EPA
MID-ATLANTIC REGION

Tracking downstream water quality benefits of urban stream restoration

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Urban nonpoint source pollution

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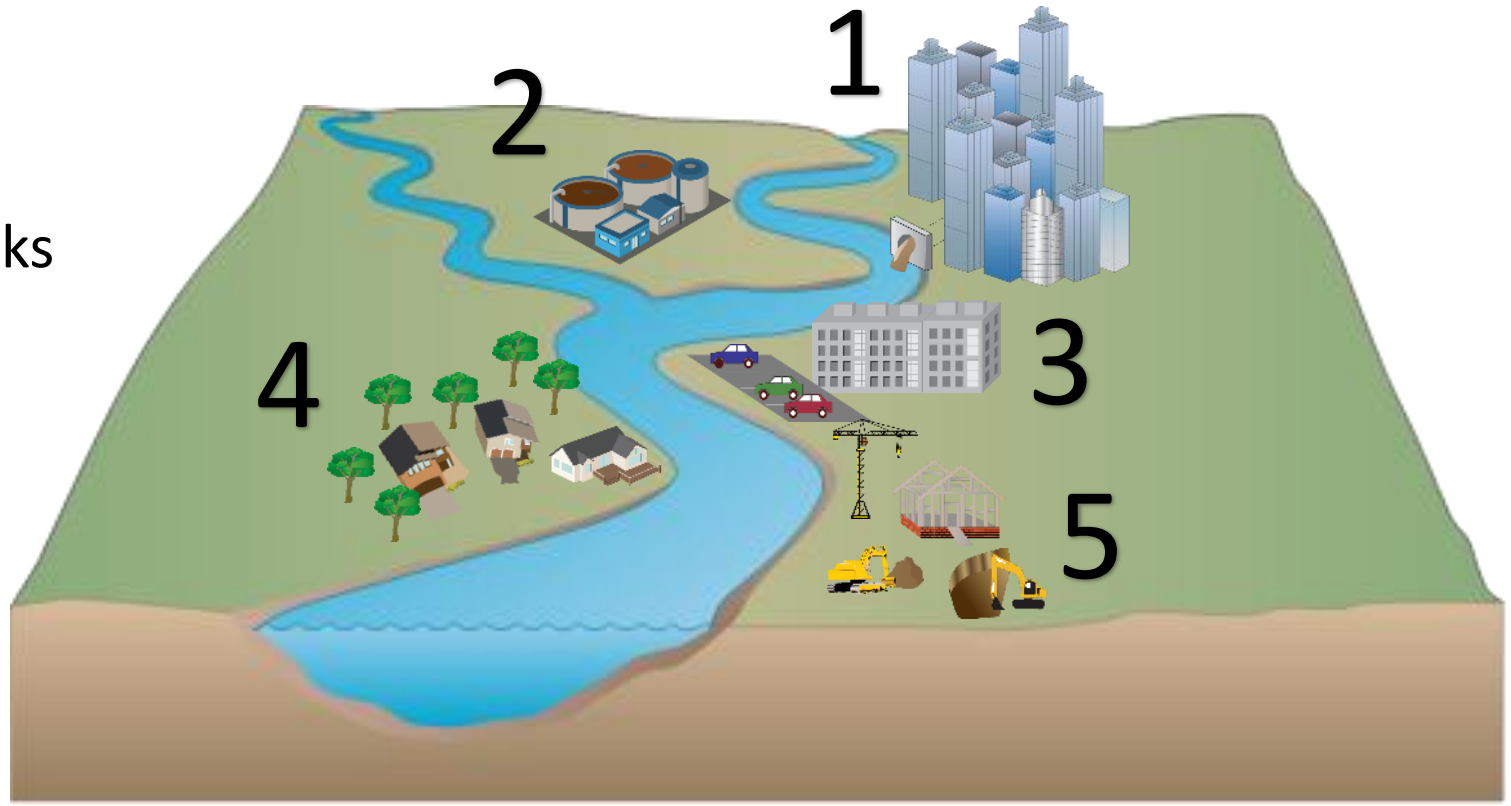
Urban nonpoint source pollution

- Sources:
  1. Stormwater runoff
  2. Wastewater/sewage leaks
  3. Road salt
  4. Fertilizer
  5. Construction sites



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Urban nonpoint source pollution

- Sources:
  - Stormwater runoff
  - Wastewater/sewage leaks
  - Road salt
  - Fertilizer
  - Construction sites
- Urban stream degradation

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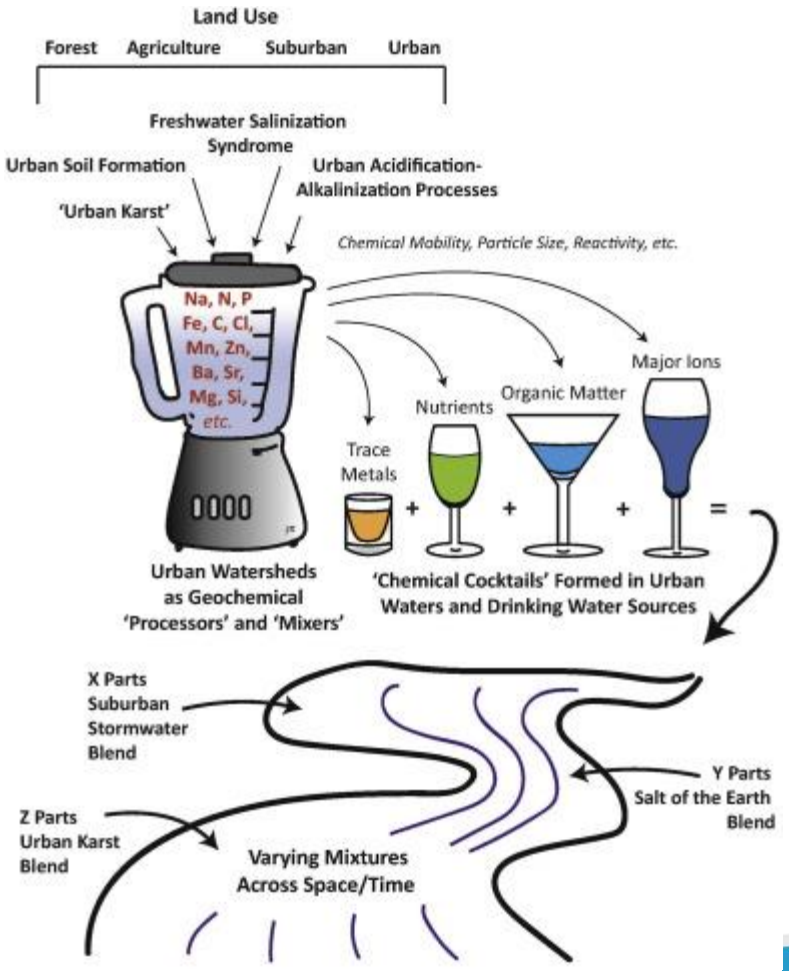
Urban nonpoint source pollution

- Sources:
  - Stormwater runoff
  - Wastewater/sewage leaks
  - Road salt
  - Fertilizer
  - Construction sites
- Urban stream degradation
- Chemical cocktails



Kaushal et al. 2020, *Applied Geochemistry*

Stream restoration mitigates impacts of urban nonpoint source pollution

- Improve water quality
- Restore hydrologic connectivity
- Habitat creation
- Reduce streambank erosion
- Examples: riparian buffers, **step pools**, streambank stabilization, j-hooks

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Section 319 nonpoint source pollution program

- Established through 1987 amendments to Clean Water Act
- Provides funding and federal assistance to states/tribes
- Billions invested to reduce NPS pollution
- Load reductions credited throughout entire watershed

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Research questions

- Does partial stream restoration influence downstream water quality?
- How far downstream are benefits observed?

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Methods

- Study conducted in highly restored urban stream
- Monthly synoptic monitoring through four seasons; emphasis around two restored stream reaches
- Recored stream characteristics using multiprobe (YSI pro-dSS)
- Water chemistry analysis using ICP spectroscopy
- Macroinvertebrate sampling/rapid habitat assessment in April 2023

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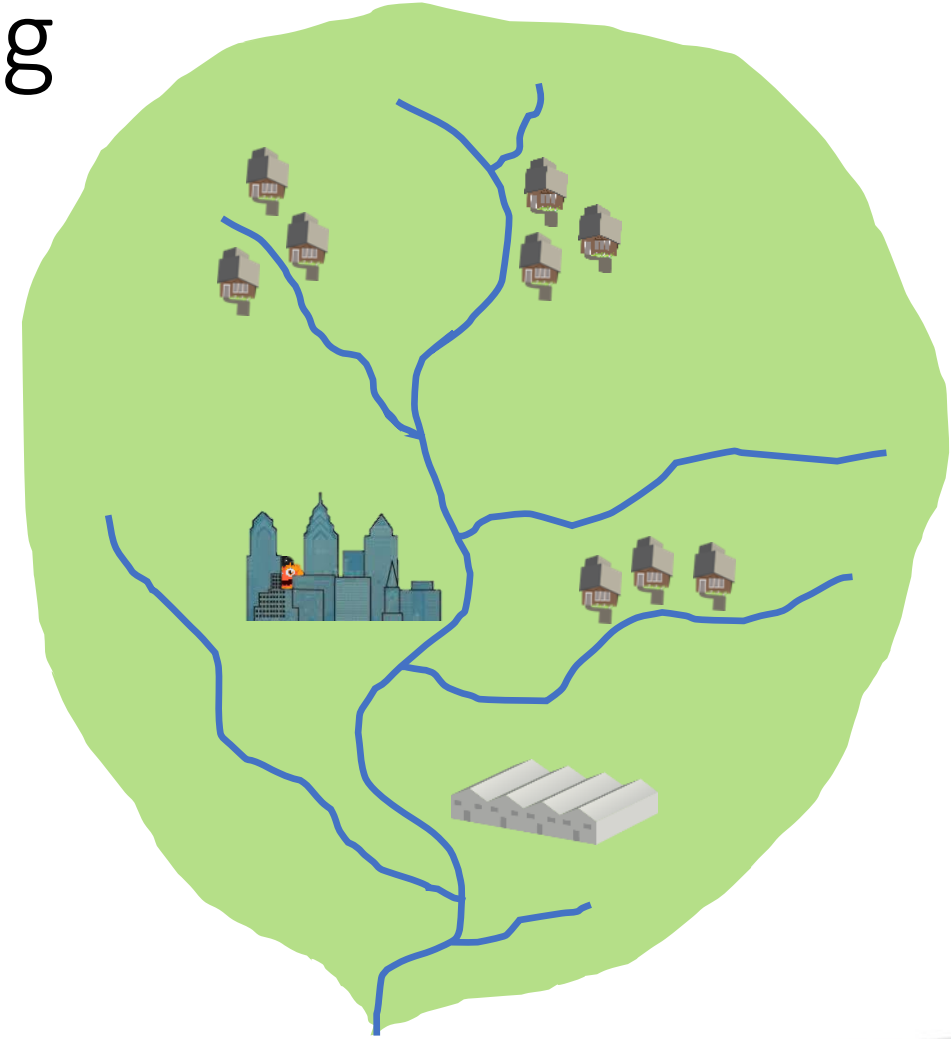
Synoptic stream monitoring



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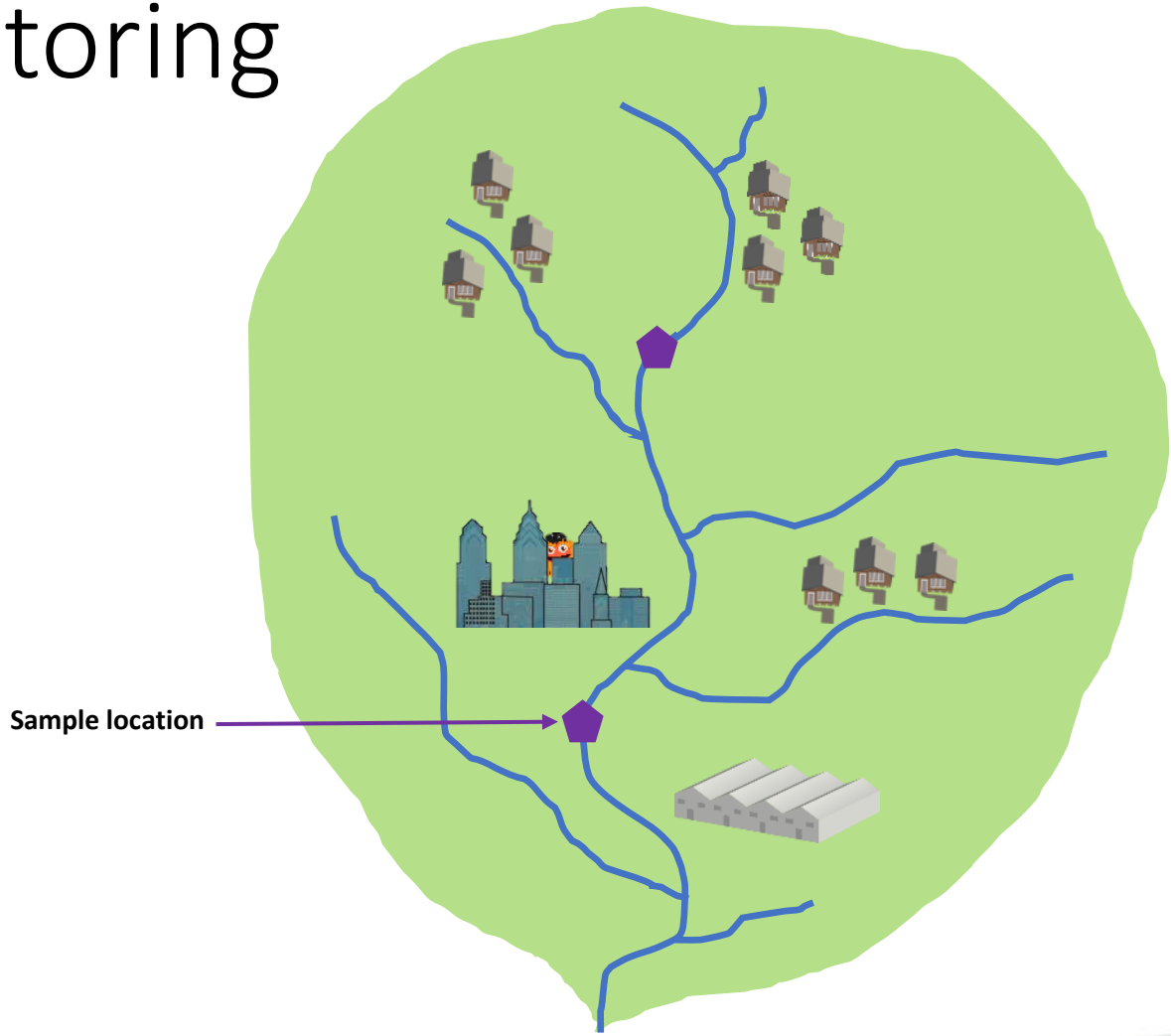
Synoptic stream monitoring



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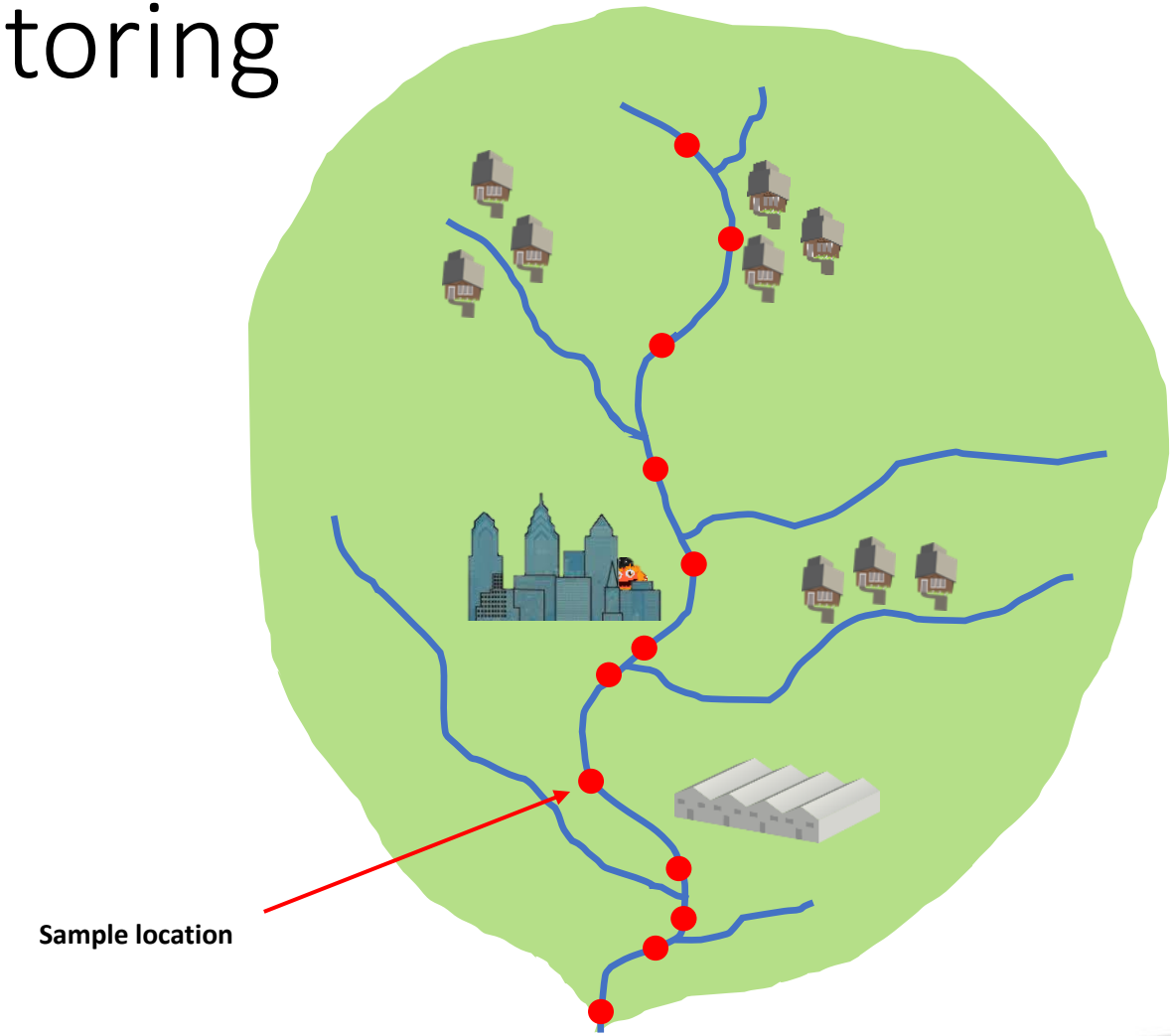
Synoptic stream monitoring

- High resolution sampling
- Detect spatial/temporal changes in water quality
- Identify pollutant hotspots
- Direct targeted restoration activities



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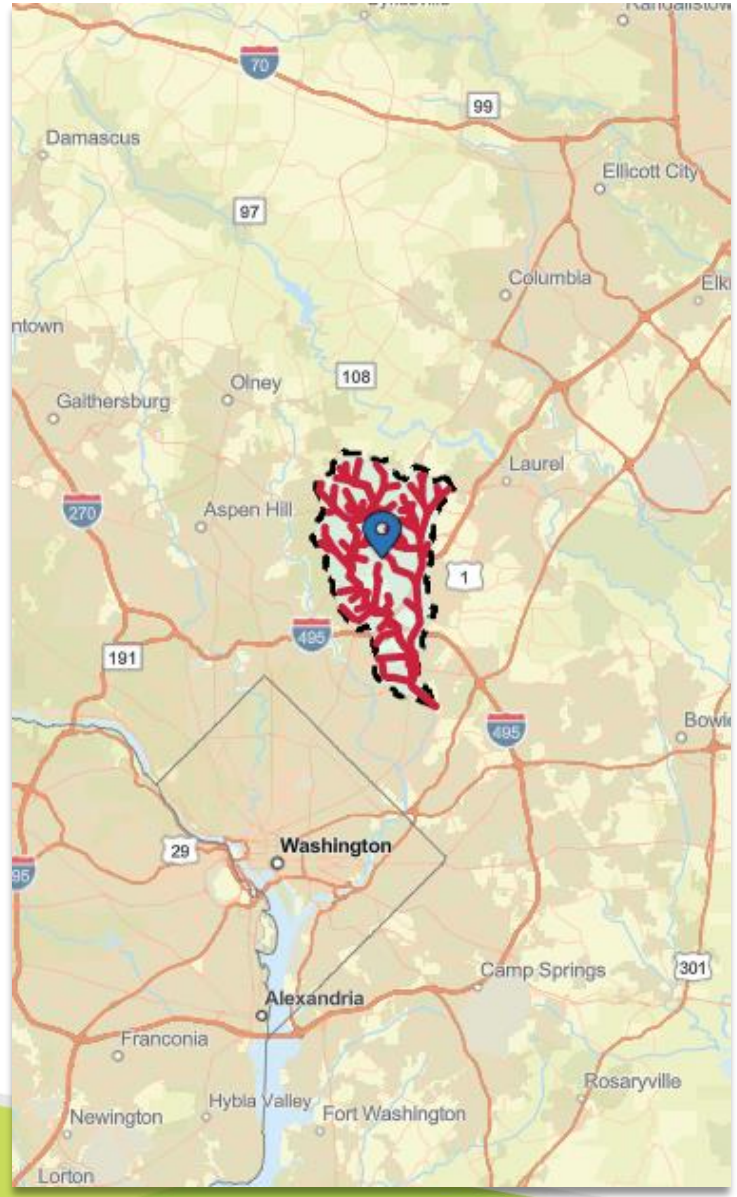

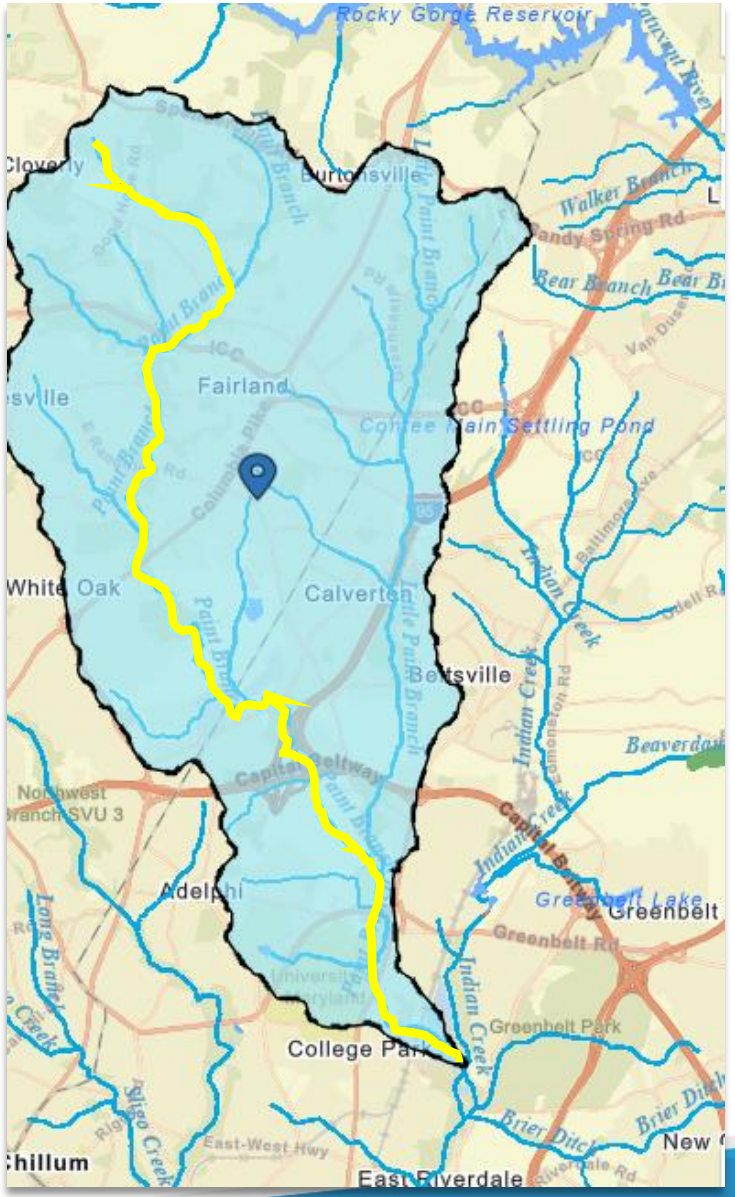

Paint Branch Creek

- Located in Montgomery and Prince Georges County, Maryland

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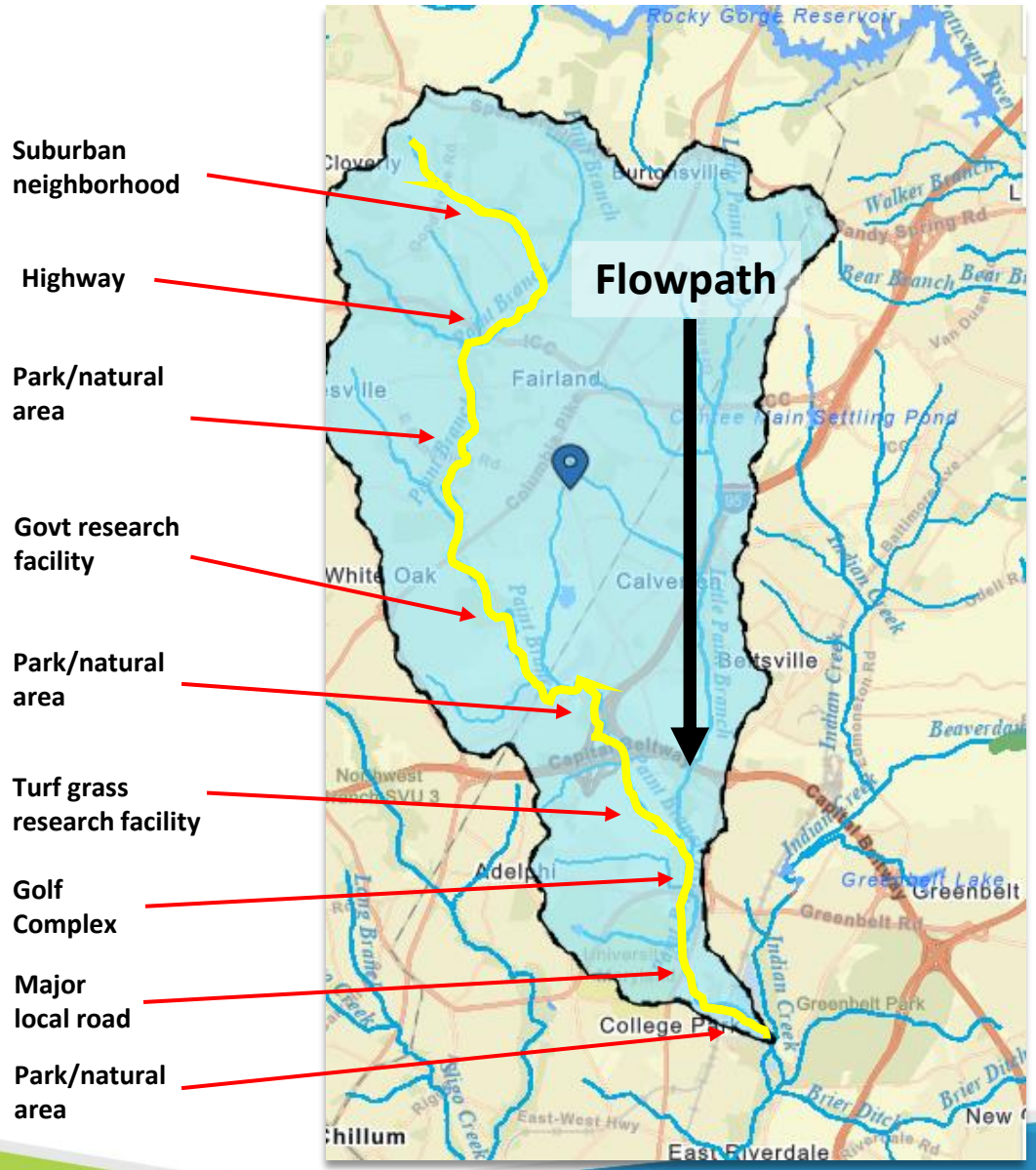
Paint Branch Creek

- Located in Montgomery and Prince Georges County, Maryland
- Varied land uses across watershed
- Much of channel located in stream valley parks
- Increasing urbanization gradient downstream



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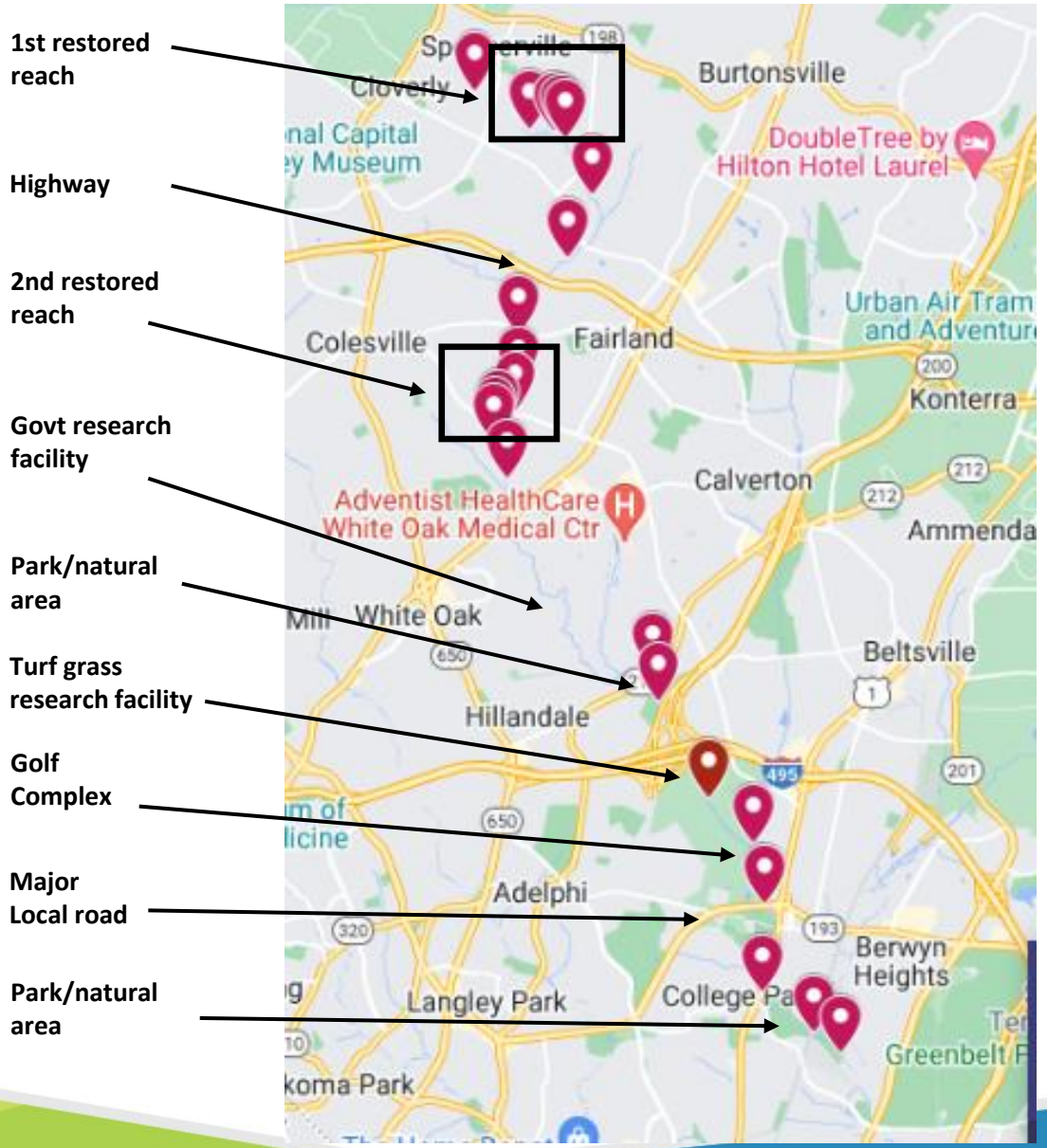
Paint Branch Creek



- 22 monitoring locations
- One above and three right below each restored reach
- Attempt to capture effects of major land use features

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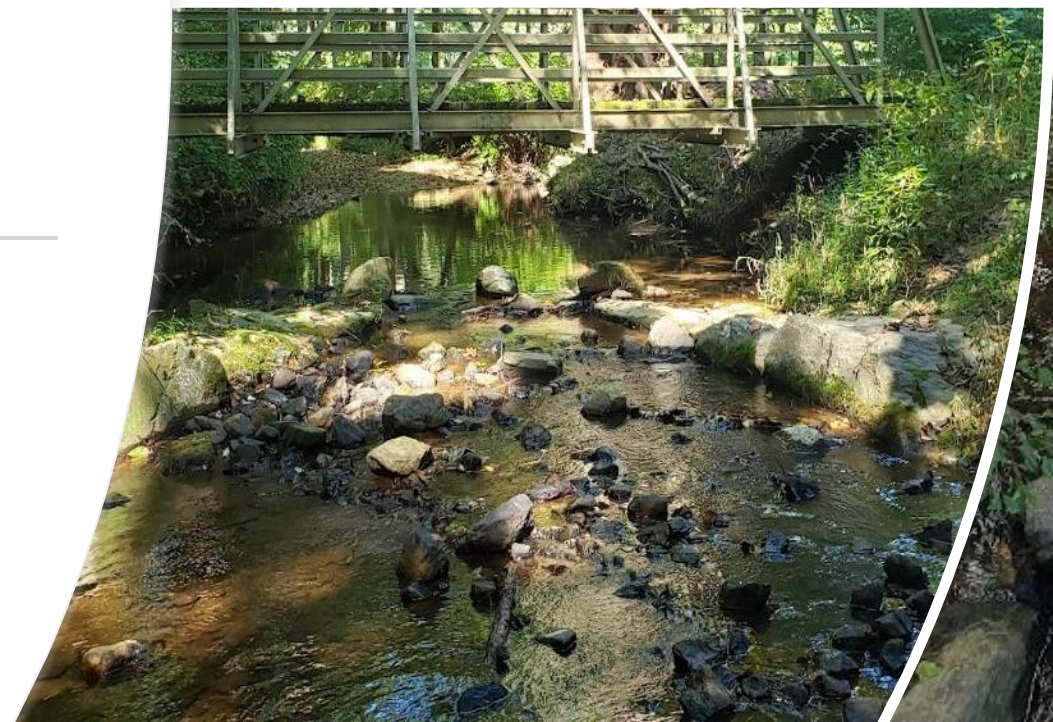
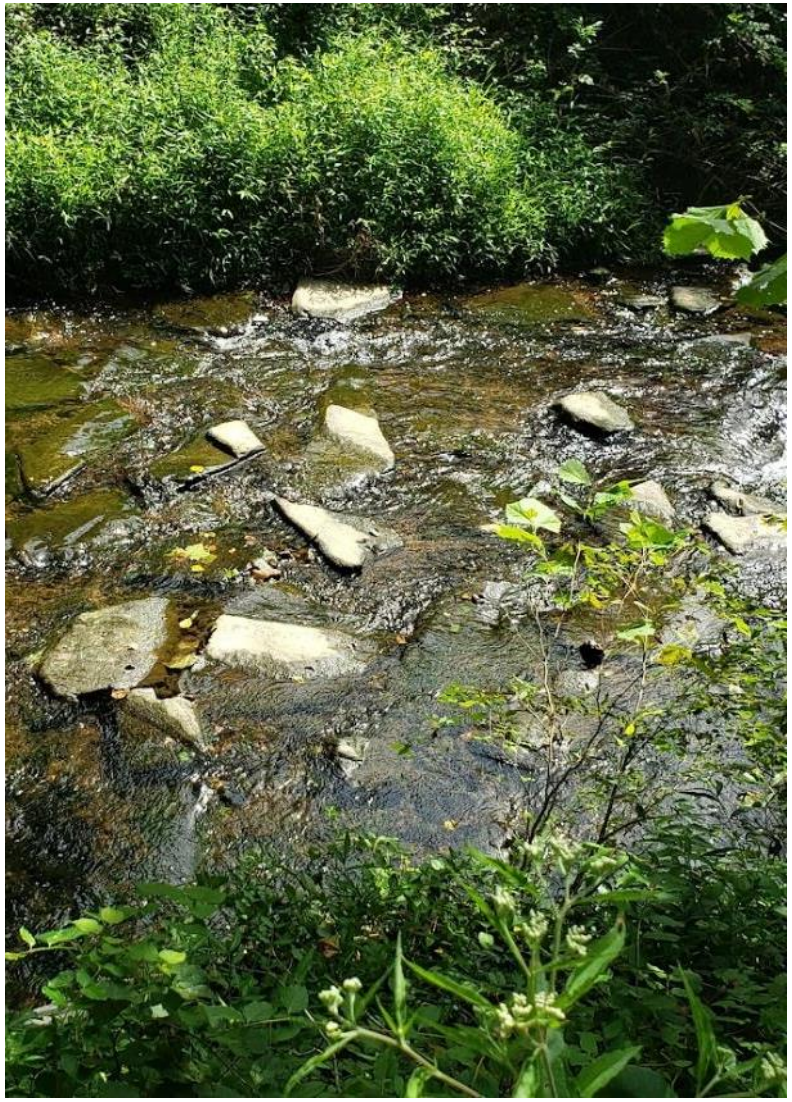
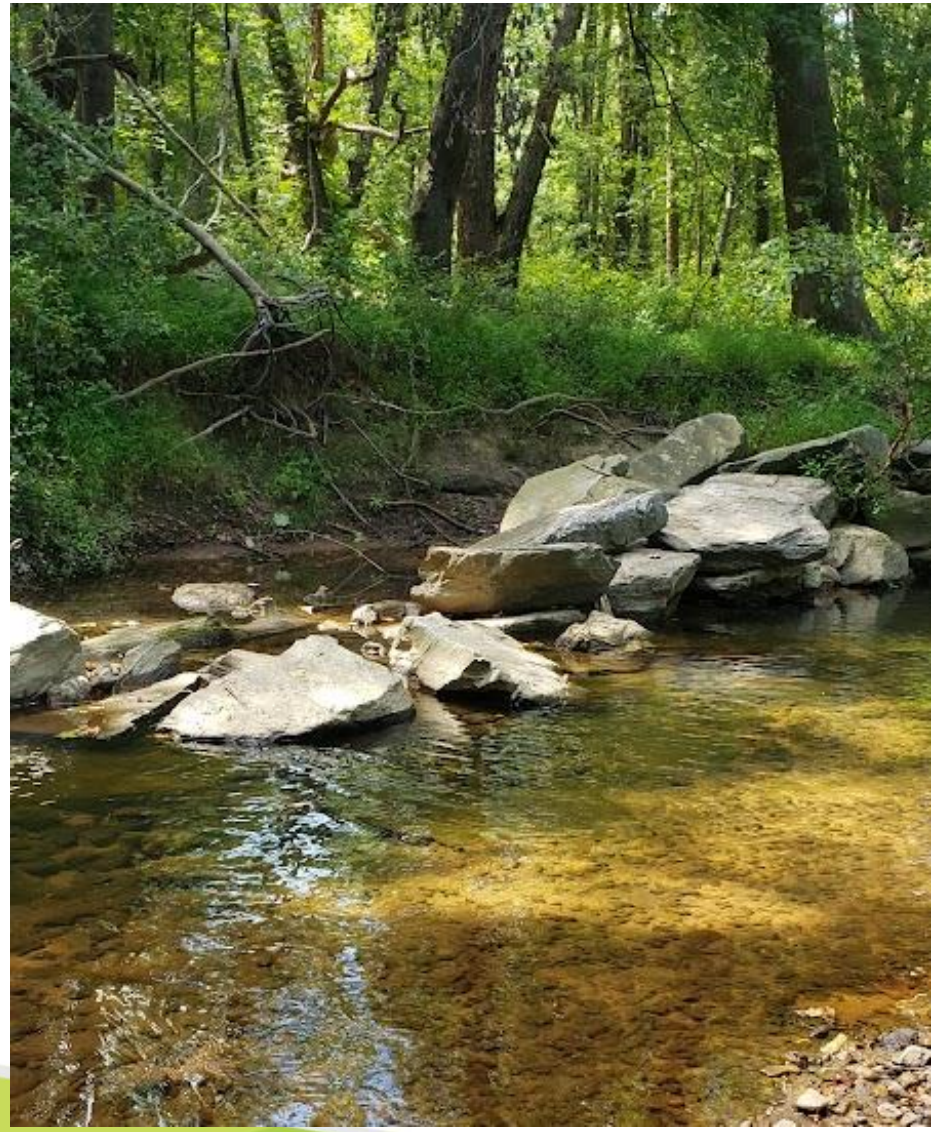
1st restored reach

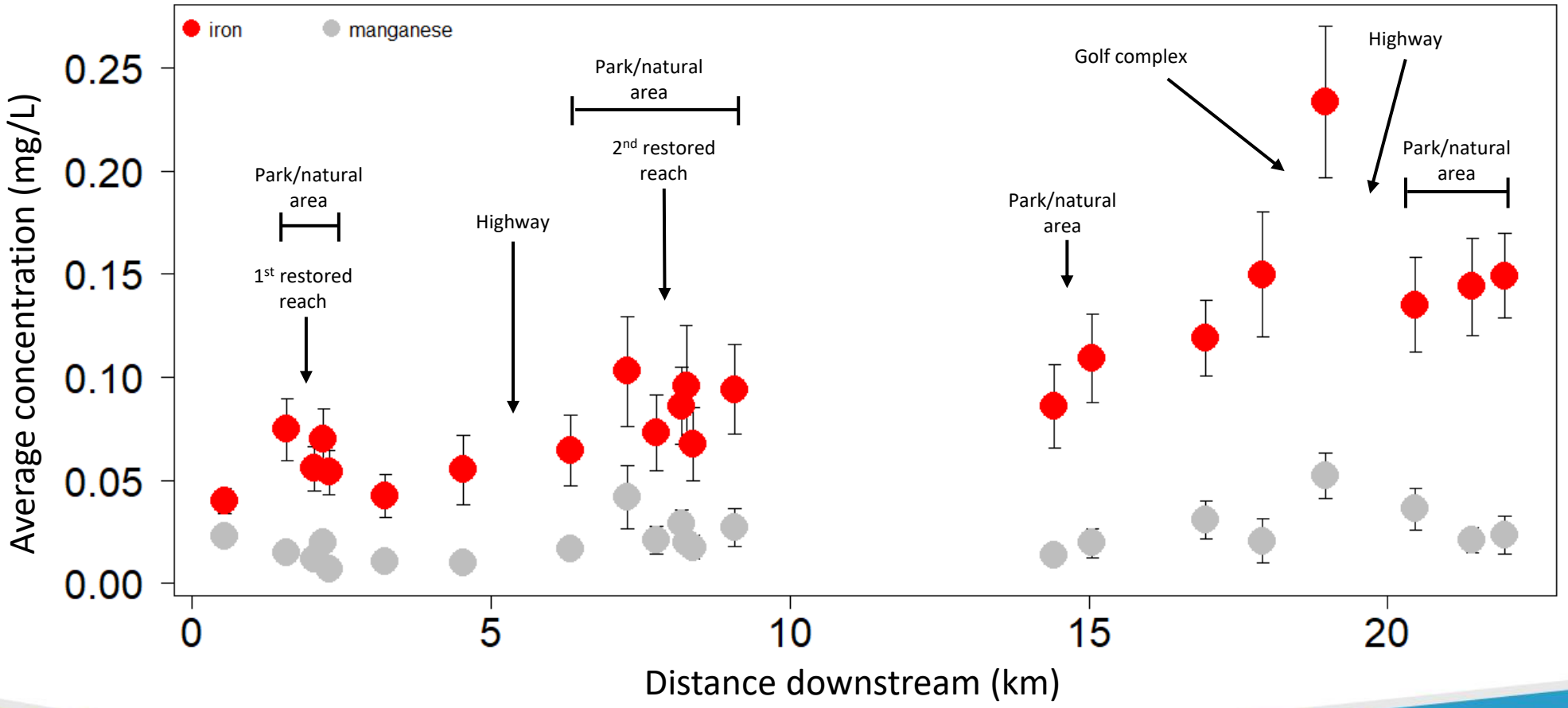




Second restored reach



Fe increases, and Mn stable, as you move downstream, impacts of different land uses observed



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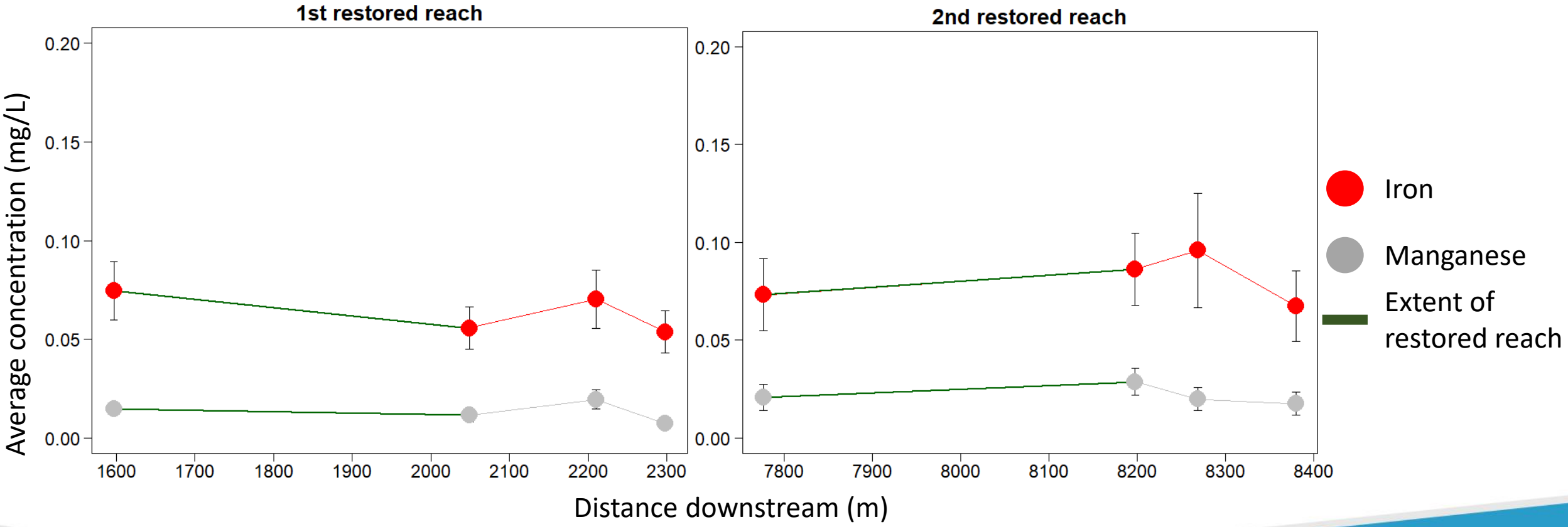
changes to Fe and Mn concentrations opposite after each restored reach



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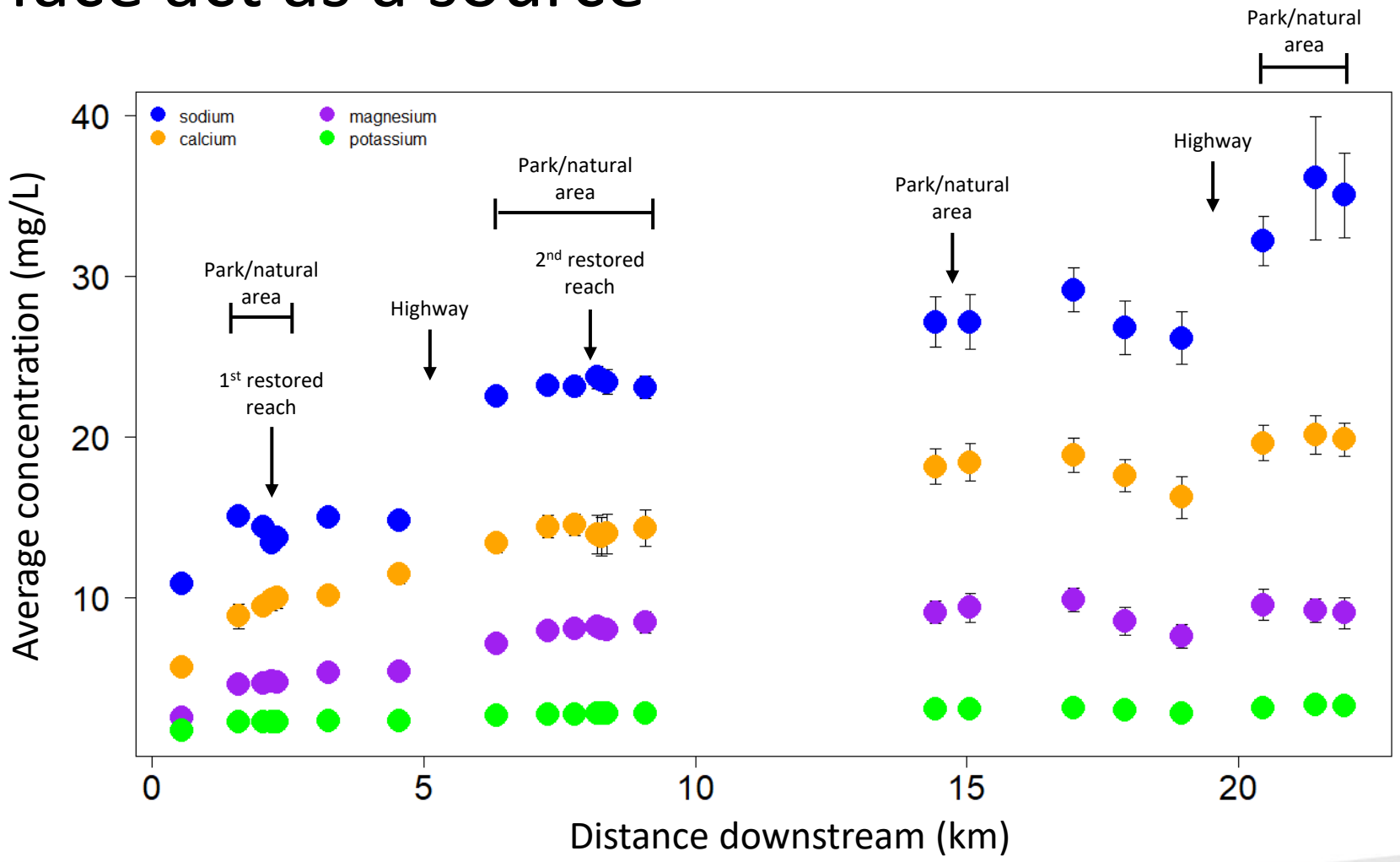
Natural areas act as a buffer while roads/impervious surface act as a source



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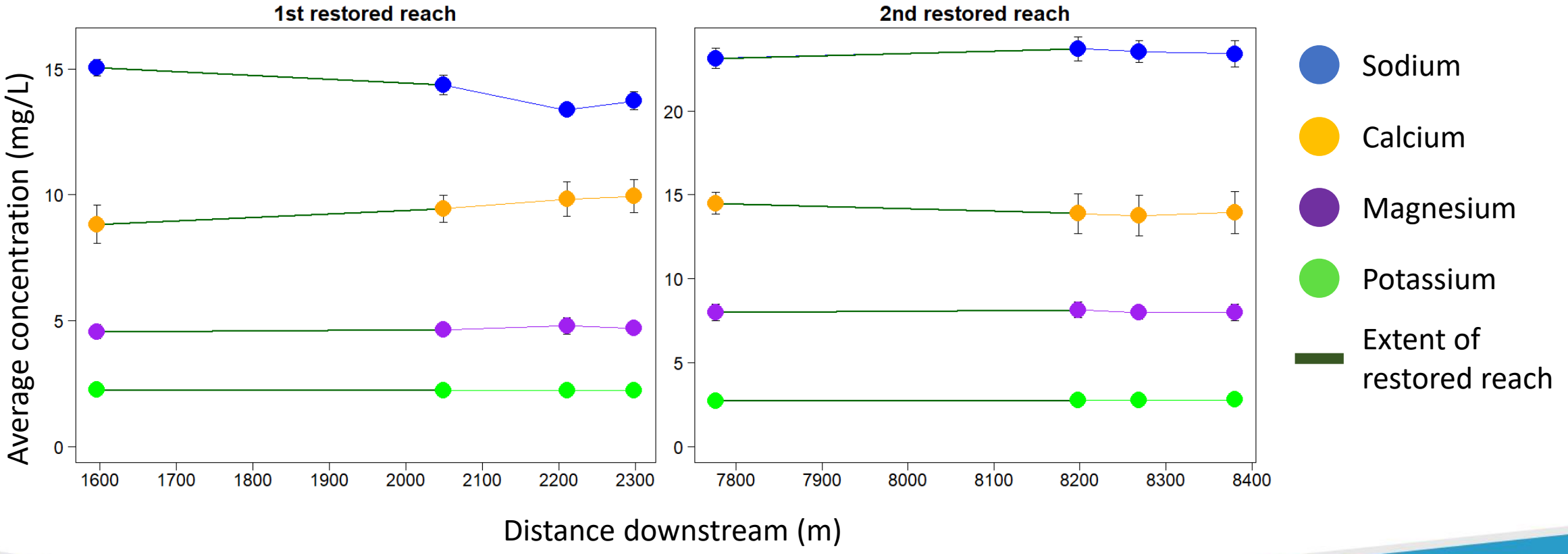
Minor changes to water quality directly downstream of restored reaches



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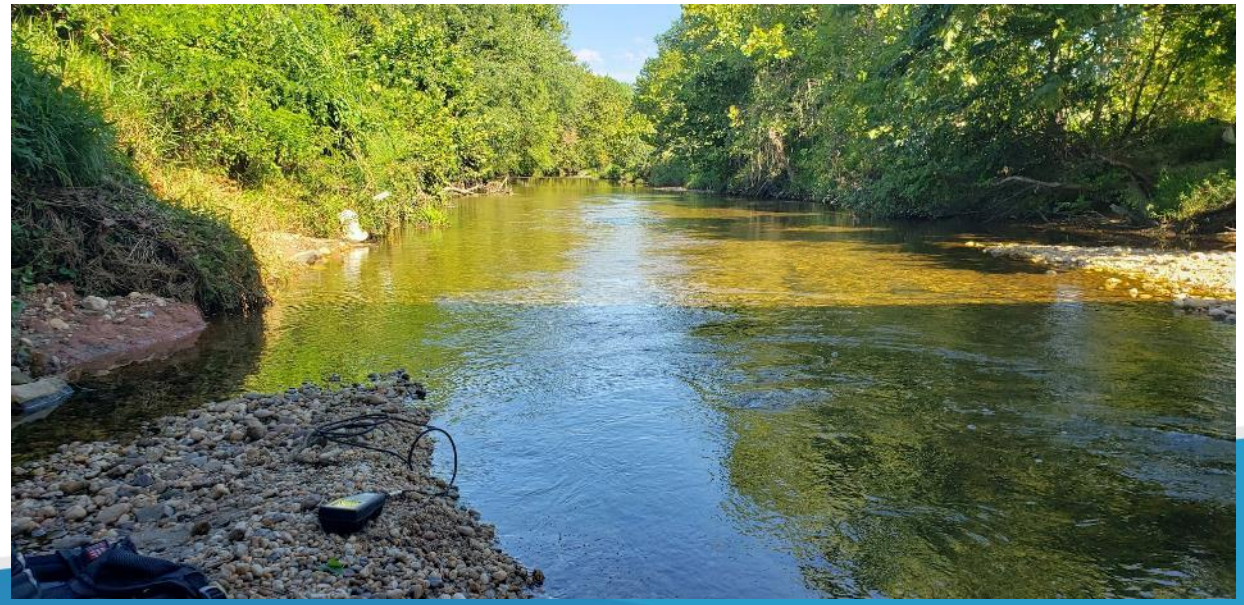
Restoration provided minor benefits to stream health

Sample location	Instream Cover	Epifaunal Substrate	Embeddedness	Channel Alteration	Sediment Dep	Freq of Riffles	Channel Flow Status	Bank Veg	Bank Stability	Riparian Zone	TOTAL	Mean Habitat	Rating
PB-2	15	14	14	18	15	17	15	13	14	16	151	15.1	Sub-Optimal
PB-3	13	17	15	17	10	15	15	15	13	17	147	14.7	Sub-Optimal
PB-4	14	15	15	15	10	16	13	9	8	18	133	13.3	Sub-Optimal
PB-5	14	11	14	8	9	17	15	13	12	17	130	13.0	Sub-Optimal

Optimal: 20 to 16; Sub-optimal: 15 to 11; Marginal: 10 to 6; Poor: 5 to 0



Lower than expected IBI score despite restoration and conservation practices

Sample location	Index Region	Score # total macros taxa	Score # EPT indentified		Score # #taxa ephem	Score % intol urban	# EPT	Score % # ephem	# chirpn	Score % clinger	# intol urban	Sum score	% eph	IBI	Rating	ntol ban	% clinger
PB-2	EPIEDMONT	5	119	3	30	1	5	1	67	3	3	16	0.84	2.67	Poor		42.02
PB-3	EPIEDMONT	5	120	1	19	1	0	1	48	3	4	12	0	2	Poor		18.33
PB-4	EPIEDMONT	3	111	1	26	1	3	0	79	1	9	10	0	1.67	Very Poor		45.95
PB-5	EPIEDMONT	3	116	1	22	1	3	0	70	1	6	10	0	1.67	Very Poor		29.31

Cricotopus larvae (non-biting midge)
Source: https://v3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=1078279

Naididae (Naidid worm)
Source: https://www.inaturalist.org/photos/232780135

Tvetenia larvae (non-biting midge)
Source: https://v3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=719409

Cheumatopsyche larvae (caddisfly)
Source: https://www.macroinvertebrates.org/taxa-info/trichoptera-larva/hydropsychidae/cheumatopsyche/lateral

Conclusion

- Partial stream restoration can provide **some** observable improvements in water quality
- Synoptic sampling **detected** pollutant hotspots or buffering capacity related to specific land use features
- Watershed-scale drivers (impervious surface/stormflow) may **overpower** benefits from restoration activities

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Thank you

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