



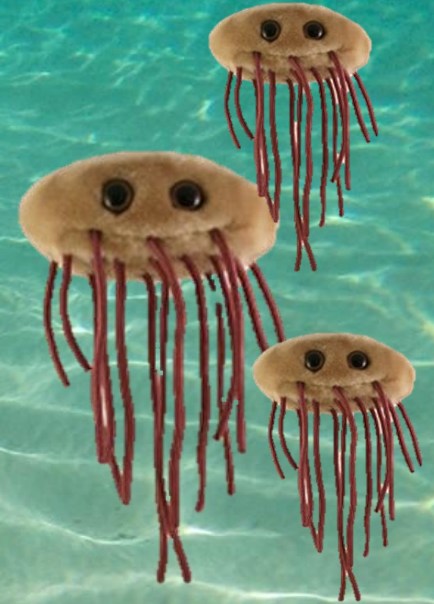
Statewide Efforts to Reduce *E. coli* in Surface Waters



Molly Rippke, Surface Water Assessment Section

MICHIGAN WATER QUALITY STANDARDS FOR *E. COLI*

- *E. coli* is our indicator of fecal pollution
- Designed to protect human health
- Partial body contact – year-round
 - 1000 *E. coli* per 100mL
- Total body contact – May 1-October 31
 - 300 *E. coli* per 100mL as a daily max.
 - 130 *E. coli* per 100mL as a 30-day geometric mean



What are the sources of *E. coli*?

- ◆ Point sources – regulated by NPDES permit
- ◆ Nonpoint sources- not regulated by NPDES permit

Regulated (CAFO)
and unregulated





Photo by Barry-Eaton District Health Department



Surface water
and
storm sewers



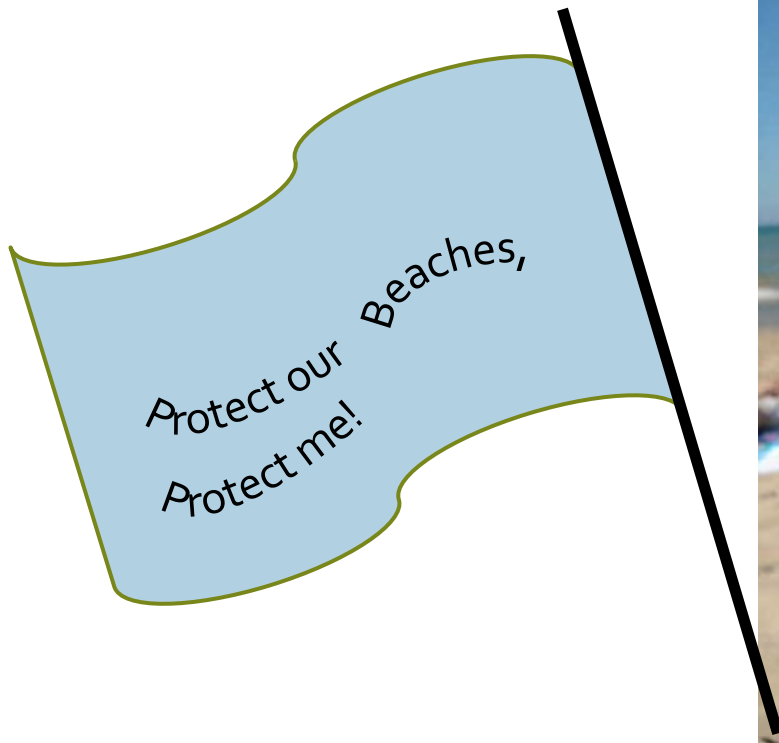
Regulated and unregulated







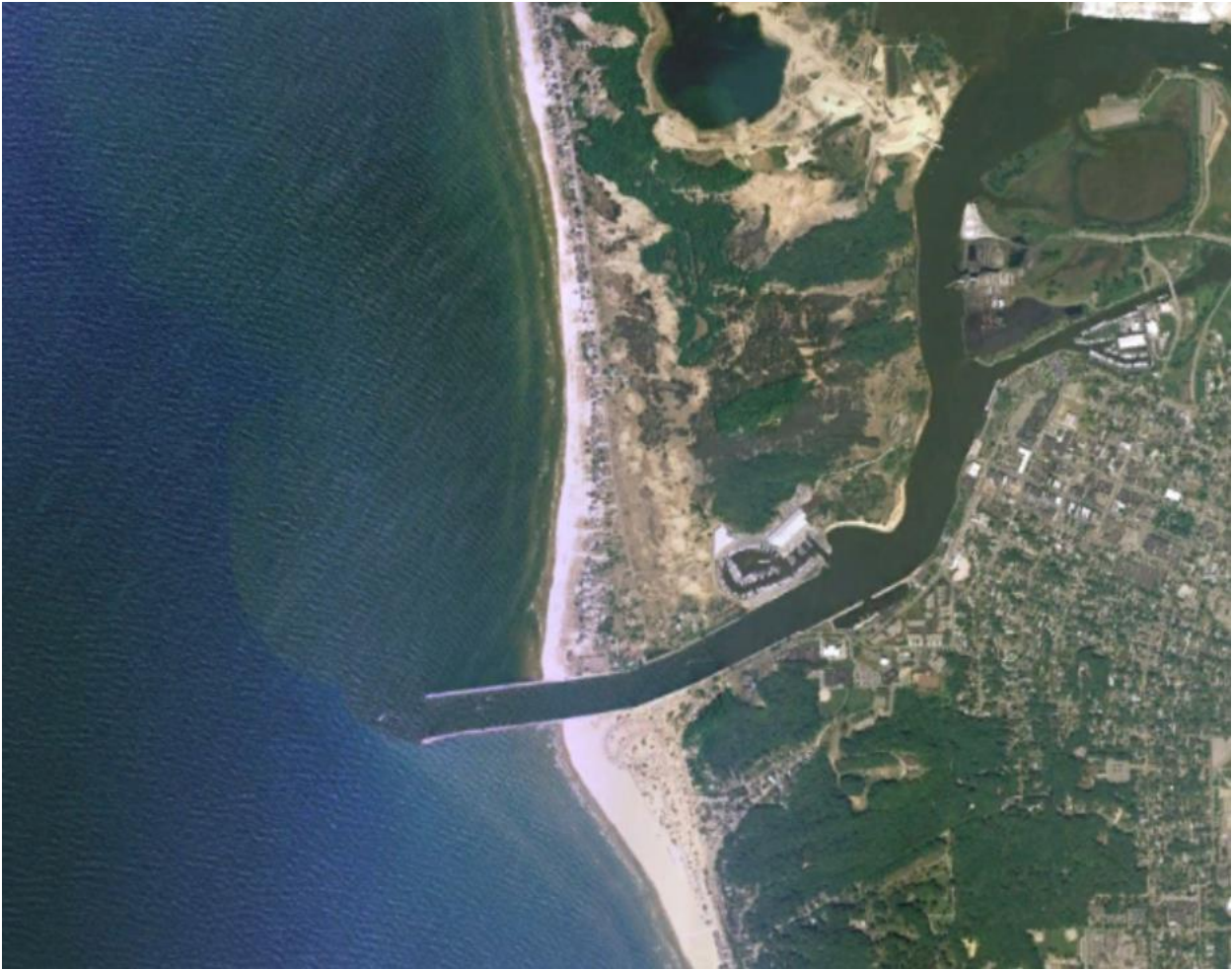
Normal effluent (disinfected)
Biosolids (treated)
CSOs must be controlled
SSOs (illegal)



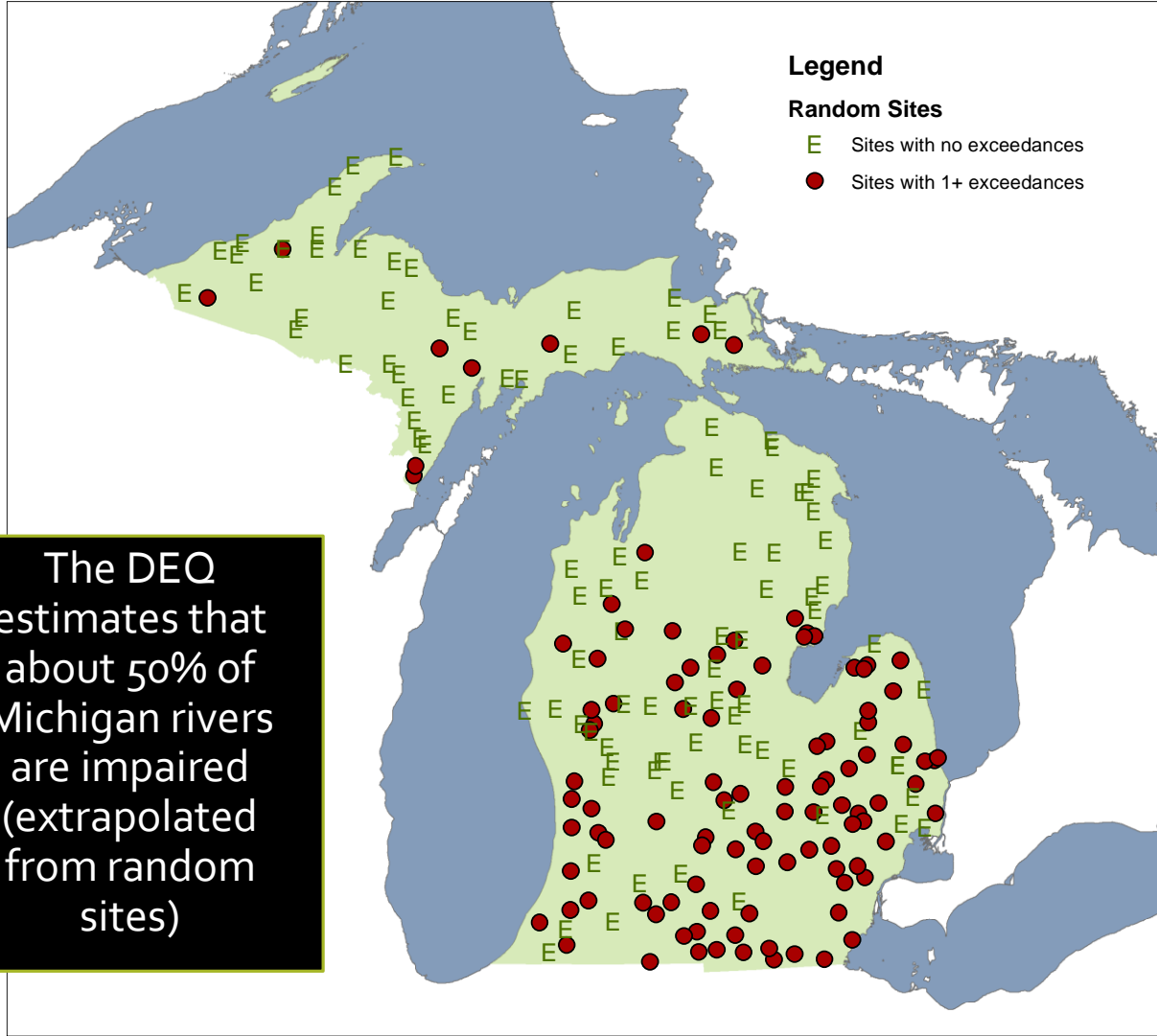


“All rivers
lead to
the beach”





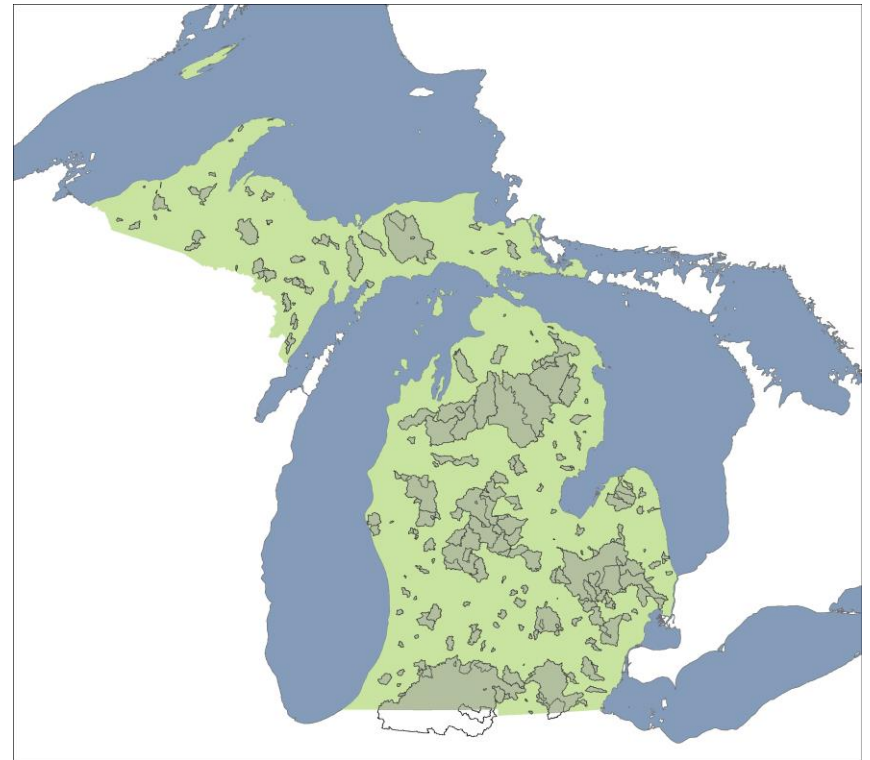




The DEQ estimates that about 50% of Michigan rivers are impaired (extrapolated from random sites)

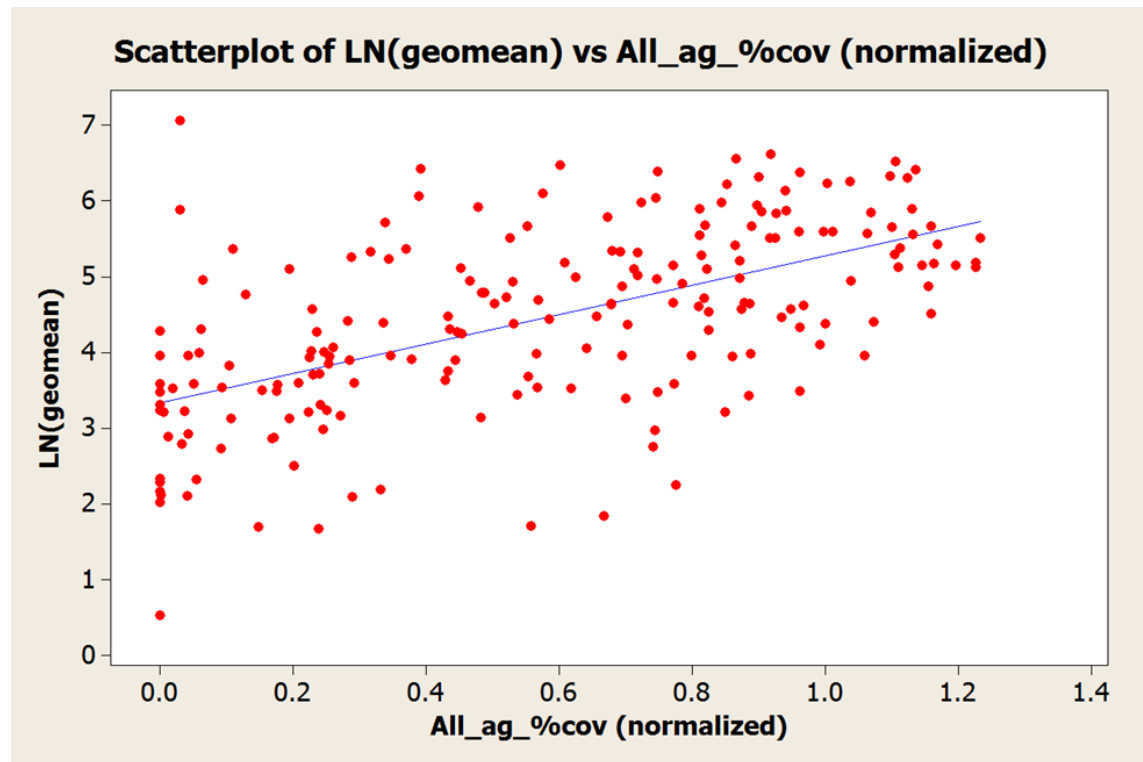
Study Design

- Methods
 - Completely random site selection done by the USEPA with the goal of making statewide conclusions on water quality
 - 50 sites per year - 2009, 2011, 2012 or 2013
 - Each site monitored 4 times (May, July, September, and November)



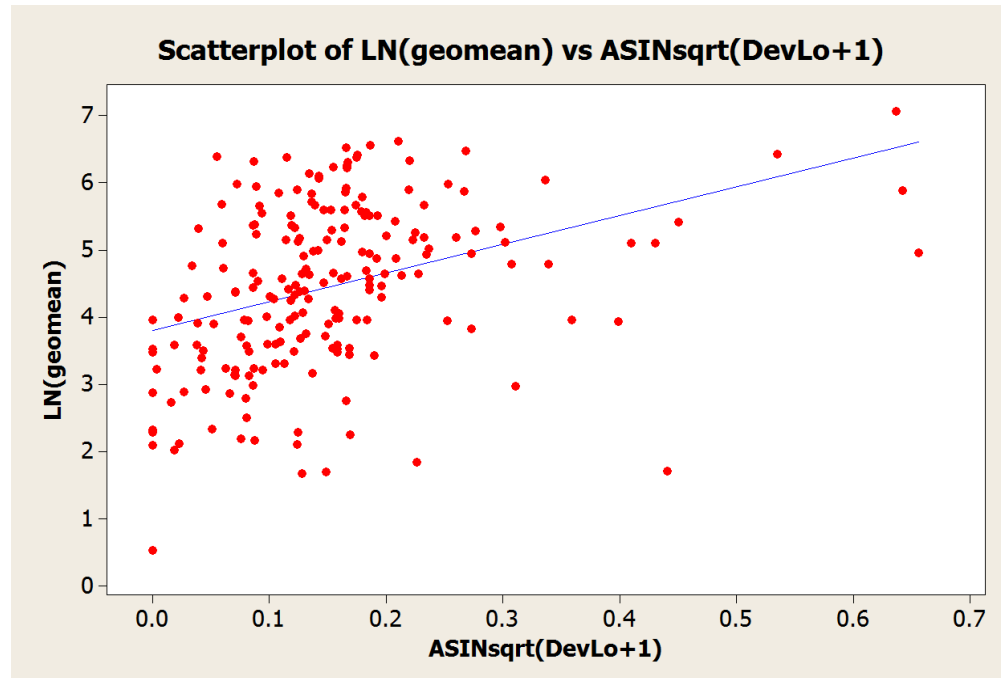
What watershed characteristics were correlated with HIGHER E. coli?

- Agricultural land cover
($r=0.59$)



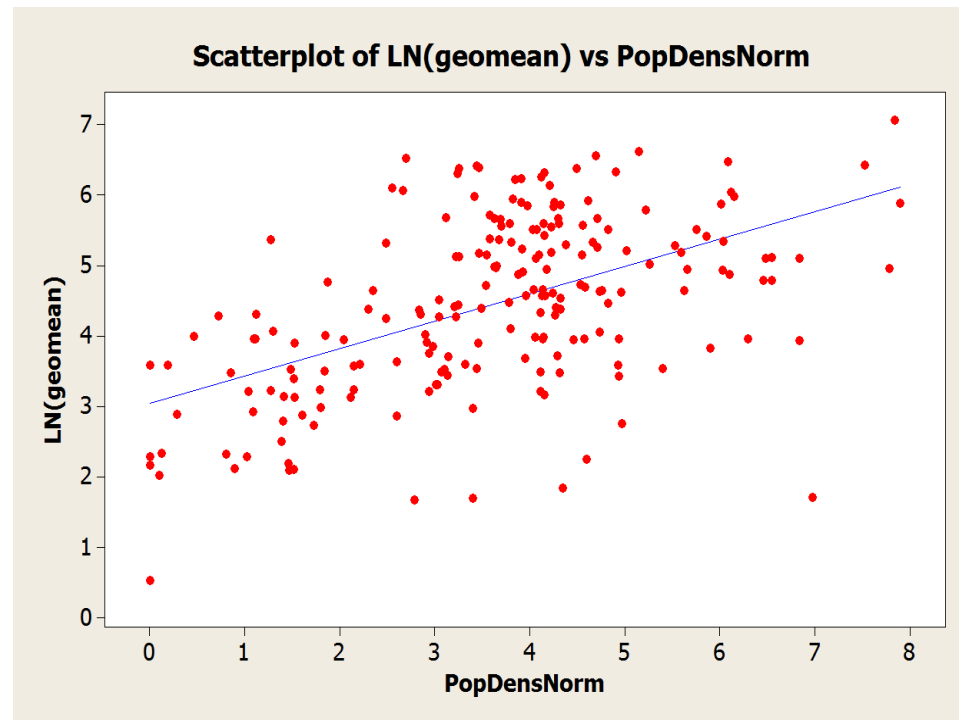
What watershed characteristics were correlated with HIGHER *E. coli*?

- *Low Density Developed land*
($r=0.37$)
- *All Dev. Land Combined?*
($r=0.29$)



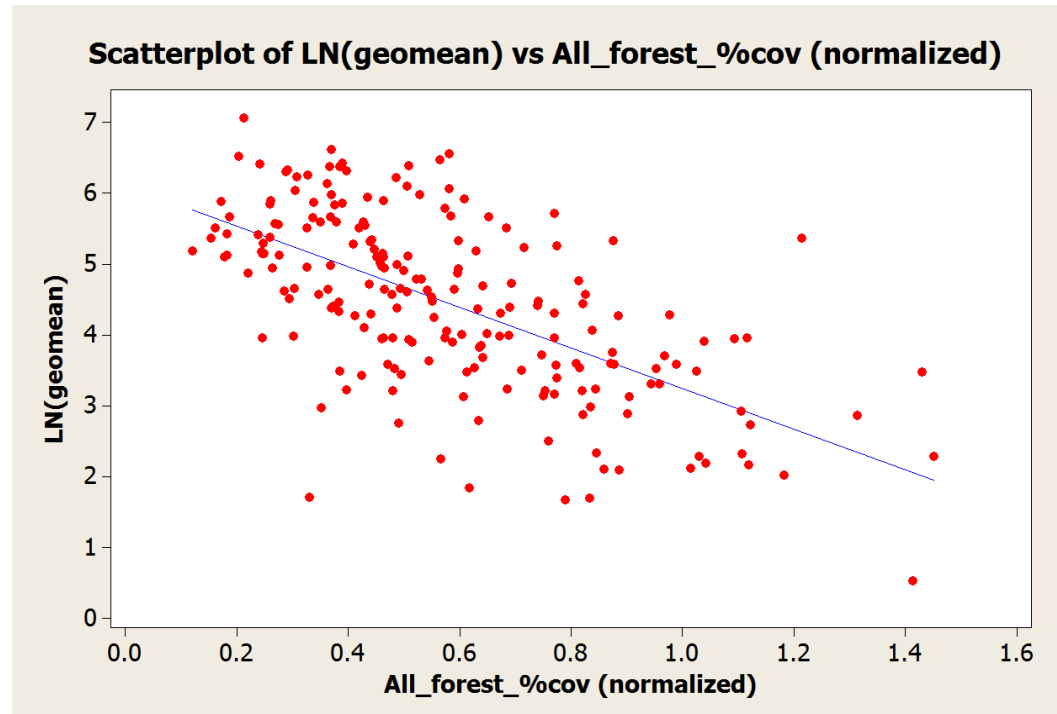
What watershed characteristics were correlated with HIGHER E. coli?

- Population Density ($r=0.53$)



What watershed characteristics were correlated with LOWER E. coli?

- Forested Land
($r = -0.63$)



Cannot solve the problem if we do not know what is causing it.

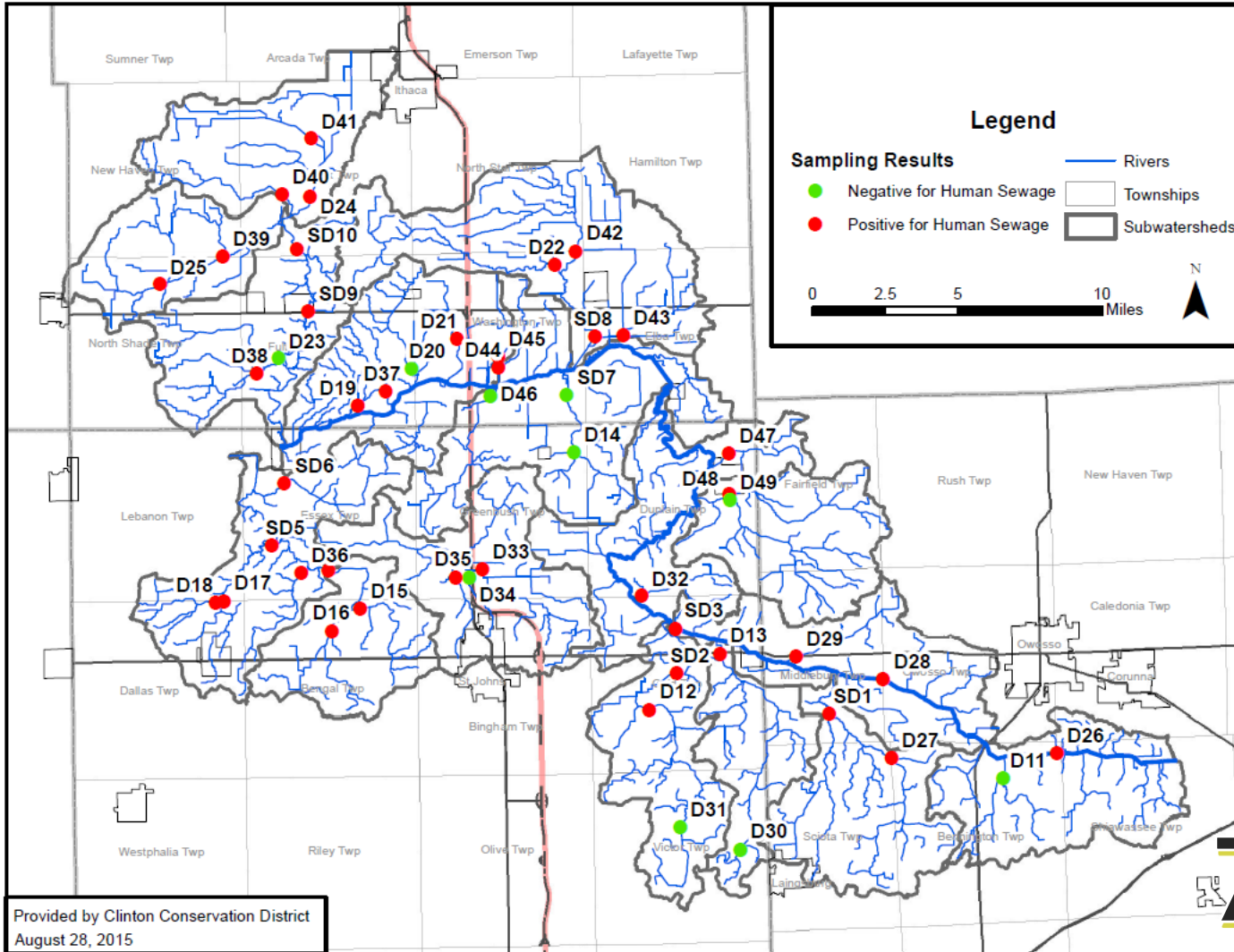
Options:

- Canine Scent Tracking for human sewage
- DNA/qPCR



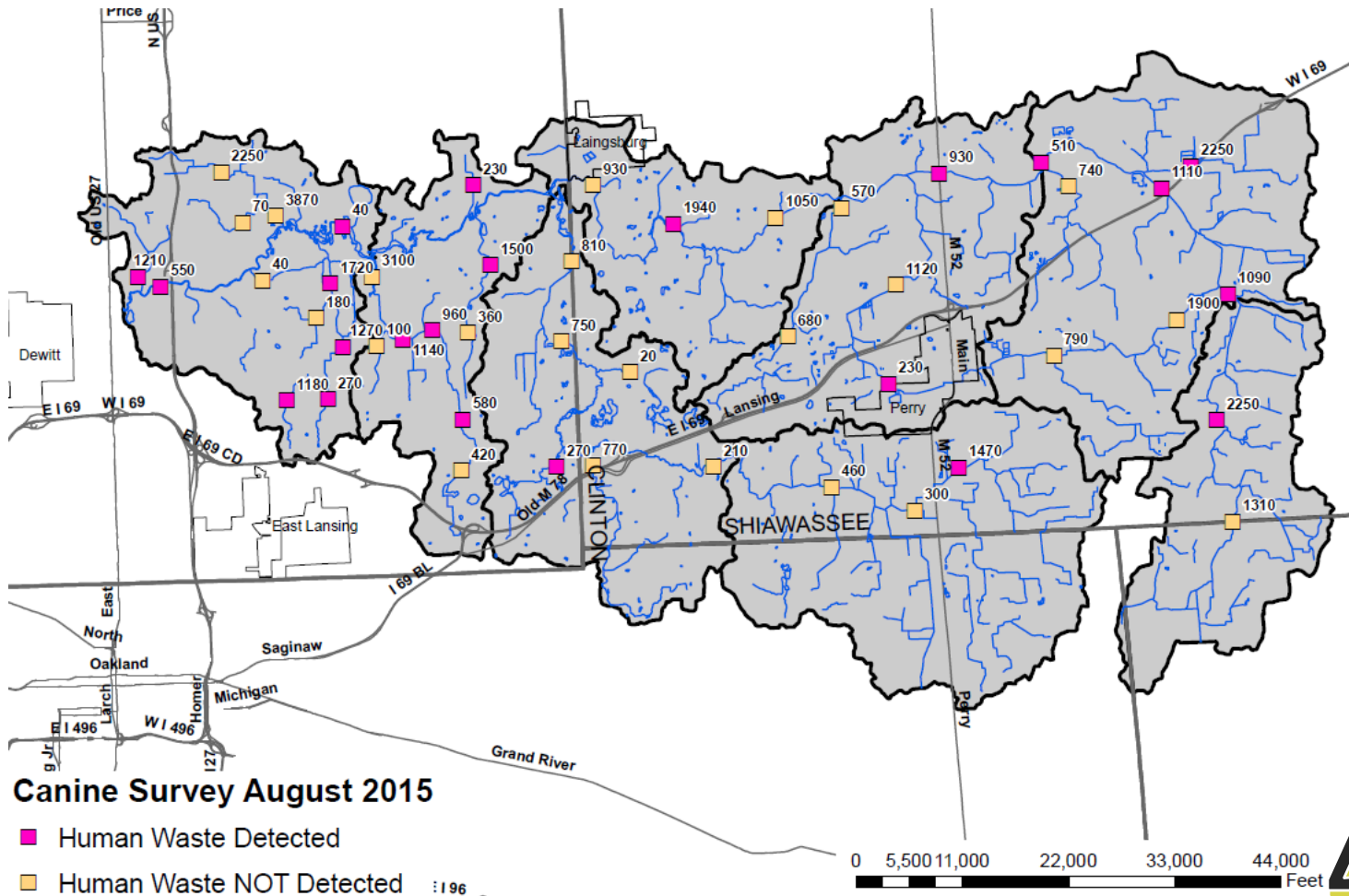
Maple River

Courtesy of Clinton County Conservation District – CMI
Funded Project



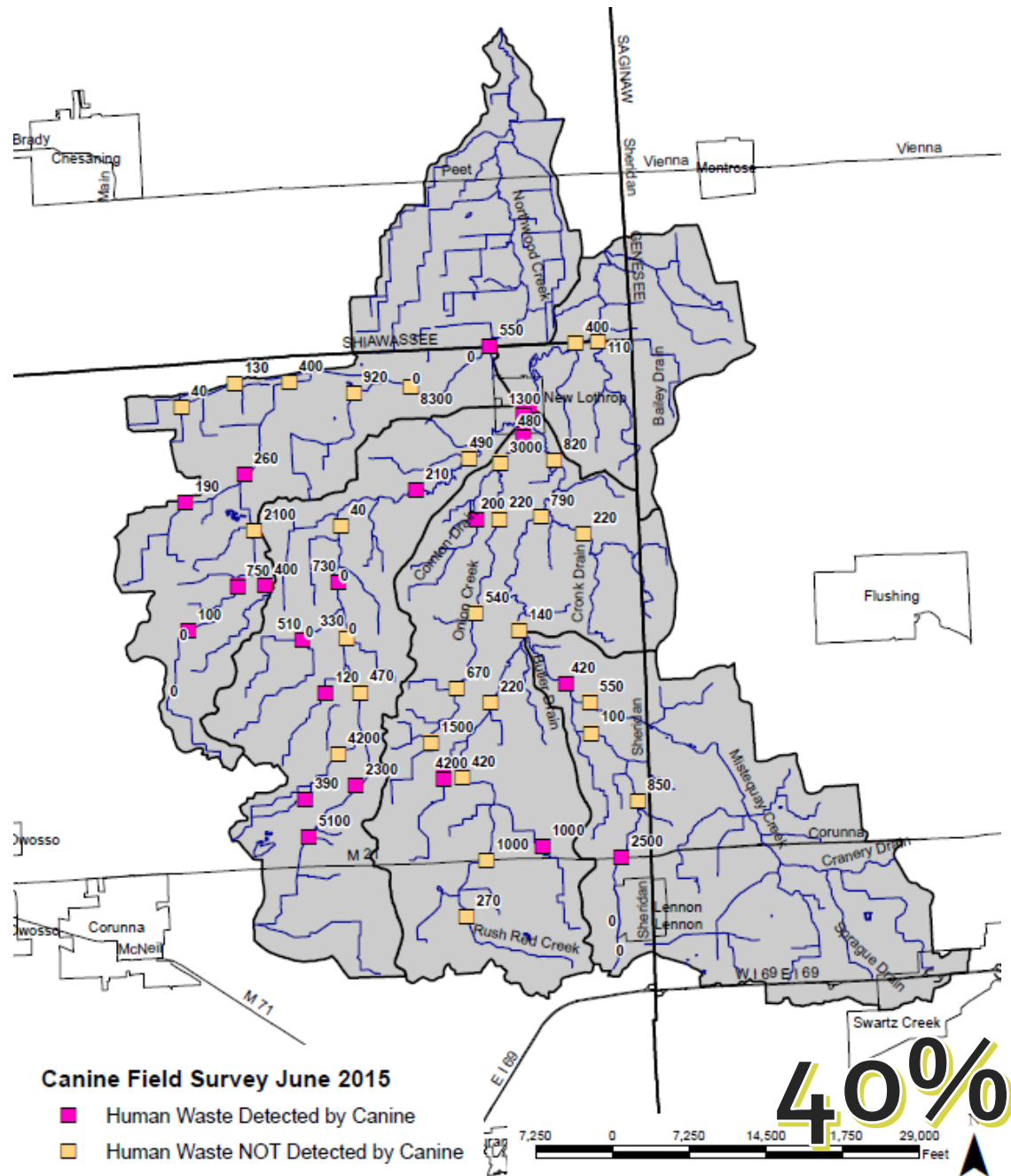
Upper Looking Glass

Courtesy of Shiawassee County Conservation District –
Project Funded by a SAW Grant



Misteguay

Courtesy of
Shiawassee
County
Conservation
District –
Project Funded
by a SAW
Grant



DNA/QPCR



WATER QUALITY ADVISORY

BACTERIAL LEVELS HERE CURRENTLY
EXCEED STATE STANDARDS.

CHILDREN, ELDERLY & THOSE IN
ILL HEALTH ARE ADVISED NOT TO SWIM.

- qPCR results for E. coli are a better predictor of illness than the culture method

WATER QUALITY ADVISORY

BACTERIAL LEVELS HERE CURRENTLY
EXCEED STATE STANDARDS.

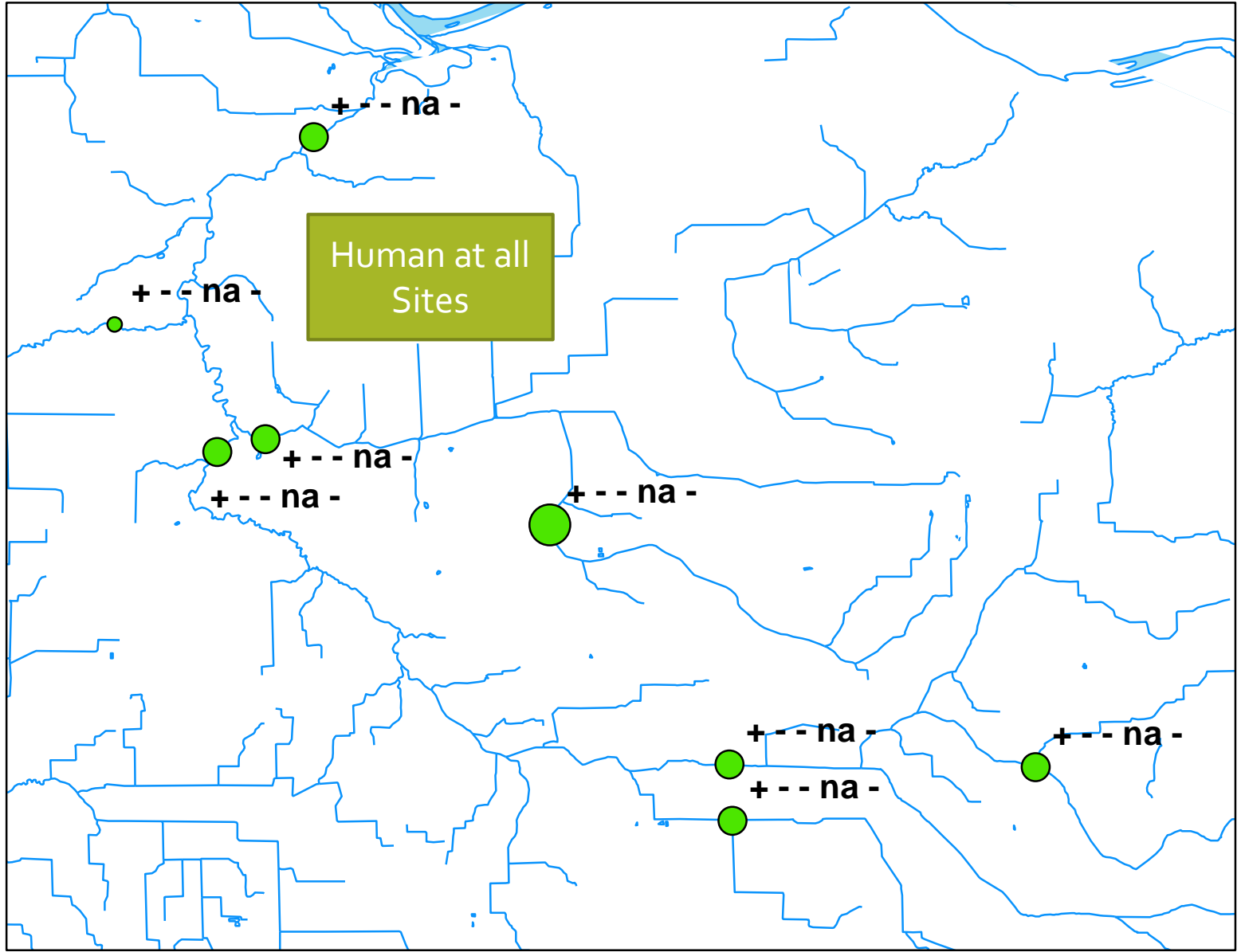
CHILDREN, ELDERLY & THOSE IN
ILL HEALTH ARE ADVISED NOT TO SWIM.

- But...we don't have a 'target' for qPCR yet (because the units are different than the culture method)

DNA/qPCR for Source Tracking

- Compares DNA (dead or alive) of sample to a library of known samples
- Very good at telling us what the cause is... not very good at telling us what the cause IS NOT

HUMAN, RUMINANT, BOVINE, GOOSE AND SWINE



Human at all Sites

+ - - na -

+ - - na -

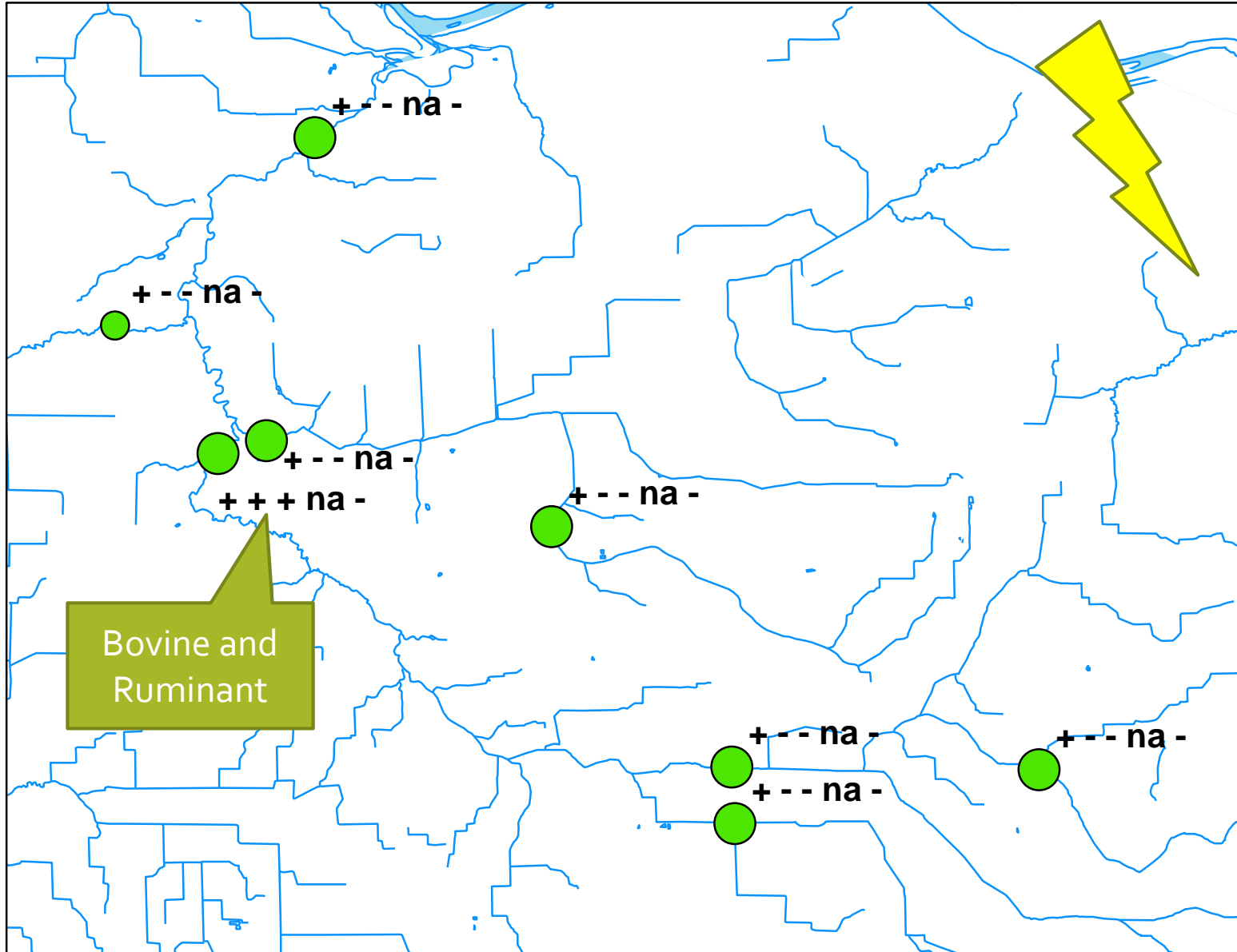
+ - - na -
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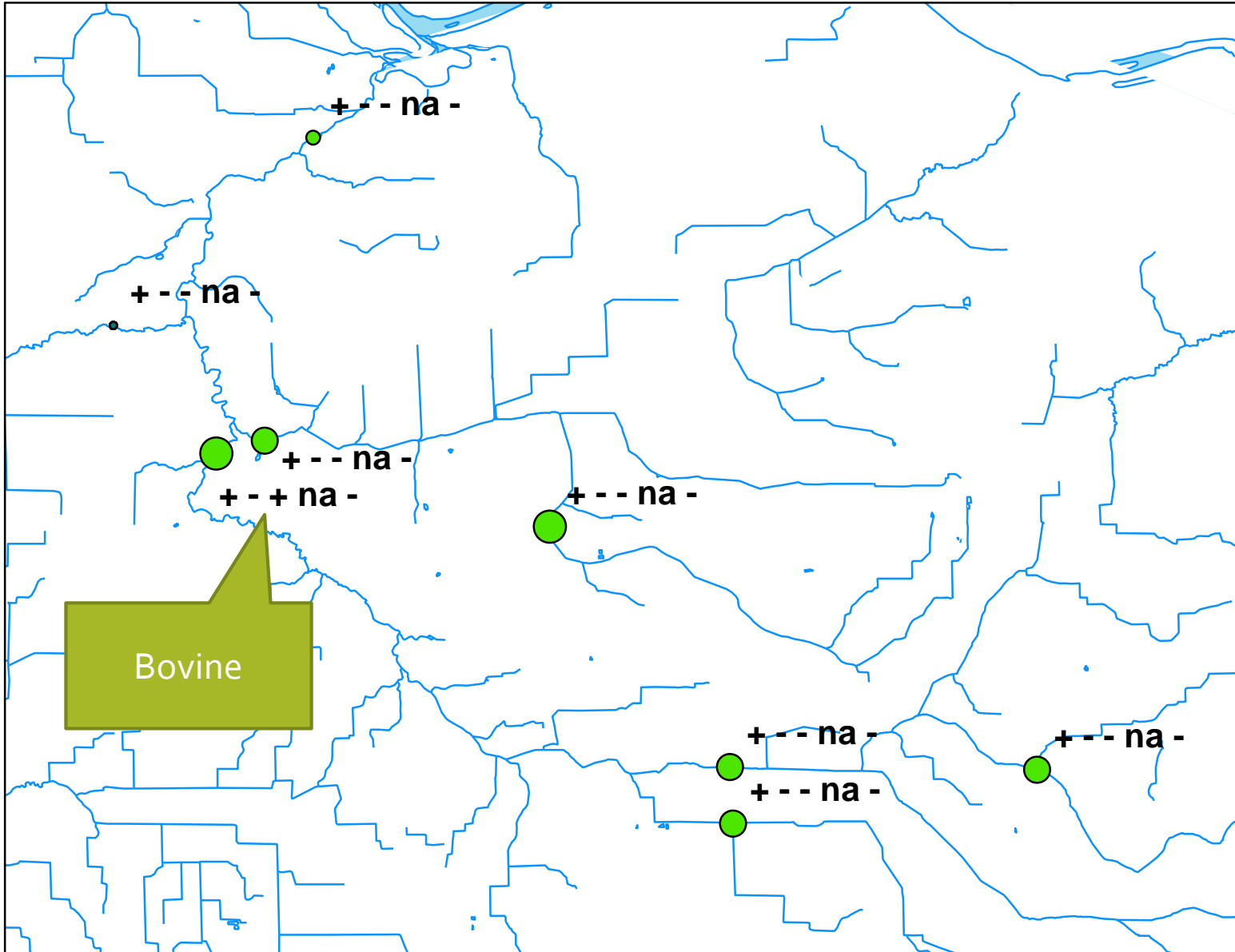
+ - - na -
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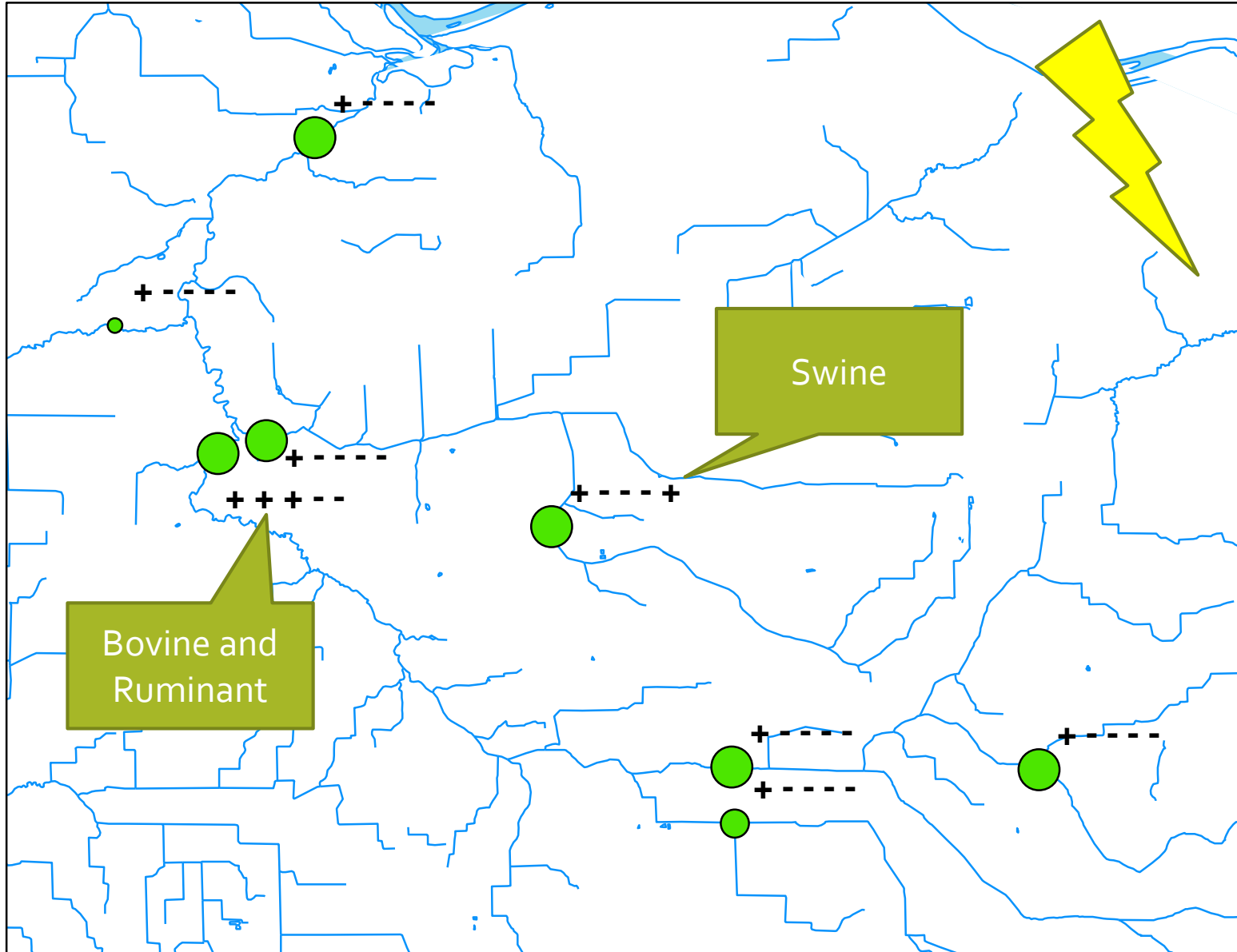
HUMAN, RUMINANT, BOVINE, GOOSE AND SWINE



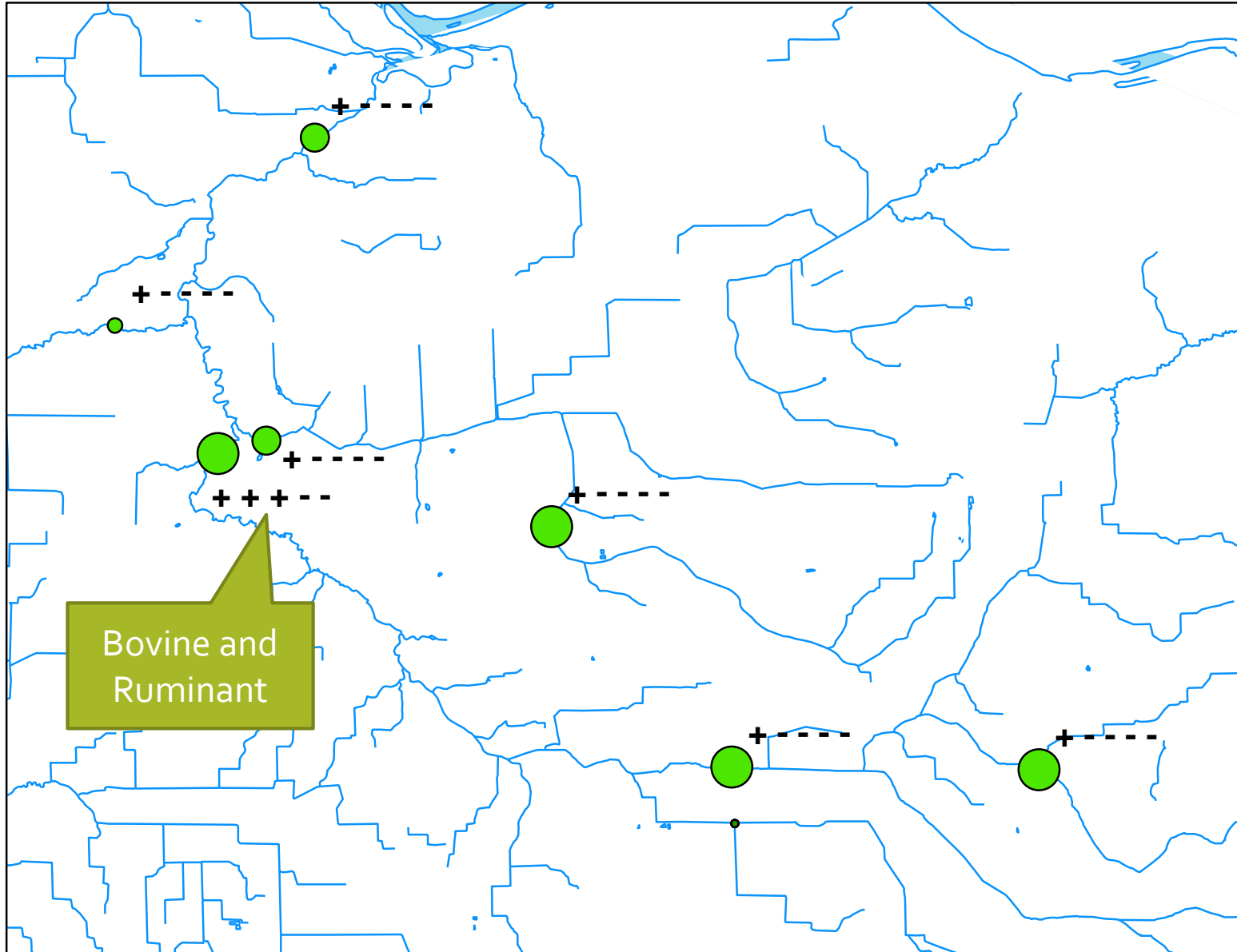
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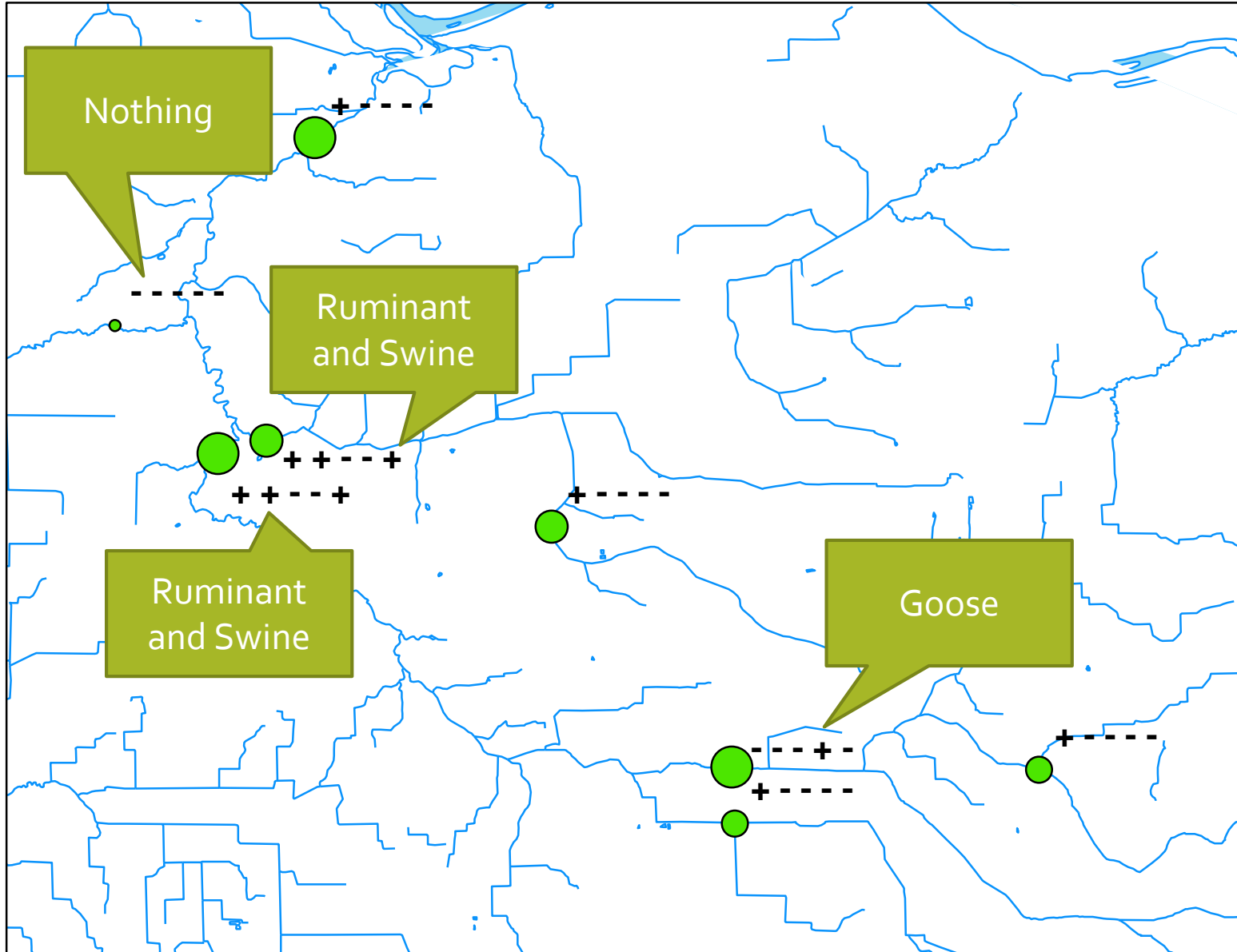
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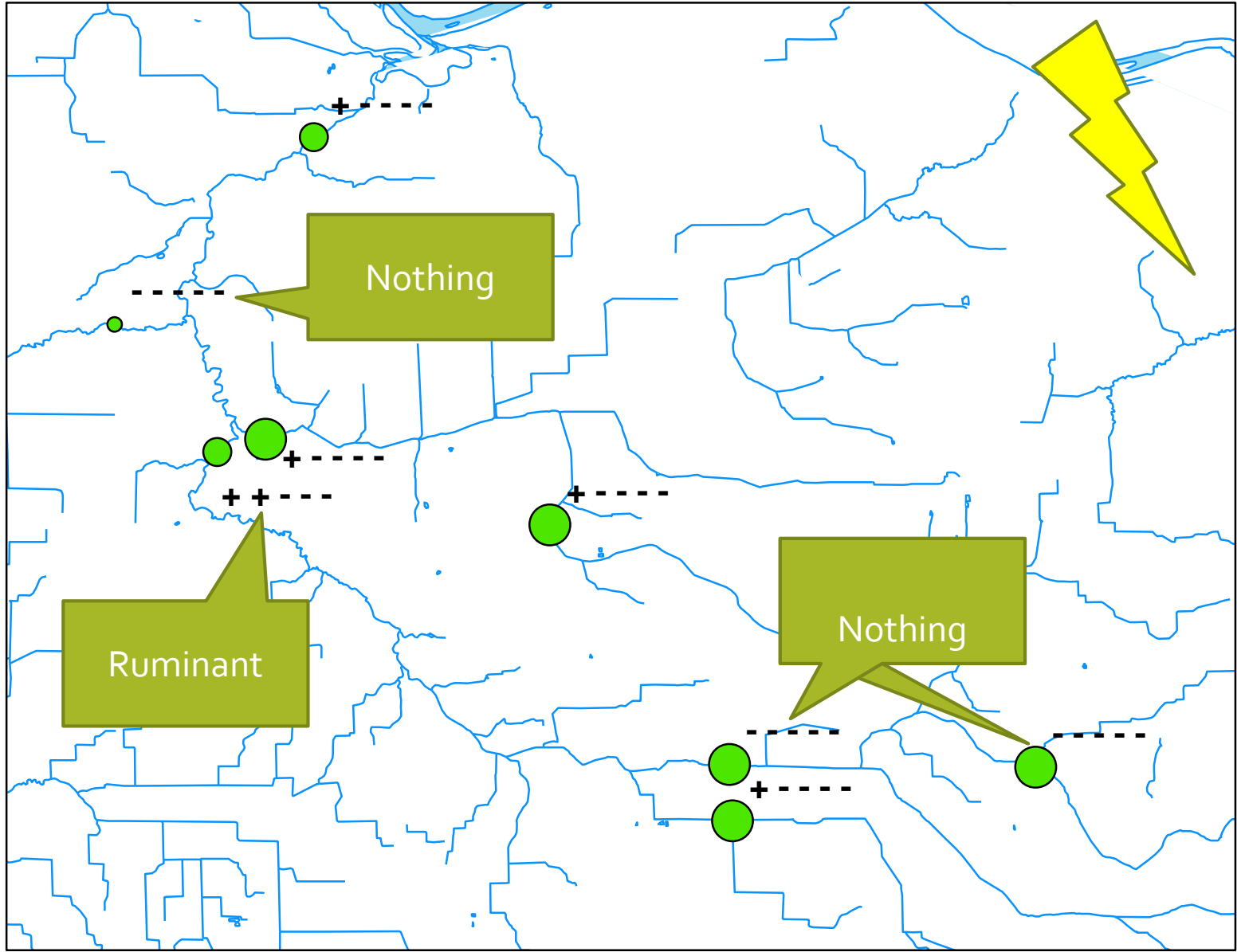
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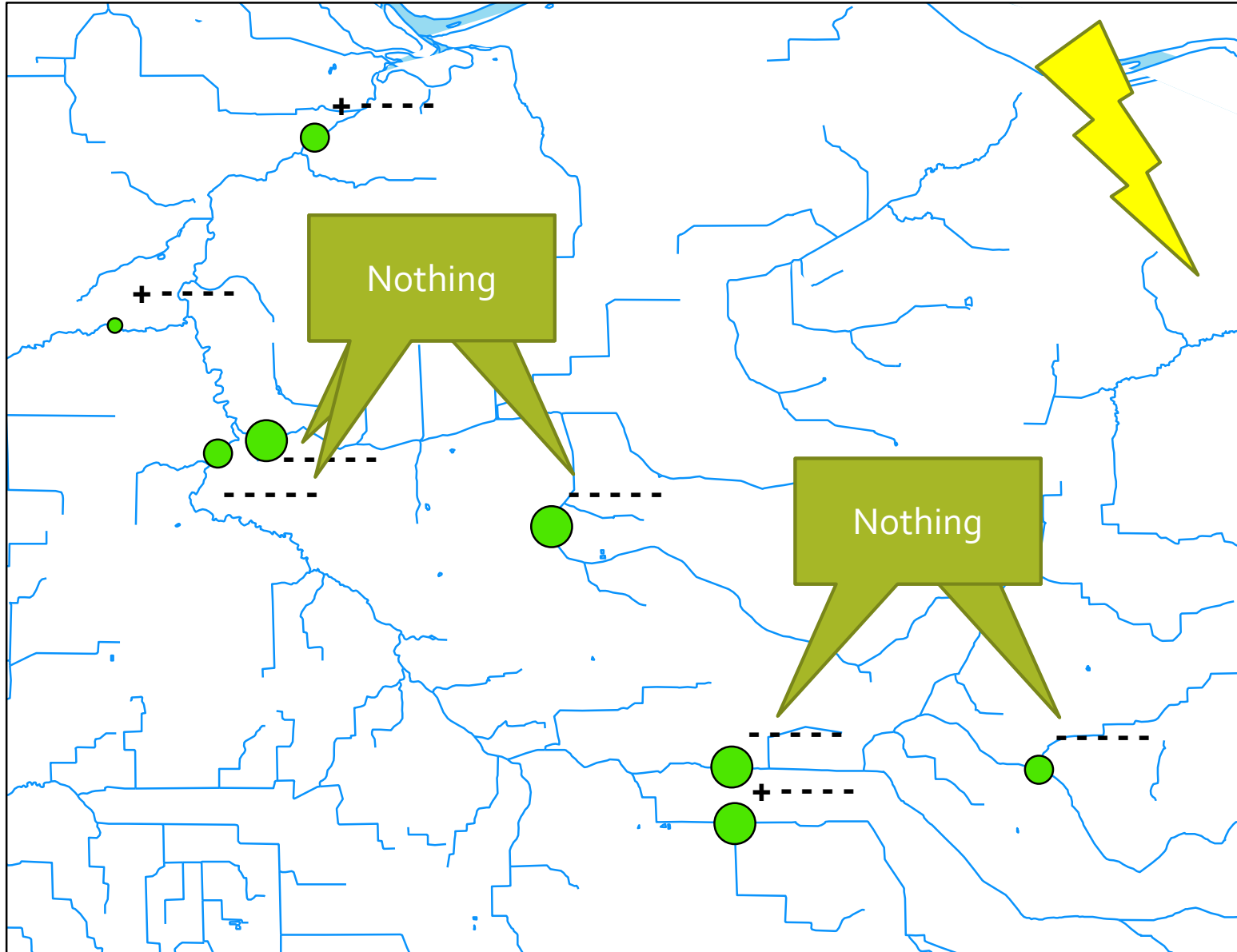
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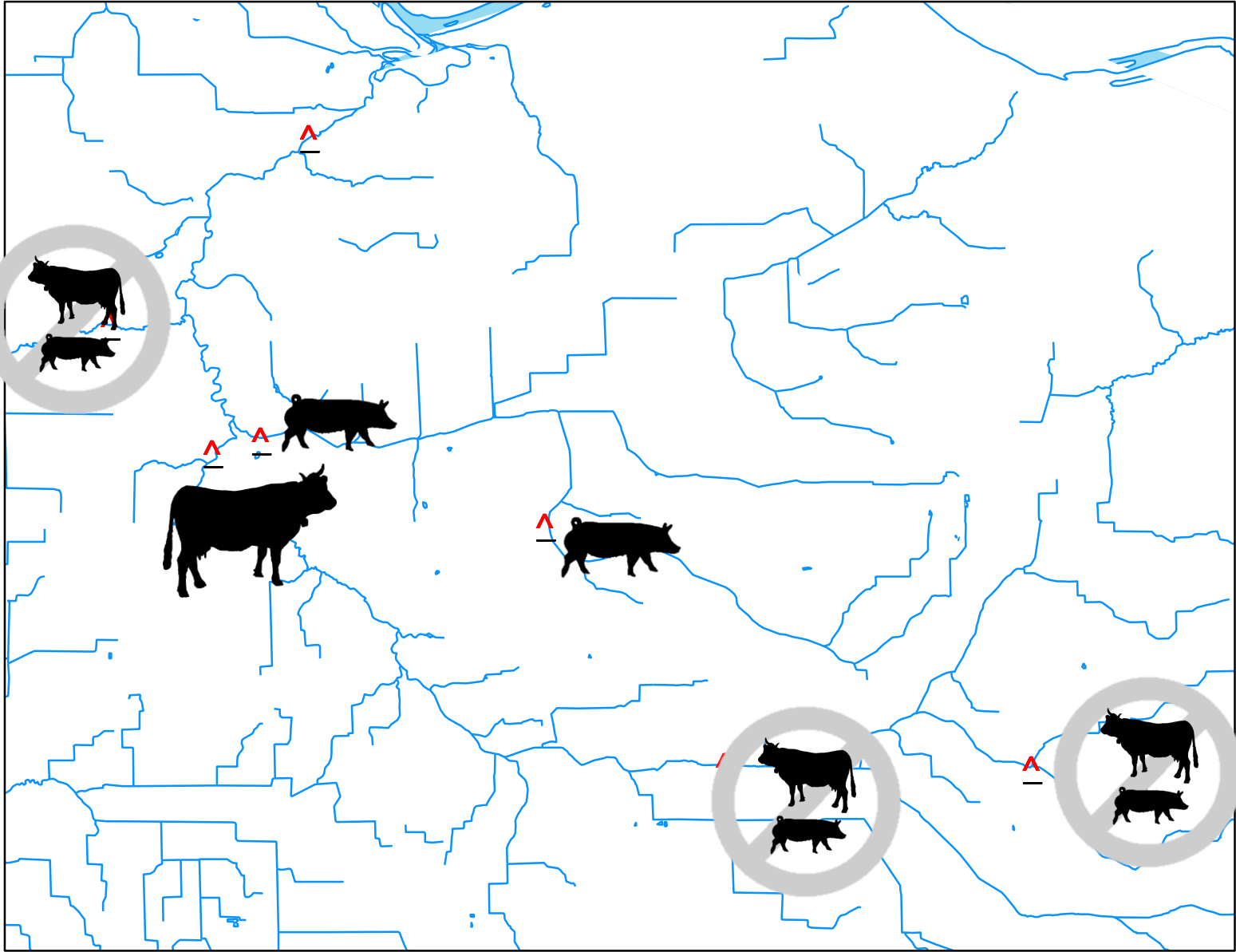


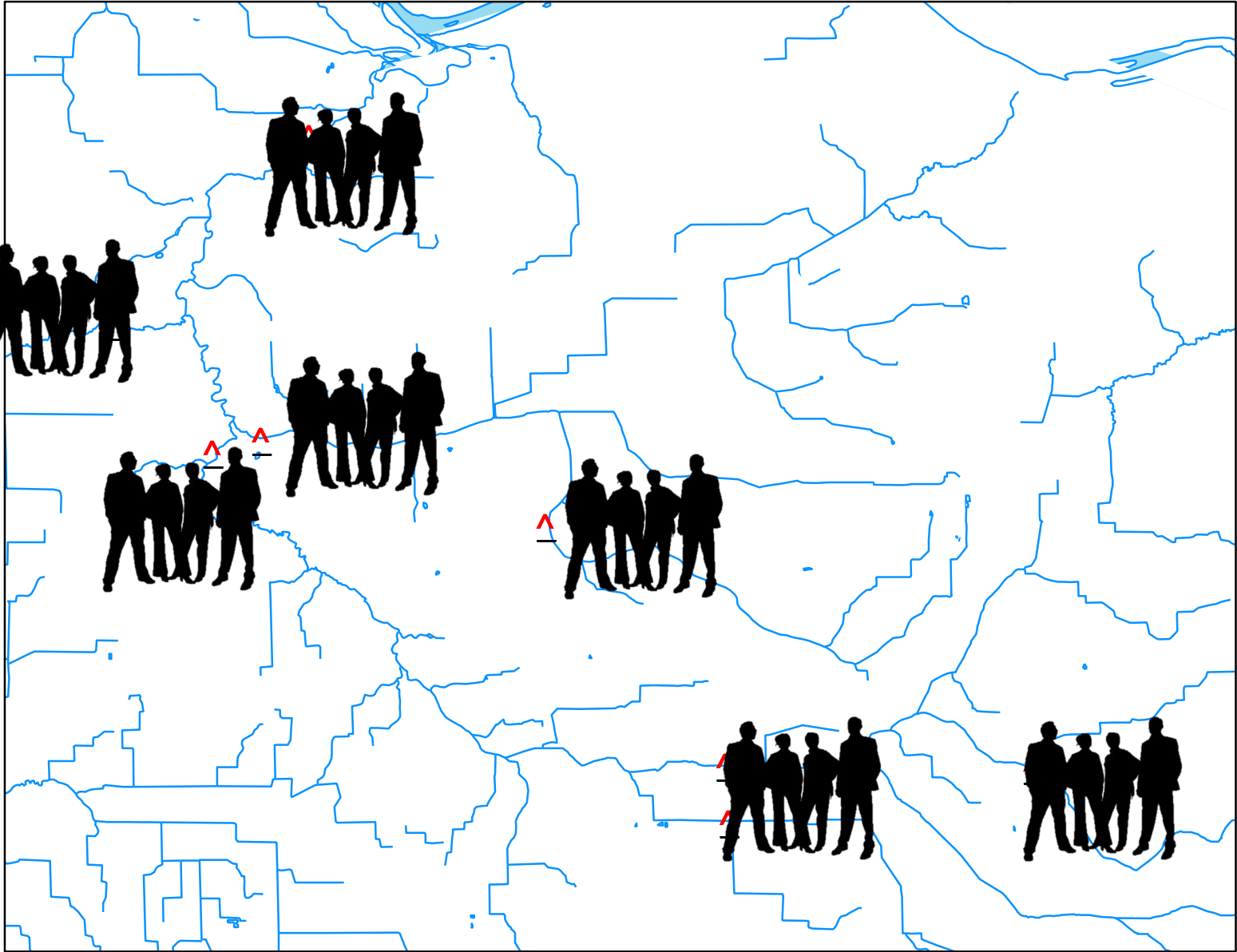
HUMAN, RUMINANT, BOVINE, GOOSE AND SWINE



HUMAN, RUMINANT, BOVINE, GOOSE AND SWINE







Reasons that DNA may not show up:

- It can decompose
- Dead DNA is harder to detect than 'living' (culturing living bacteria prior to DNA analysis can amplify the signal.... Not so for dead stuff)
- Maybe it settles out with the sediment
- Maybe it didn't end up in your sample jar
- Maybe it was never there and isn't a source (You won't know unless you sample more)

The image features a collection of approximately 15 cartoonish jellyfish swimming in clear, shallow, turquoise water. Each jellyfish has a light brown, bell-shaped body with two large, black, circular eyes. They have long, thin, reddish-brown tentacles hanging from the bottom of their bells. The water is bright and clear, with light rays filtering through, creating a shimmering effect on the sandy bottom. The jellyfish are scattered throughout the frame, some larger and some smaller, giving a sense of a diverse population.

What is the DEQ doing
about this problem?



Investing in solving it!

What is the DEQ doing about this problem?

qPCR:

- Ten labs statewide now use DEQ-provided equipment to test surface water using the qPCR method
- Making progress on real time beach monitoring right now...eventually, this equipment can be used in more advanced source tracking techniques




**In 2016 we are developing a
Statewide *E. coli* Total Maximum
Daily Load**

A photograph of two people standing on a concrete bridge with a metal railing. Two long, thin vertical poles extend from the bridge down into a river. The background is filled with dense green trees. The scene is brightly lit, suggesting a sunny day.

A Total Maximum Daily Load

- List potential sources
- Summarizes data
- Informs everyone what we are doing about each type of source
- Makes recommendations
- Provides info. on resources



Statewide *E. coli* TMDL

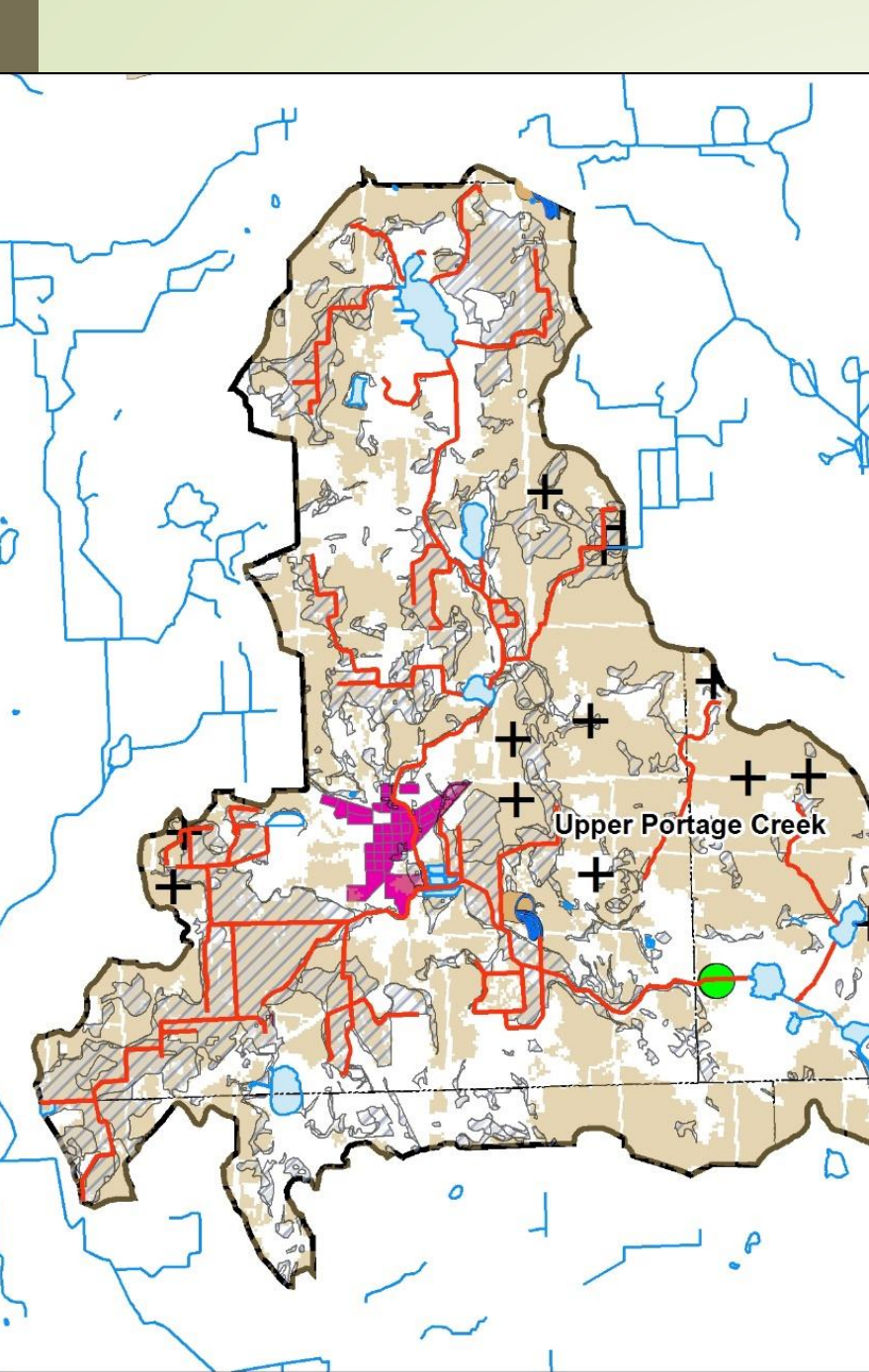
- A statewide approach will speed up needed pollutant reductions in POINT SOURCE (NPDES permits) **by decades**
- Open up the discussion to find statewide solutions and approaches to tackle major issues

Source Assessment

- Describe each source type spatially across the state
- Describe conditions which lead to problems (proper vs. improper practices)

Reasonable Assurance

- Describe all regulations and voluntary programs that may help fix the problem
- May include special NPDES permit requirements to control the pollutant



Identify

Identify from: **Watersheds**

Location: 731,892.868 4,706,060.404 Meters

Field	Value
HUC_12	040900050304
HU_12_NAME	Upper Portage Creek
area_sqmi	22.27
Cultivated%	34
High Intensity Developed %	0
Low Intensity Developed %	3
Medium Intensity Developed %	1
Open Developed %	3.9
Hay/Pasture %	21
Water %	2
Total Developed Land %	7.8
Total Agricultural %	55
Total Wetland %	19
Forest %	16
Human Population #	2690
Housing Units #	1110
Population Density per sq. mi.	
Housing Unit Density per sq. mi.	
Lost Wetlands (% of presettlement)	
Natural Buffers %	
New Developed Land (sq. mi)	
New Cultivated Land (sq. mi)	
Impervious %	
Hogs (estimated)	
Cattle (estimated)	
Percent of ag. land that is tilled (estimated)	
Percent of ag. land that is used for manure application (estimated)	
Approx. Number of Septic Systems (coming soon)	

559
Septic
Systems

Identified 1 feature

Resources for Fixing Problems

Water and Waste Disposal Loans/Grants (USDA)

<http://www.rd.usda.gov/programs-services/water-waste-disposal-loan-grant-program>

Stormwater, Asset Management, and Wastewater (SAW) Program

www.Michigan.gov (search for "SAW Grant")

Clean Water Act Section 319 Grants

www.Michigan.gov/nps

Search the Federal Database of Grant/Loan opportunities here:

<https://ofmpub.epa.gov/apex/watershedfunding/f?p=fedfund:1>

Links to other funding sources can be found on www.Michigan.gov/nps

ARE WE DOING ALL
WE CAN DO?





Go to www.Michigan.gov
We are "TMDLs and Integrated
Reporting"



Molly Rippke
Department of Env. Quality
Water Resources Div.
rippkem@Michigan.gov
Phone: 517-284-5547