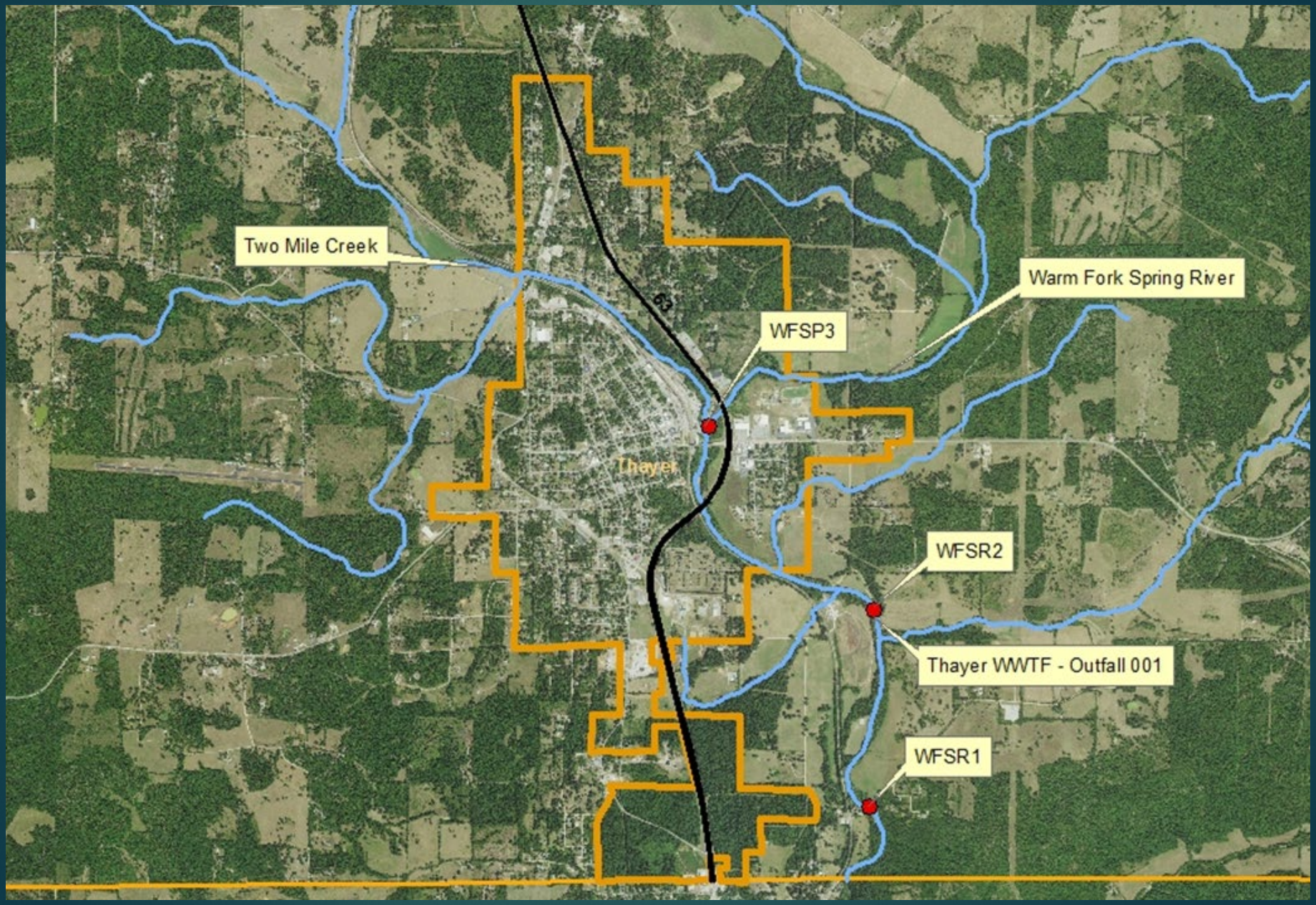
Trace Creek CSI project Results

- Post-TMDL monitoring for pH
- Important relationship between pH and watershed location (predominantly rhyolite geology in upper watershed changing to dolomite geology in lower watershed)
- Important relationship between pH, watershed location, and temperature

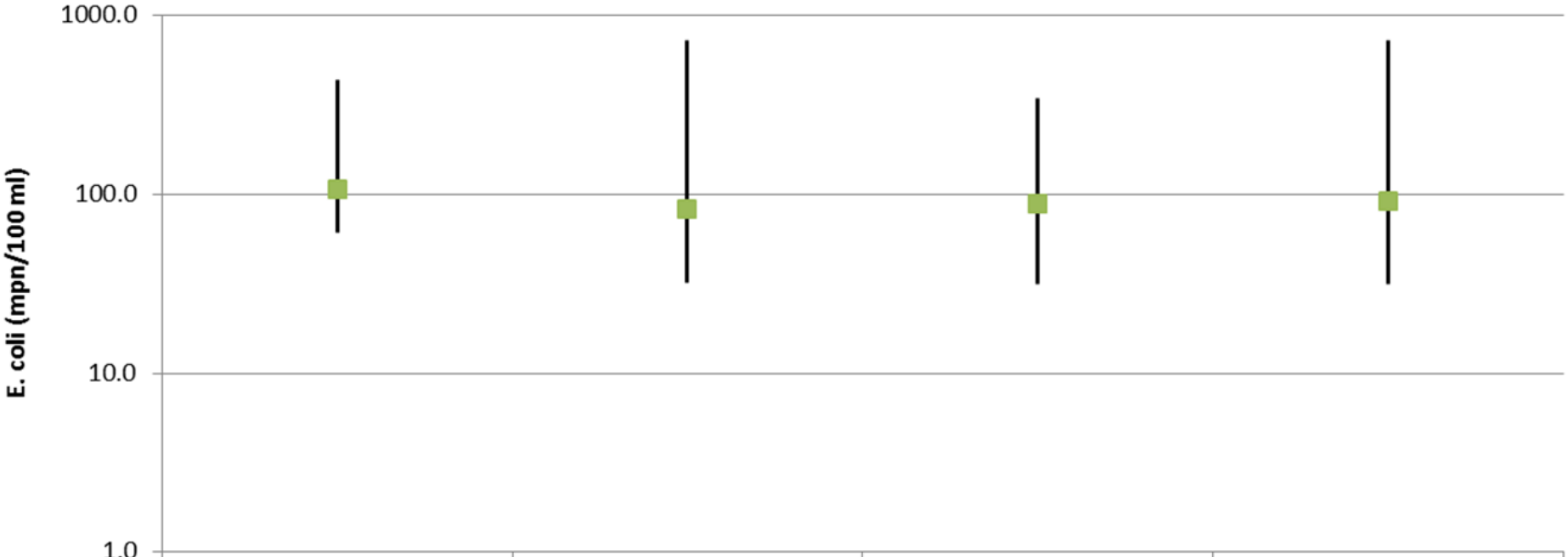
Warm Fork Spring River CSI Project - 2016

- 303(d) list for coliform bacteria in 2006

Warm Fork Spring River – Oregon County (*E. coli*)

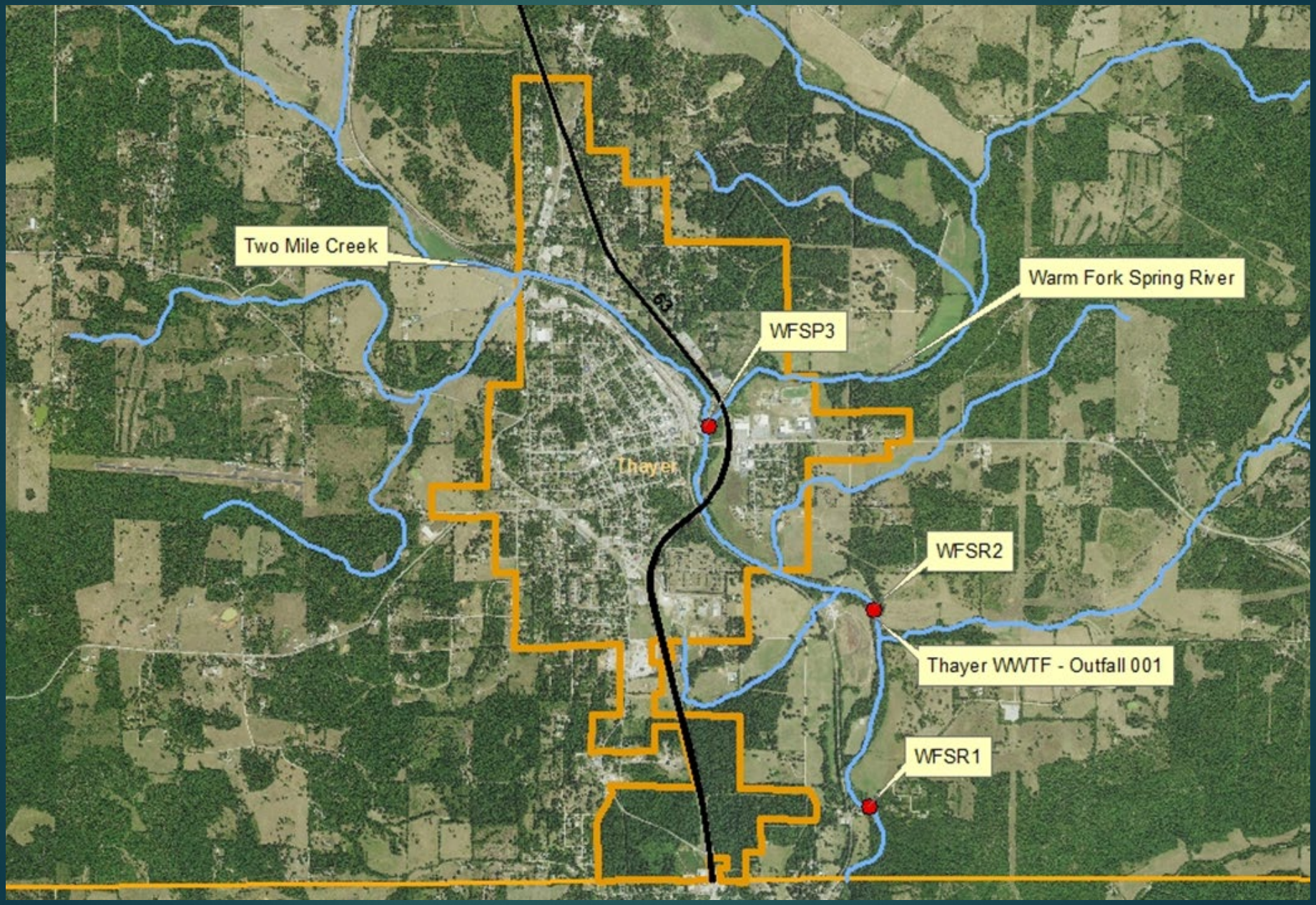


Warm Fork Spring River CSI Project
E. coli Data (Log_{10} Scale)
4/25/2016 - 10/03/2016



	WC1 (n=7)	WC2 (n=7)	WC3 (n=7)	Overall (n=21)
Maximum	435.2	727	344.8	727.0
Minimum	60.9	31.8	31.5	31.5
Geomean	106.2	83.1	89.0	92.3

Warm Fork Spring River – Oregon County (*E. coli*)



Warm Fork Spring River Project Results

- *E. coli* data used for 303(d) assessment
- WBID de-listed due to more extensive and newer data

Lessons learned:

- Citizen science provides useful data for regulatory purposes
- CSI Projects are limited by having a volunteer in the right place at the right time
- Expecting volunteers to commit to long-term projects is not realistic
- The cooperative agreement with the Health Dept. overnight courier service is an invaluable asset for timely sample delivery and cost savings
- Some limitations to CSI *E. coli* projects are the 8-hour holding time and the lack of cooperating approved laboratories that are willing to donate man-power and equipment for timely sample analyses
- Project planning, site determination, and flexibility are often key to providing useful data

Questions?