Mitchell Creek Source Tracking Project

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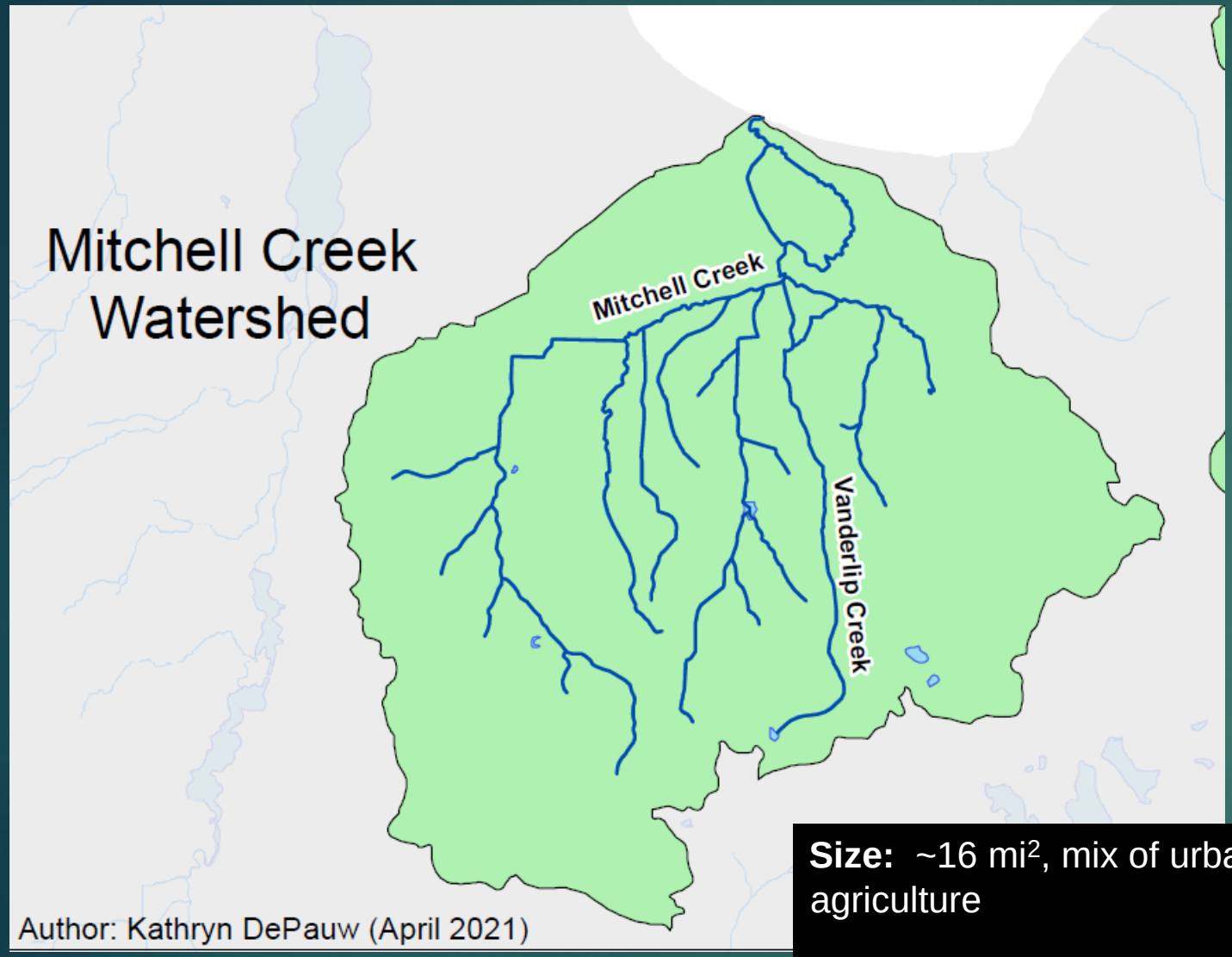
Mitchell Creek Impairment



On State Impaired Waters List (303(d) List) for:

Total Body Contact

Results of monitoring efforts by TWC in 2015
11 locations, weekly, 12 weeks

Size: ~16 mi^2, mix of urban and wetland land cover, with headwaters mostly agriculture

Issues:

- Elevated *E.coli* bacteria levels, not meeting State Water Quality Standards
- Potential public health issue, creek outlets next to State Park Beach

EGLE Grant

September 2020, awarded EGLE NPS grant to conduct microbial source tracking (MST) study to determine causes of elevated bacteria levels

Is it human or animal related? Are septic system contributing to problem? If animal, which one(s)?

Partners:

MICHIGAN STATE UNIVERSITY

EGLE
MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

CITY OF TRAVERSE CITY

EAST BAY CHARTER TOWNSHIP

SOS ANALYTICAL

GRAND TRAVERSE Health Department COUNTY

The CHARTER TOWNSHIP of GARFIELD
Grand Traverse County, Michigan

Project Tasks

Surface Water Sampling 2021-2023

Run on ALL samples – markers for fecal contamination

- *E.coli*
- Somatic coliphage indicator virus
- F-specific coliphage indicator virus
- *Clostridium perfringens*

Microbial Source Tracking Analysis

Completed by MSU lab using ddPCR (digital droplet)

Run on all *E.coli* samples >300 col/100mL

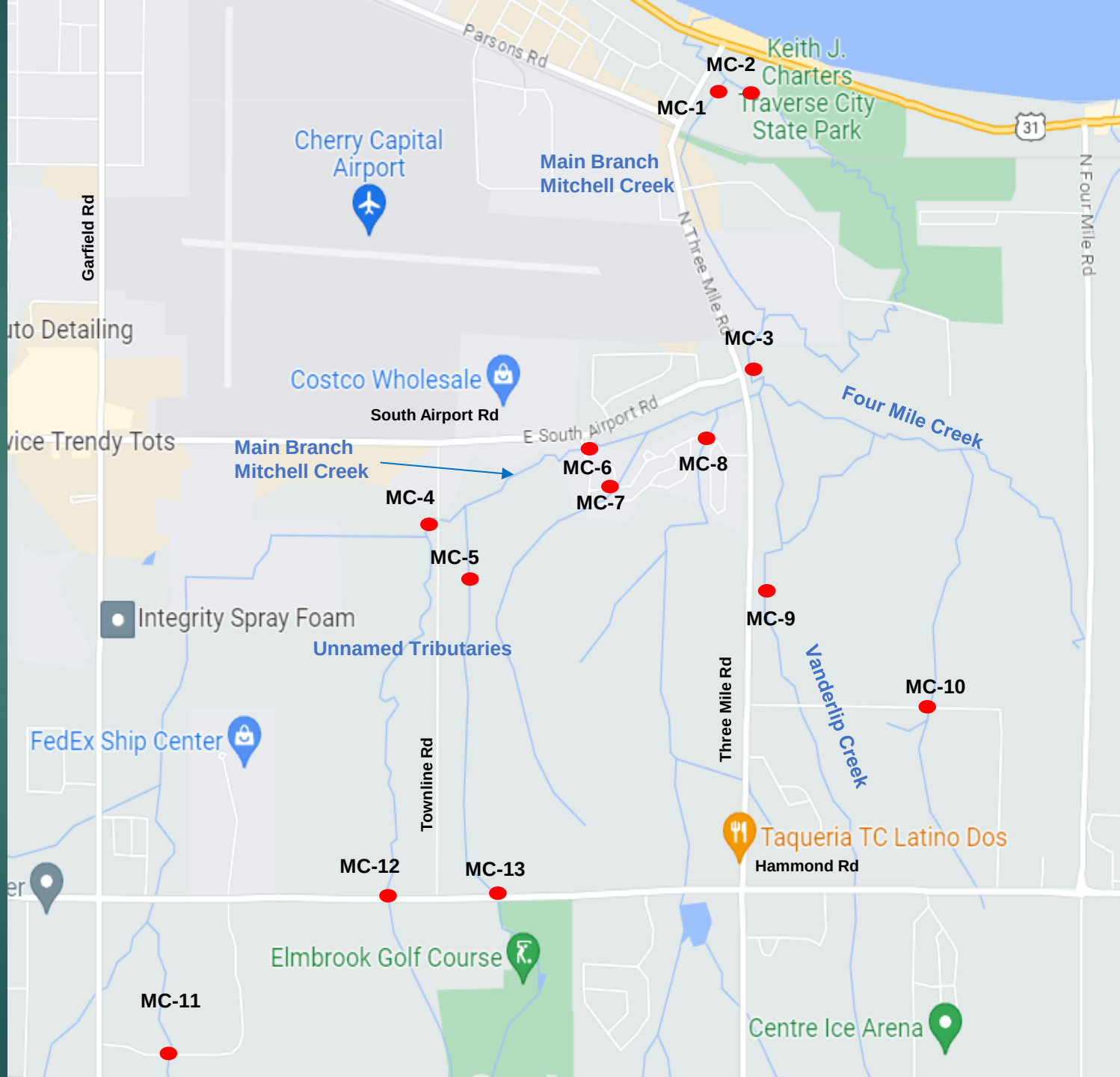
MST Markers* Tested:

- Human
- Cow
- Pig
- Dog
- Gull

**MST Markers:*

Molecular genes which are detected primarily in the fecal bacteria group the Bacteroides

Specific to animal hosts

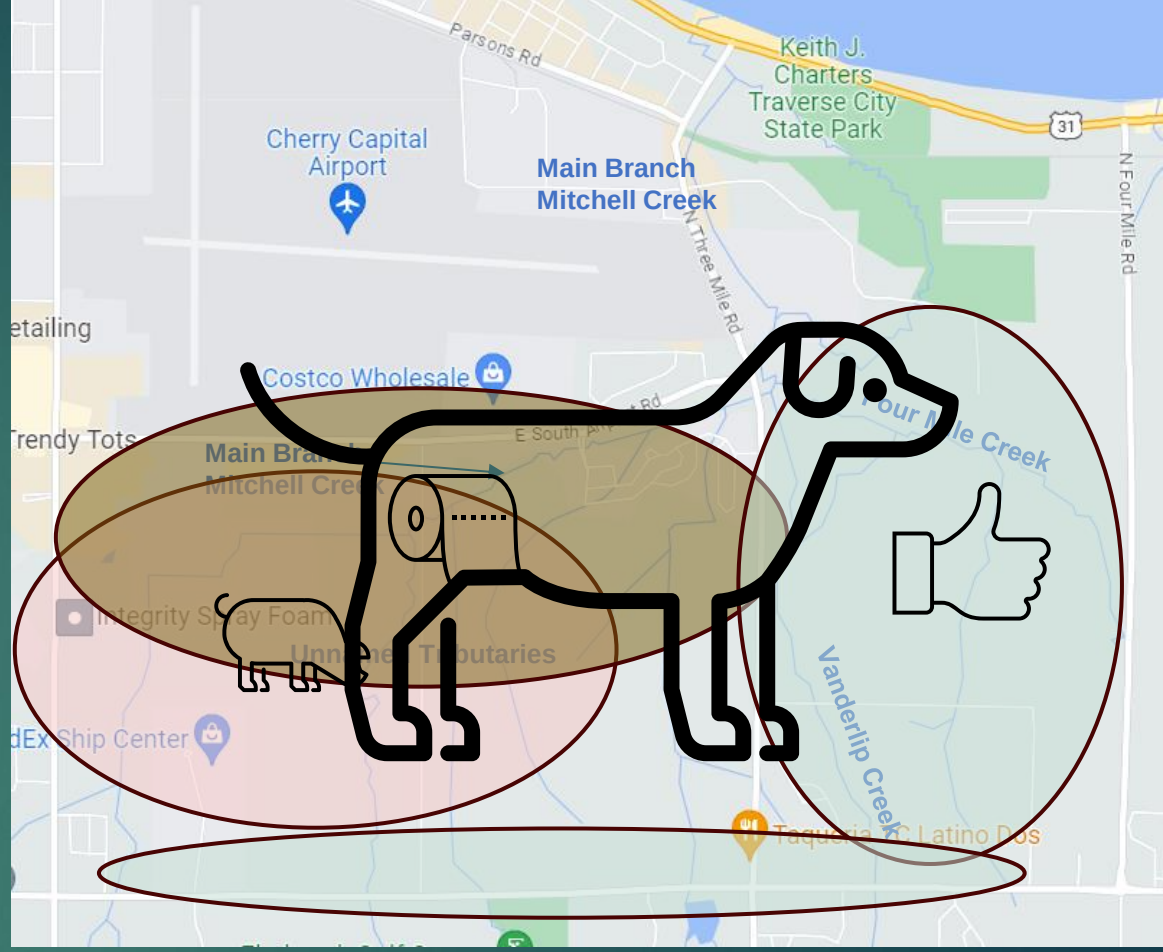


Results and Conclusions - Broad Overview

- Clear temporal pattern, rainfall driven
- Mix of fresh and old/aged sources
  (comparing Ecoli to other fecal indicators)
- Possible that Ecoli has accumulated in creek sediment and being released during rain events

Microbial Source Tracking:

- Little to no bacteria, fecal indicators, or MST markers found in eastern tribs of Vanderlip or Four Mile creeks or headwaters (Hammond Road and south)
- The western tributaries had more samples containing the pig marker
- Human marker was found in the western tributaries and central main branch
- Canine marker was widespread in all tributaries.



Fecal indicator and microbial source tracking (MST) analysis conducted in this study has not led to any obvious or consistent sources or locations of bacterial contamination, and it is difficult to determine remediation steps to reduce the impairment.

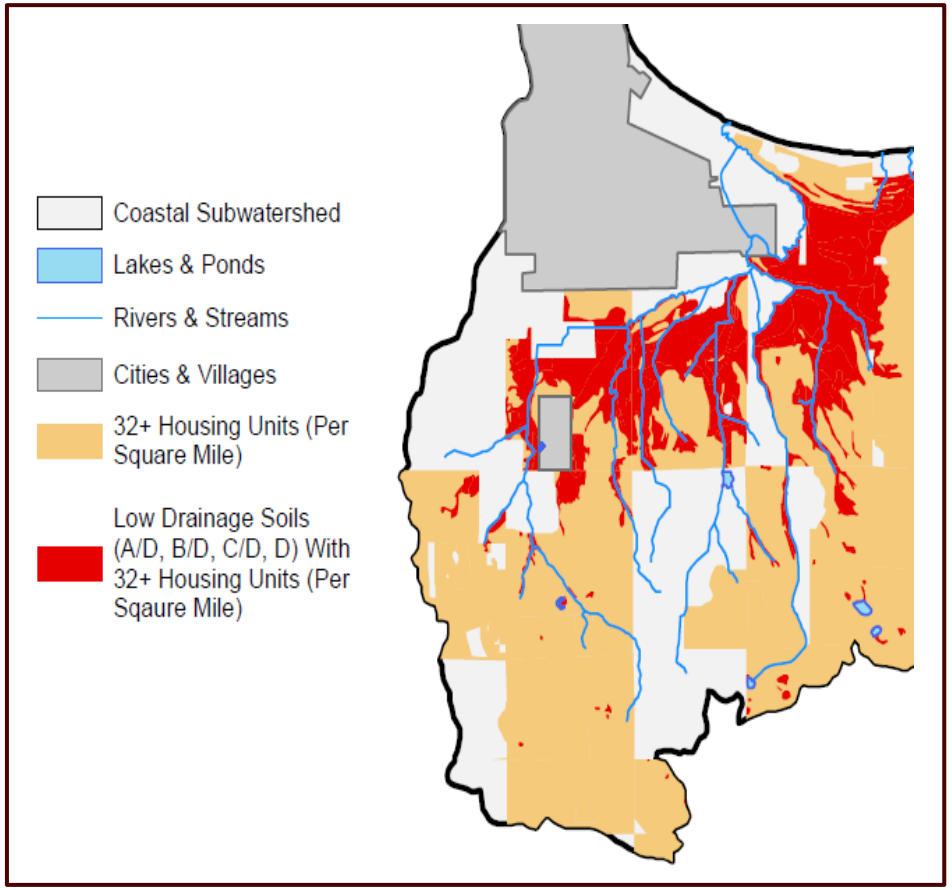
Results and Conclusions
Human Markers & Septic Systems

2021-2022
- Human markers were occasionally found in the western and central main branches of Mitchell Creek.

2023
- Expanded testing to include three upstream sites
- Included virus testing to determine potential public health impacts
- All tested sites in 2023 had no viruses or human markers present

Due to the sporadic and inconsistent findings for the human marker we cannot conclusively say at this time that leaking or failing septic systems are a consistent, major problem causing widespread impairment in the watershed.

Excerpt of Figure 25 from Coastal Grand Traverse Bay Watershed Plan – Areas At Risk for Septic Pollution



The Coastal Grand Traverse Bay Watershed Plan states that the Mitchell Creek area has a greater potential for septic system pollution than other areas in the watershed due to the density of systems combined with soil types

Results and Conclusions
Pig Markers

- Found throughout, but most often in the unnamed western tributaries.

- Looking at pairings with fecal indicators, most of the time it was from older sources
  - Release from sediments
  - Land application of pig waste that had been properly composted in storage prior to being land applied.

Here's where it gets tricky…

- 2021 - Found at nearly all the sites tested (dry and wet weather)
- 2022-2023 – Virtually none found
- Met with resource professionals - No large pig farms, but some small ones with pigs. However, all are following accepted BMPs for pig waste storage.
- No way to track land application of fresh or aged pig manure (who, where, how old, etc.).

However, if farms are following all BMPs for manure application, they are less likely to be affecting water quality in the creek and the marker may just be showing up through properly aged/composted runoff with a low bacterial and viral risk that is not harmful to human health

Results and Conclusions
Other Sources

Cow/Gull

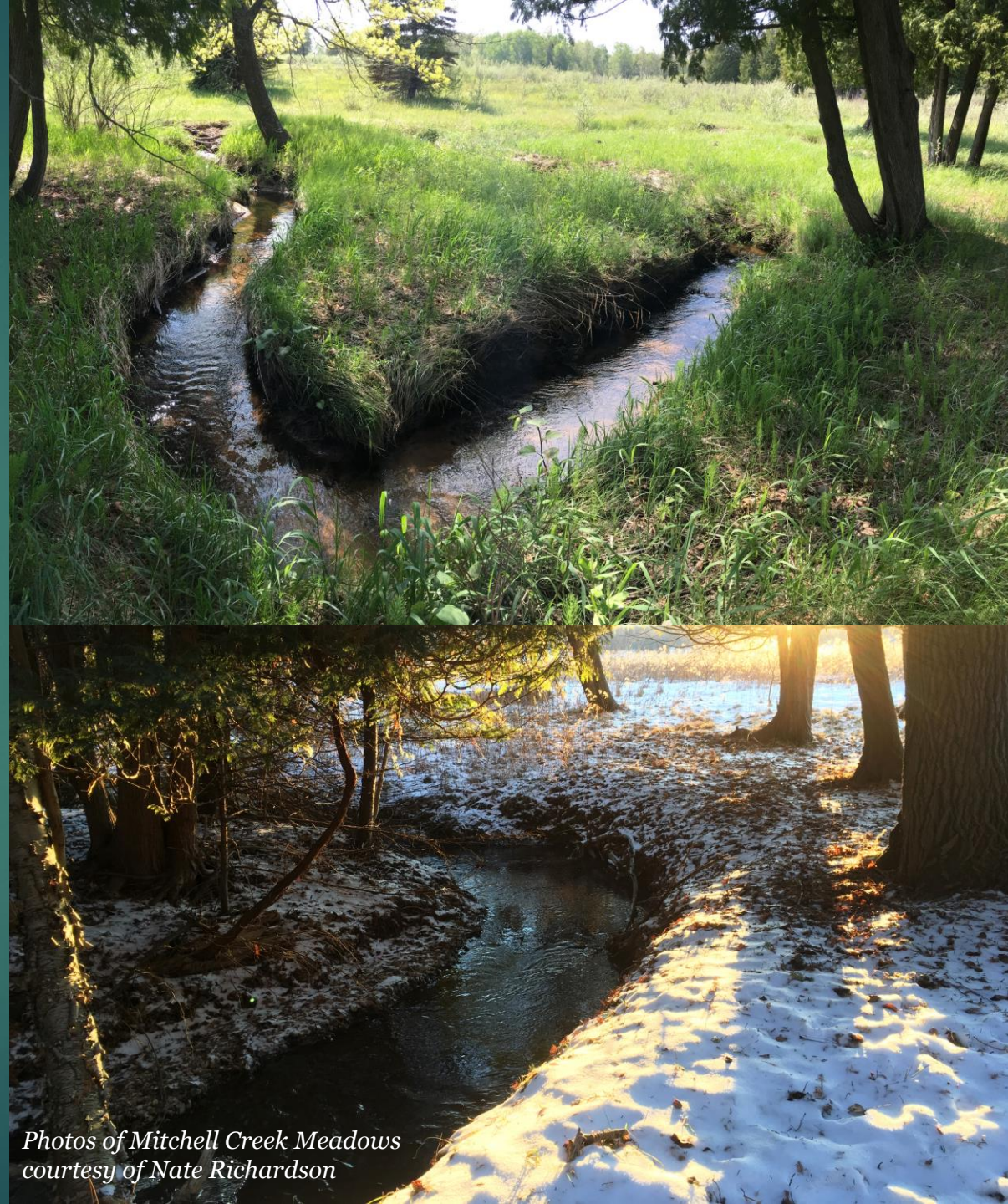
- Both cow and gull markers were virtually non-existent in this study and are not considered a threat at this time.

Canine

- The canine marker found in almost all samples tested.
- In addition to domesticated dogs, the marker may have also detected wild canines including coyote and fox.
- Therefore, we cannot confirm that fecal material from domestic dogs is a widespread concern for Mitchell Creek. If bacterial impairment is attributed to coyotes and foxes, remedying the issue will be difficult.

Recommendations

- Ensure all farms are following “Generally Accepted Agricultural Management Practices” (GAAMPs) and implement new agricultural BMPs to reduce fecal input to creek where needed.
- Provide septic system education, including maintenance, right-sizing, replacing aged systems, and proper use.
- Conduct continual maintenance of the City of Traverse City’s sanitary system and extend service to new homes or developments, when possible.
- Provide education regarding the importance of picking up and properly disposing of dog waste.
- Preserve existing forested and vegetated wetlands that have the ability to reduce bacteria in the watershed and restore forested wetlands when possible.



Photos of Mitchell Creek Meadows courtesy of Nate Richardson

Thank you!

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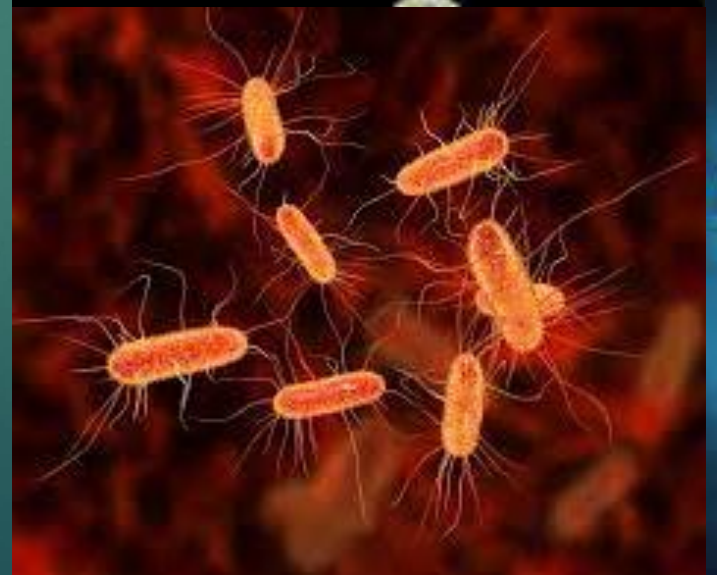
- ***E.coli*:** A bacteria that is the State of MI standard for recreational and impaired waters associated with fecal contamination. (this is what we use for beach testing)

Other indicators

- ***Clostridium perfringens:*** Bacteria, anaerobe, spore former, often used to indicate “older pollution” and materials resuspended from sediments
- **F-Specific and Somatic Coliphage:** Both are viruses found on *E.coli*. Somatic usually persists longer. Both may be indicative of recent fecal pollution because neither regrows in the environment.



Summary of Sample Collection

Date	Wet/Dry	Total Samples Collected (not including duplicates)	Total Samples Chosen for MST	MST Markers Run
7/12/2021	Dry	9	5	All*
8/4/2021	Dry	9	7	All*
9/20/2021	Dry	9	3	All*
10/4/2021	Wet	9	8	All*
10/18/2021	Dry	9	0	N/A
6/7/2022	Wet	9	9	All*
9/12/2023	Wet	10	8	• B. theta and HF183 • Pig • Viruses
10/25/2023	Wet	10	7	• B. theta and HF183 • Pig • Viruses
Totals	4 Dry 4 Wet	74 (36 dry, 38 wet events)	47 (15 dry, 32 wet events)	

- Added on to original sampling program
- Included three upstream sites
- Focused on human/pig sources

*MST markers include the following: human B. theta and HF193, pig, cow, canine, and gull
Human B. theta marker indicates more recent pollution, more sensitive and degrades faster than Human HF183

Summary of Sample Collection

Sample Type	Date	Location											
		MC-1	MC-2	MC-3	MC-4	MC-5	MC-6	MC-8	MC-9	MC-10	MC-11	MC-12	MC-13
Phase 1 Sampling													
dry	7/12/2021	326	743	289	403	519	284	449	141	150	--	--	--
dry	8/4/2021	310	306	305	425	442	414	480	243	91	--	--	--
dry	9/20/2021	168	170	256	337	454	237	722	13	38	--	--	--
wet	10/4/2021	7,854	6,368	7,569	4,785	3,657	6,132	4,782	785	275	--	--	--
dry	10/18/2021	98	76	152	161	54	143	179	15	37	--	--	--
wet	6/7/2022	1,476	500	1,255	707	647	1,068	1,506	750	113	--	--	--
Phase 3 Sampling													
wet	9/12/2023	1,278	577	1,093	611	1,058	880	1,183	--	--	126	78	816
wet	10/25/2023	2,587	1,248	2,402	2,179	579	2,757	2,496	--	--	151	35	43
Number of exceedances		**6/8**	**6/8**	**5/8**	**7/8**	**7/8**	**5/8**	**7/8**	**2/6**	**0/6**	**0/2**	**0/2**	**1/2**
	Exceeds Daily Partial Body Contact Standard (300col/100mL)												
	Exceeds Daily Total Body Contact Standard (1,000col/100mL)												
Percentage of Partial/Total Body Contact Exceedances by Type of Sample Event (Dry and Wet)													
% of all events		75%	75%	63%	88%	88%	63%	88%	25%	0%	0%	0%	50%
% of wet events		100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	50%
% of dry events		50%	50%	25%	75%	75%	25%	75%	0%	0%	n/a	n/a	n/a