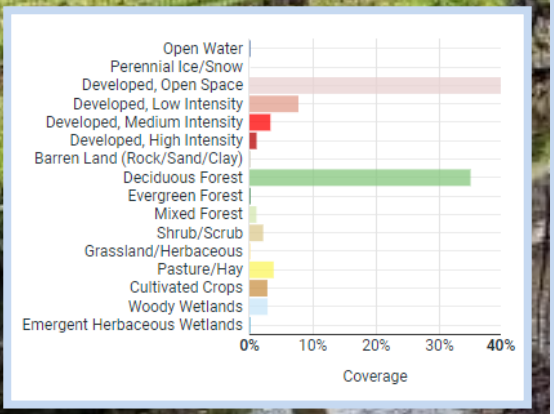
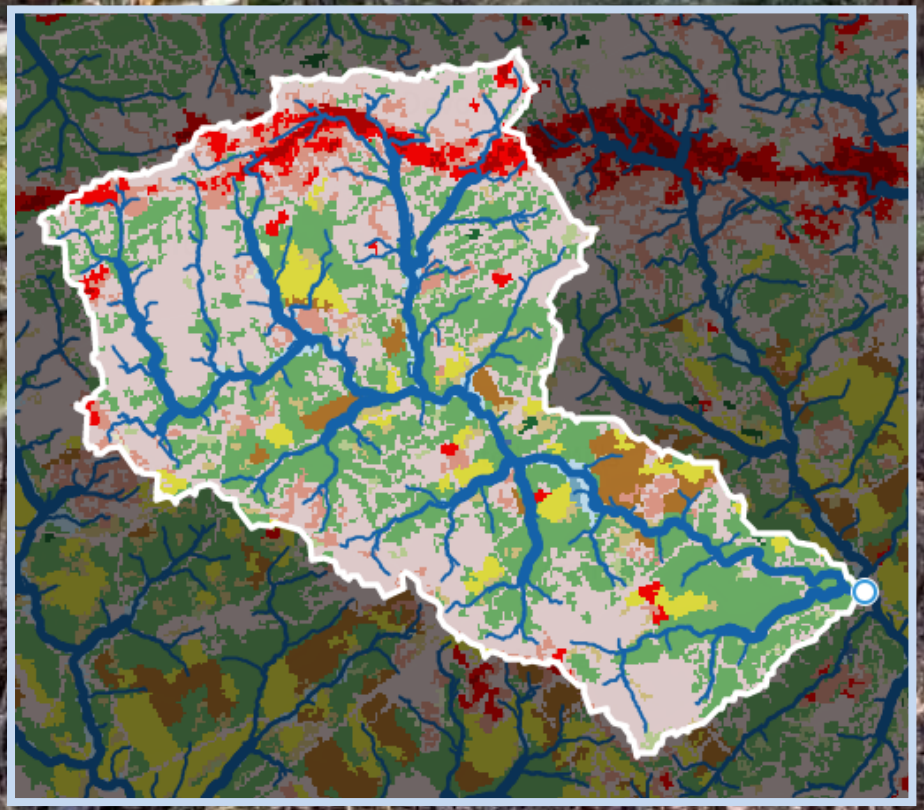
Darby Creek Valley Association's Watershed 101, Online Seminar Series

April 23, 2020

Introduction to Model My Watershed®

David Bressler, Stroud Water Research Center





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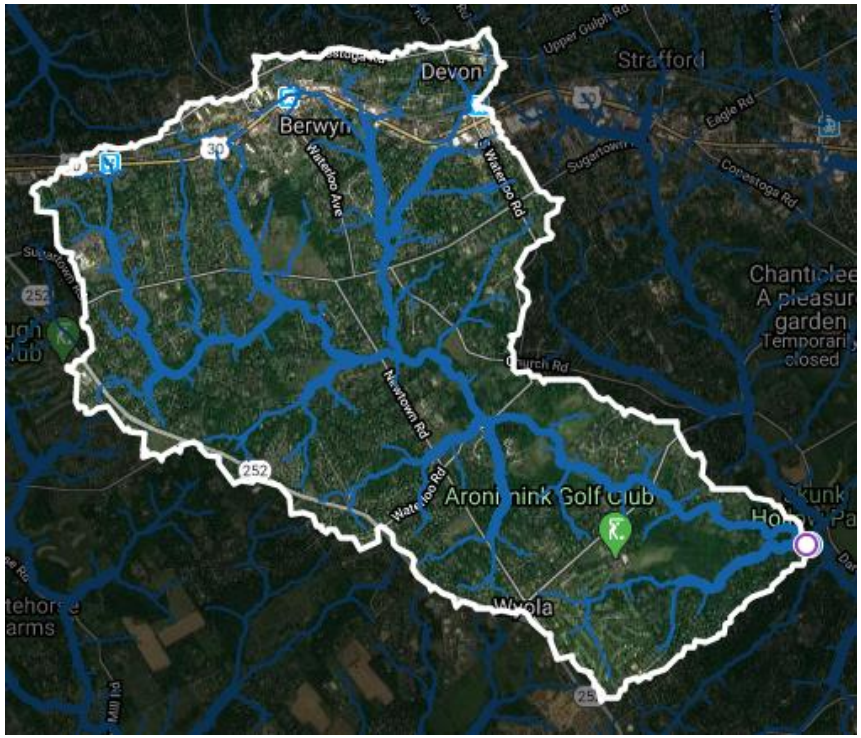
Overview

Model My Watershed®

- What is Model My Watershed?
- What can I do with Model My Watershed?
- **Case study and online tutorial of ModelMW, Darby Creek headwaters**
  - Overview of urban streams – context for our region



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Goals

- **Understand the basics of ModelMW**
  - How to use ModelMW
  - How results can help me better understand my watershed

- Better understanding of the connection between the landscape and stream health
  - **Urban context**

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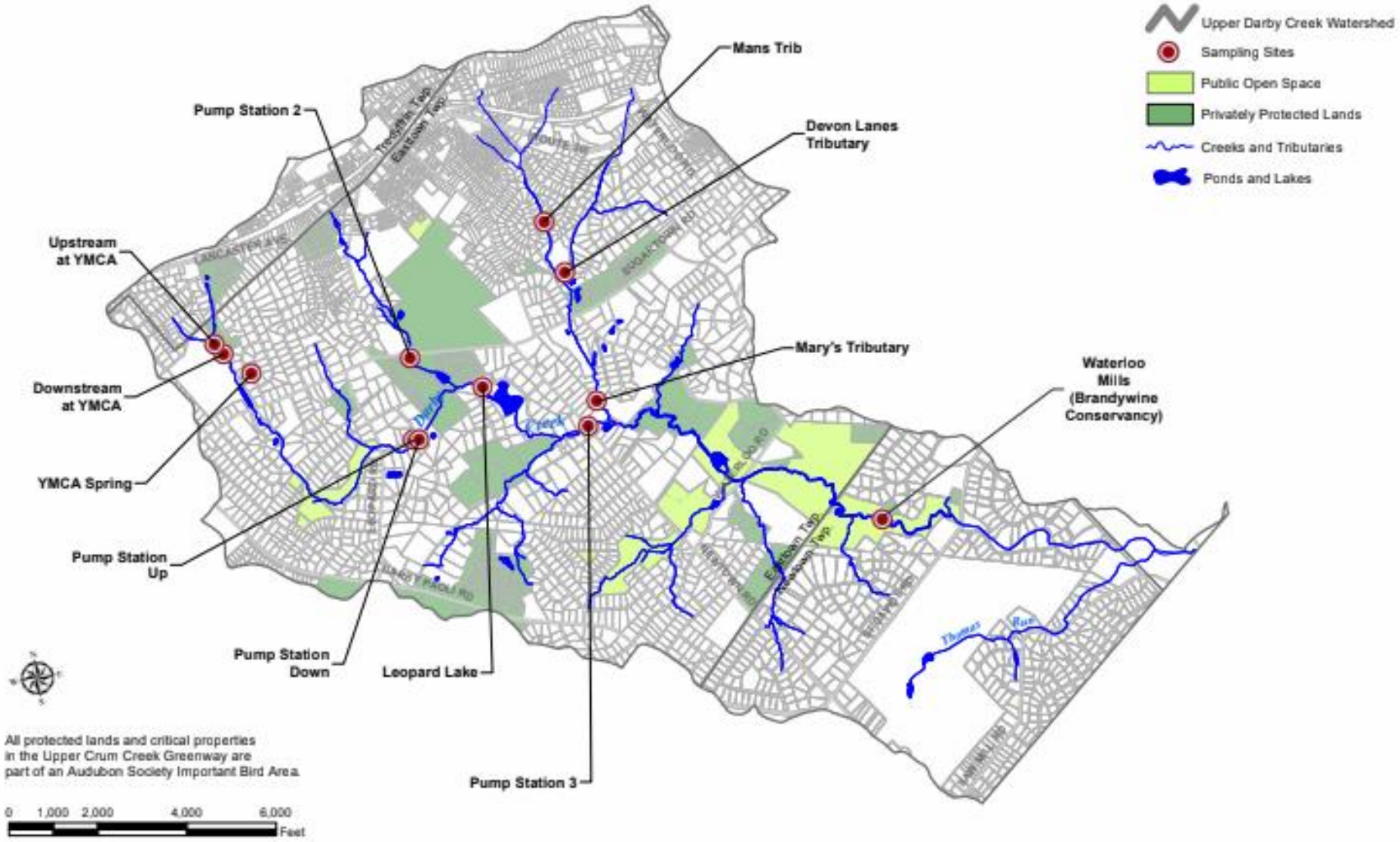
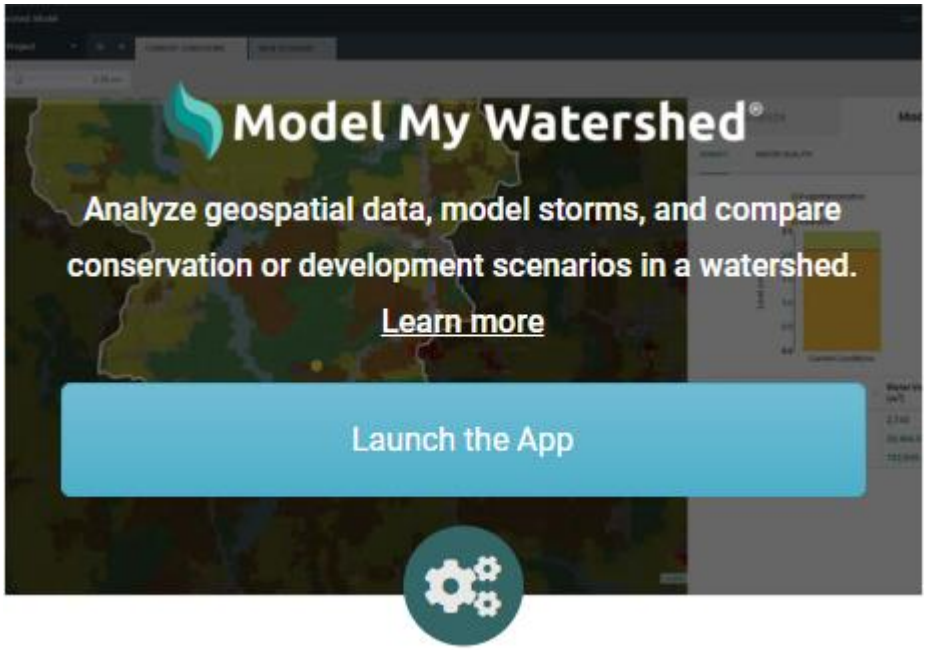
DCVA/WCT - Darby Creek Headwaters Monitoring Project



What is Model My Watershed?

- *Model My Watershed* is a watershed-modeling web app that enables users to investigate:
  - Land use and soil data
  - Stormwater and water quality impacts
  - Influence of conservation practices



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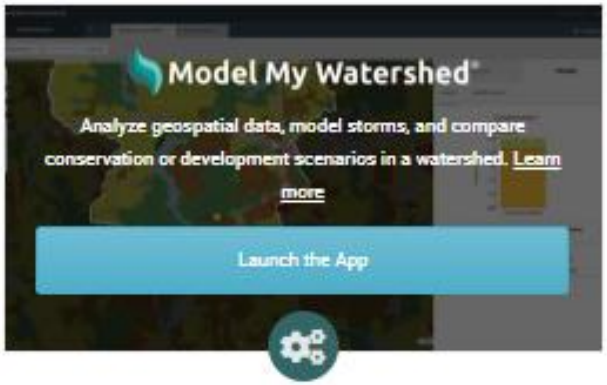
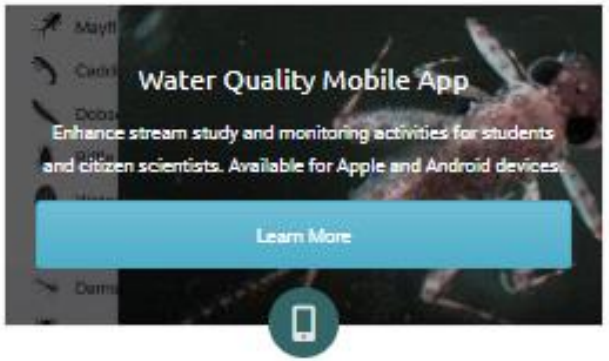
WikiWatershed®





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Model My Watershed Tutorial

- Wikiwatershed overview - https://wikiwatershed.org/
- Runoff Simulator - https://runoff.modelmywatershed.org/
- Model My Watershed - https://modelmywatershed.org/
  - Basic functions
  - Intro to modeling features
  - Help page
  - Videos, webinars, curricula

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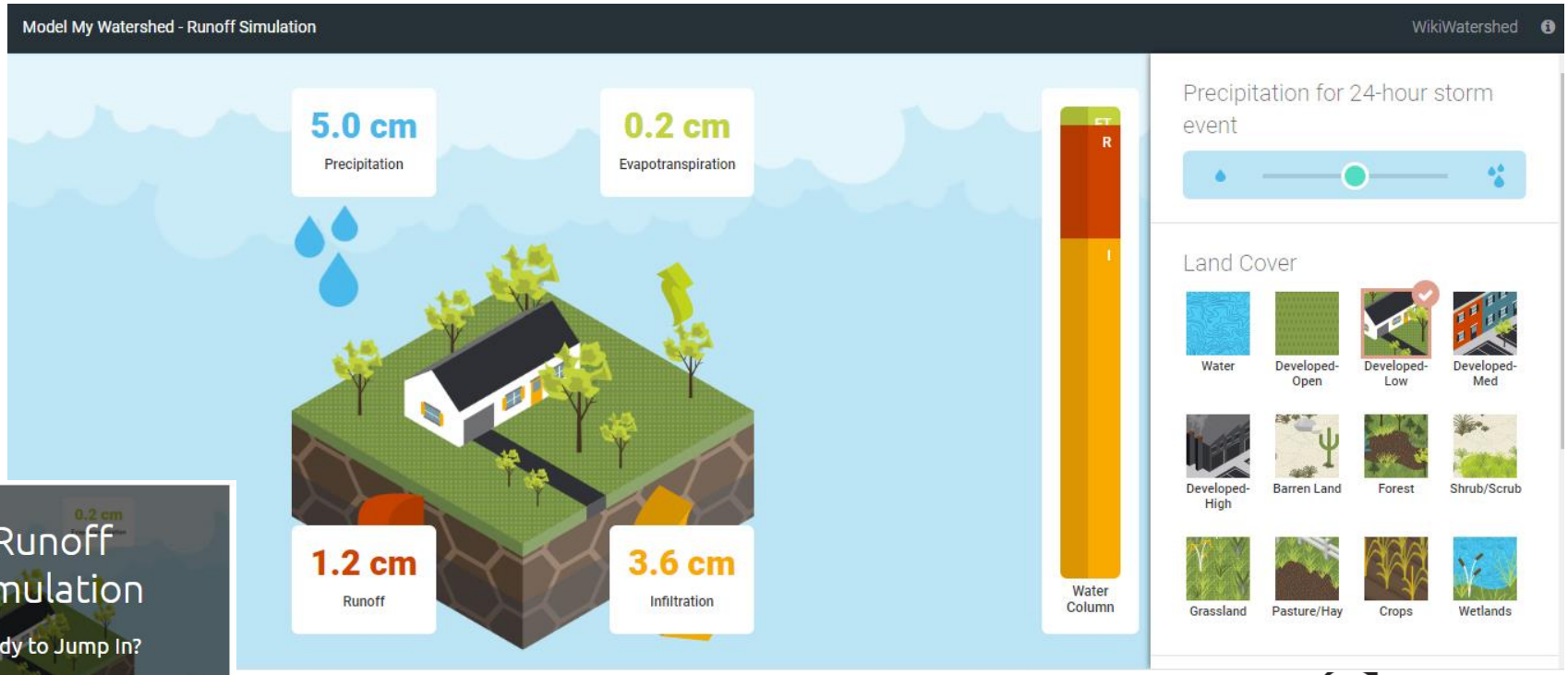
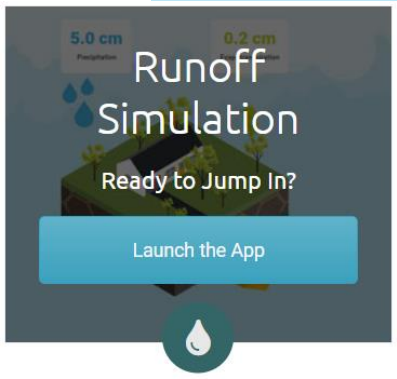
What can I do with ModelMW?

- **Education**
  - Runoff Simulator – education on connection of land use and soils to runoff, https://runoff.modelmywatershed.org/





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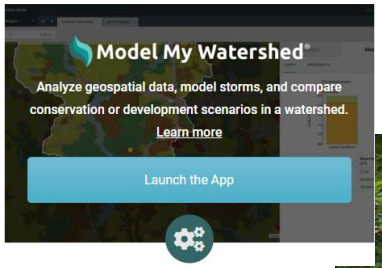
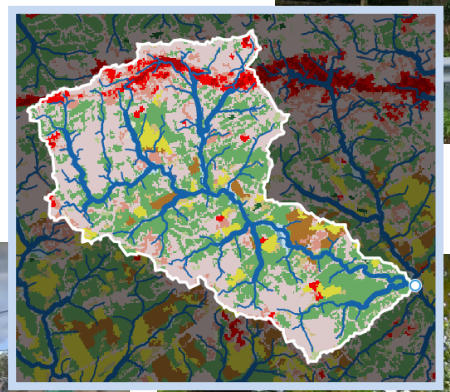
What can I do with ModelMW?

- **Mapping and Analysis**
  - Maps of land use, soils, other layers
  - Watershed boundaries
  - Detailed stream maps
  - https://modelmywatershed.org/

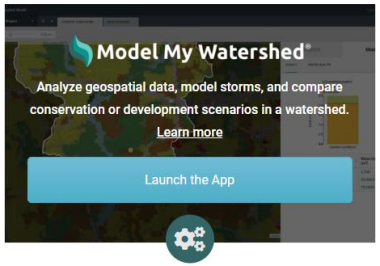


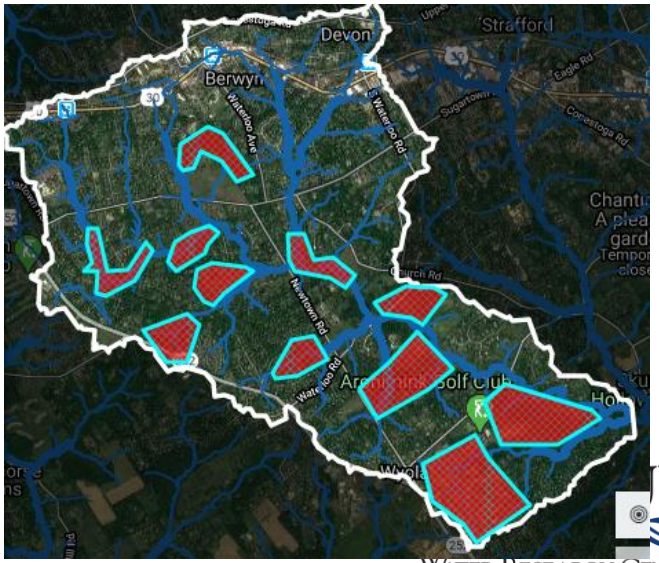


What can I do with ModelMW?

- **Modeling**
  - Effects of land use changes on water quantity and quality

What would happen to water quantity and quality if my forested watershed was developed?





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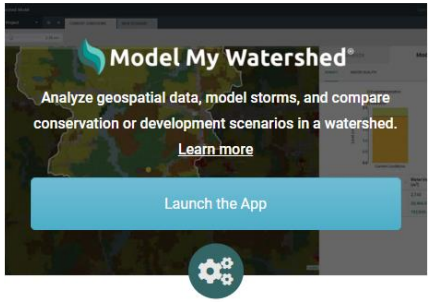
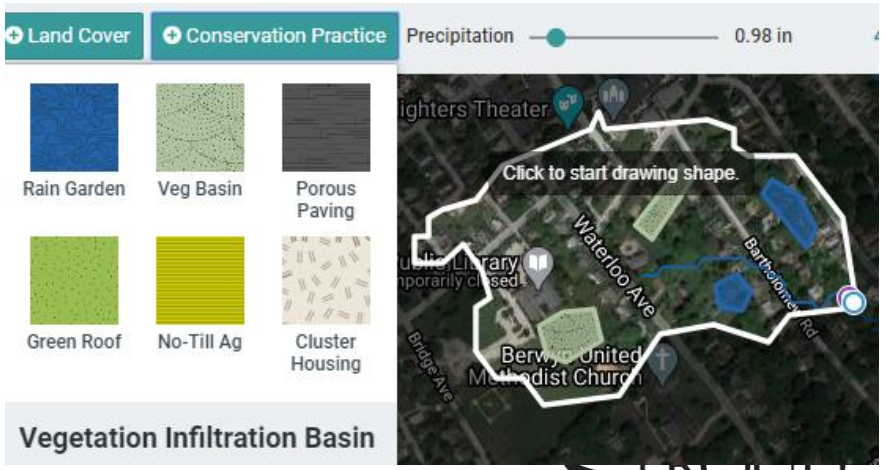
What can I do with ModelMW?

- **Modeling**
  - Effects of conservation practices on water quantity and quality

What would happen to water quantity and quality if my development used conservation practices?





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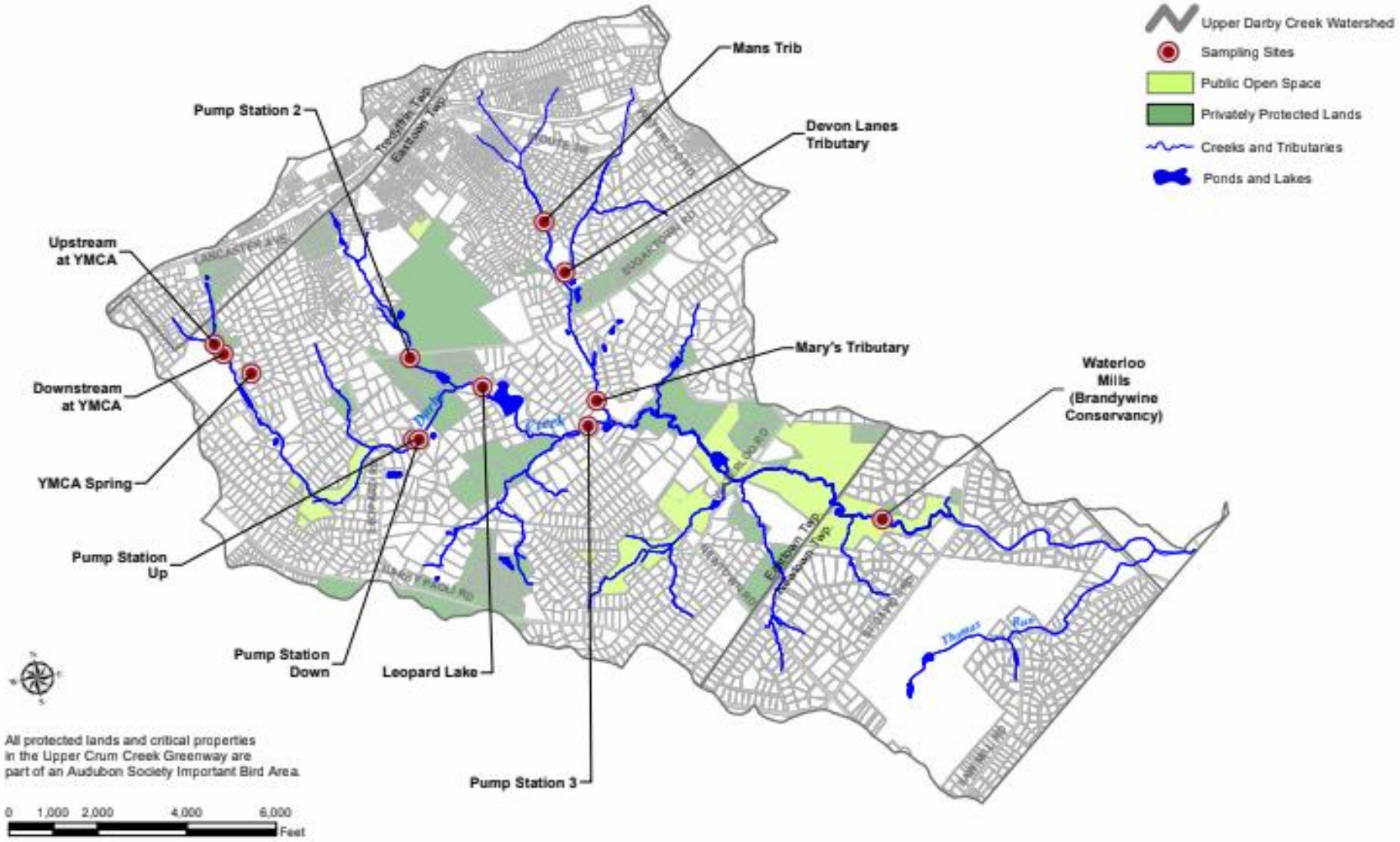
DCVA/WCT - Darby Creek Headwaters Monitoring Project



On to the Tutorial!

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  - Basic functions
  - Intro to modeling features
  - Help page - videos, webinars, curricula

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Resources

- Help – https://wikiwatershed.org/help/model-help/
- Technical Documentation – https://wikiwatershed.org/help/model-help/mmw-tech/
- Videos – https://wikiwatershed.org/videos/#model-my-watershed
- Curricula – https://wikiwatershed.org/curricula/

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If you are interested in becoming a volunteer contact:

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Derron LaBrake

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DCVA
DARBY CREEK VALLEY ASSOCIATION

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Lauren McGrath

Email: LBM@wctrust.org

WILLISTOWN
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Notes and additional materials

- See following slides

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- Connection of landscape activities to stream health
- Urban is a focus in southeastern PA and Darby headwaters
- Urbanization effects – overview of effects on hydrology, chemistry, temperature, and biology
- How does ModelMW help understand land use in your watershed
  - Runoff simulator to understand concepts
  - ModelMW analyze to understand what's there
  - Model MW model to understand how changes for the better or worse will affect water quantity and quality (nutrients and sediment)

Urban land impacts on stream health

- **Hydrology** – flooding, flashy flows
- Chemical pollutants
  - Road salts and other road-associated pollutants (gas/oil, PAHs, etc.)
  - Pesticides
  - **Nutrients (Nitrogen and Phosphorus)**
  - Pharmaceuticals, Per- and polyfluoroalkyl substances (PFAS), and other “emerging contaminants”
- **Sediment**

*Those listed in **Blue** above can be modeled in ModelMW

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		Forest-to-urban gradient						Agriculture-to-urban gradient		
		Portland	Salt Lake City	Birmingham	Atlanta	Raleigh	Boston	Denver	Dallas	Milwaukee
Chloride and nutrients	Nitrogen	↑	▲	–	^	^	^	–	–	–
	Phosphorus	^	–	–	–	–	▲	–	–	–
	Chloride	▲	^	^	↑	^	↑	^	▲	↑
Pesticides	Herbicides[1]	^	^	^	↑	▲	–	–	–	–
	Insecticides[2]	▲	^	–	^	^	^	▲	^	–
	PTI[3]	–	–	–	▲	^	^	–	^	–
Hydrophobic contaminants	Occurrence[4]	▲	No data	(5)	↑	↑	No data	↑	^	↑
	PAHs[6]	▲	No data	No data	↑	↑	No data	↑	▲	↑
	Toxicity[7]	↑	No data	↑	↑	↑	No data	↑	▲	↑

[1] Total herbicide concentration.
[2] Total insecticide concentration.
[3] Pesticide Toxicity Index (PTI).
[4] Number of different hydrophobic contaminants detected with semipermeable membrane devices (SPMDs).
[5] Birmingham samples were evaluated only for overall toxicity, not individual contaminants.
[6] Concentration of polycyclic aromatic hydrocarbons (PAHs).
[7] Toxicity of overall mixture of hydrophobic contaminants based on the P450 bioassay.

Relation to urban development

Increases with urban development

↑ Strong (rho ≥0.7)

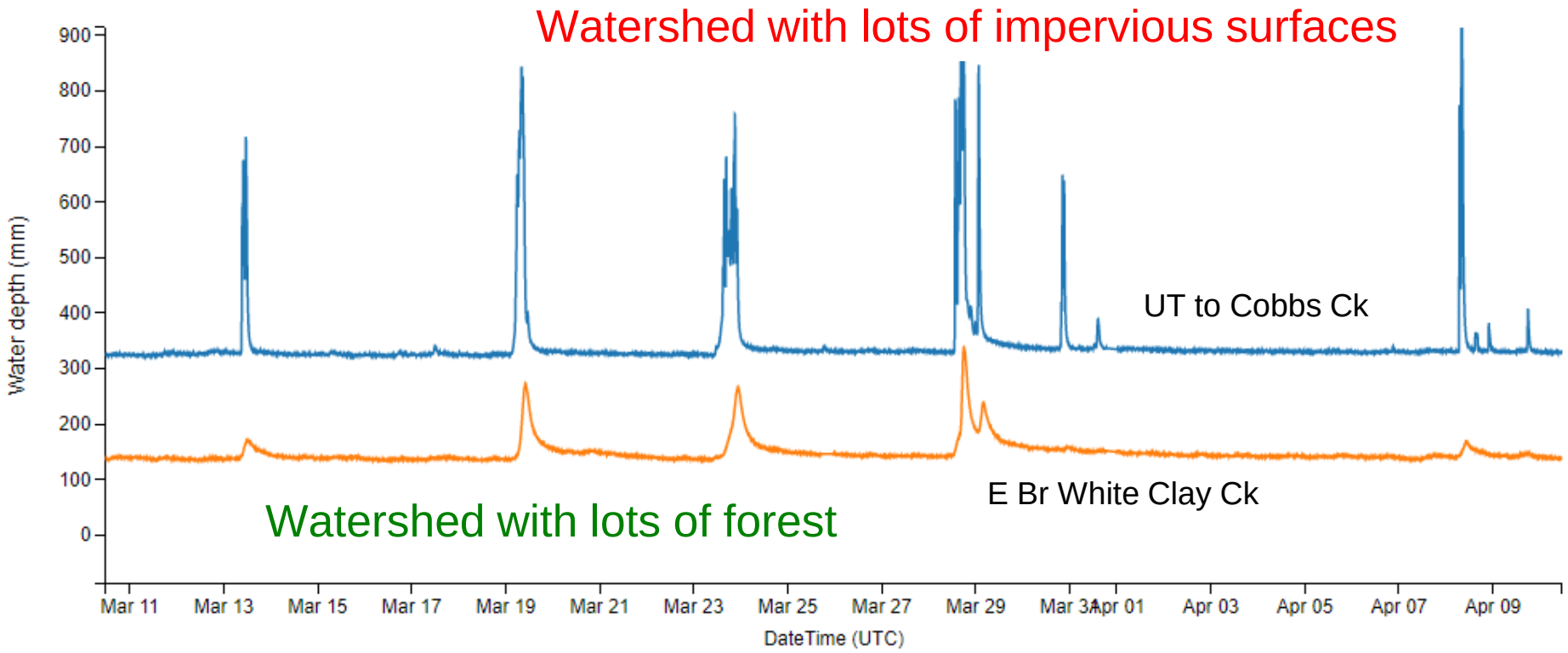
^ Moderate (rho 0.5 to 0.69)

▲ Weak (rho 0.4 to 0.49)

– rho <0.4

Water Depth (Discharge or Stream Flow)

- Stream flow is more extreme, flashier, more flooding in urban than forested watersheds



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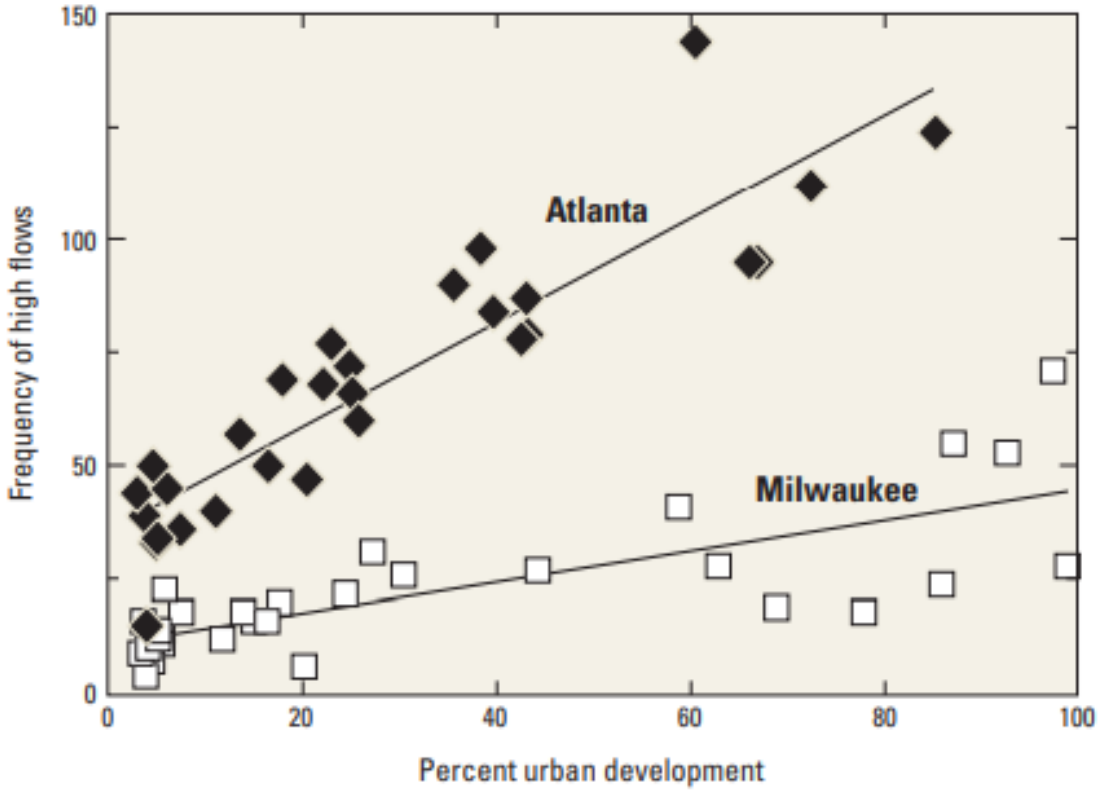

Figure 4–1. The frequency of high flows increased with urban development, although the rate of change differed among study areas, as seen by the different slopes of the lines in this example for Atlanta, Ga., and Milwaukee, Wis.

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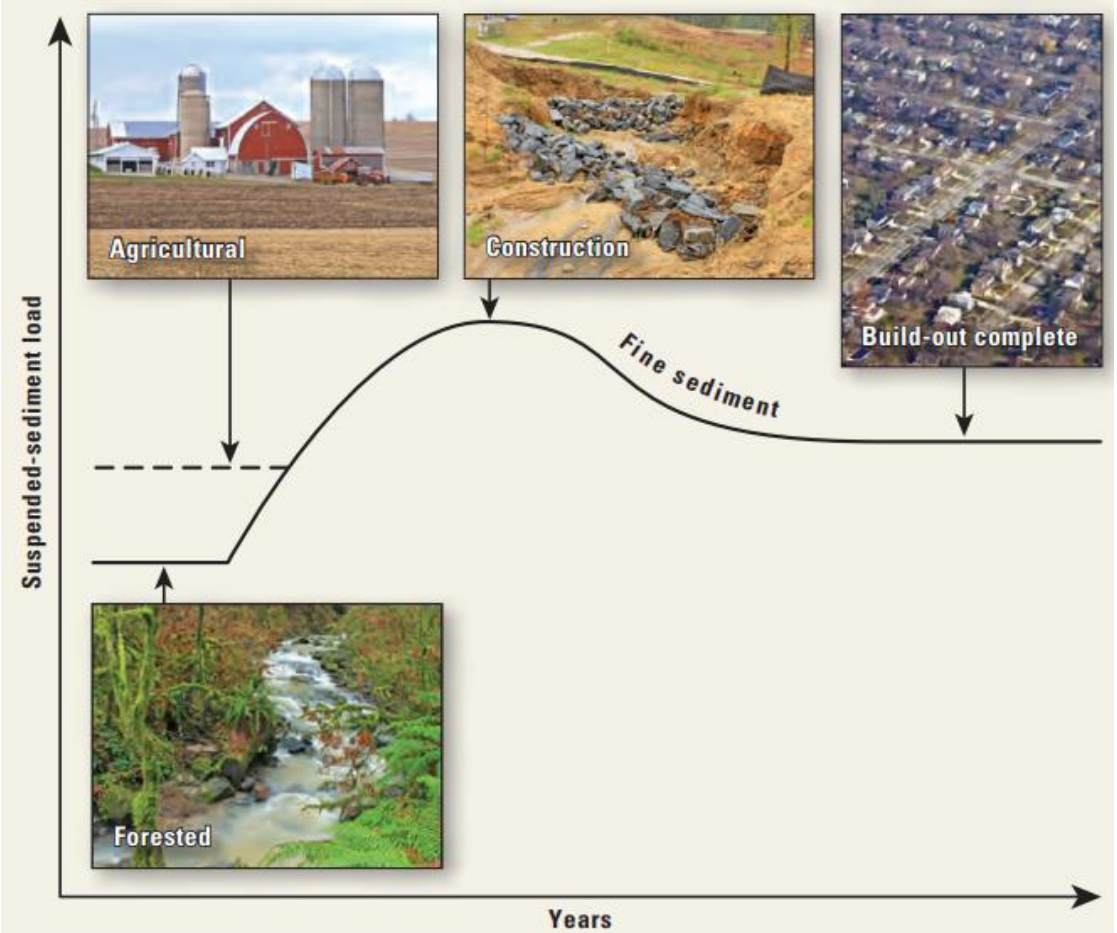

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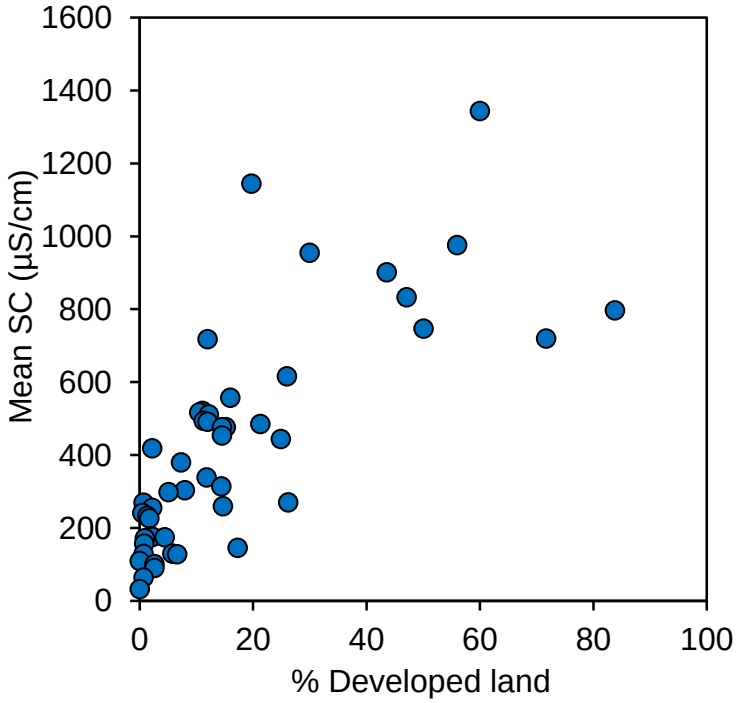
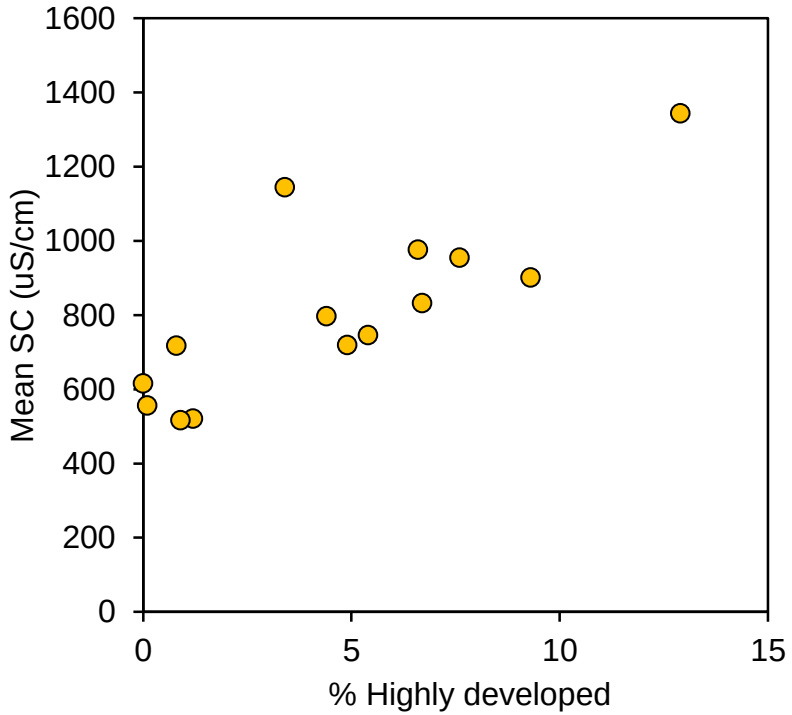
Using Model MW to understand my watershed's issues

- Making connections to how urban land impacts stream health





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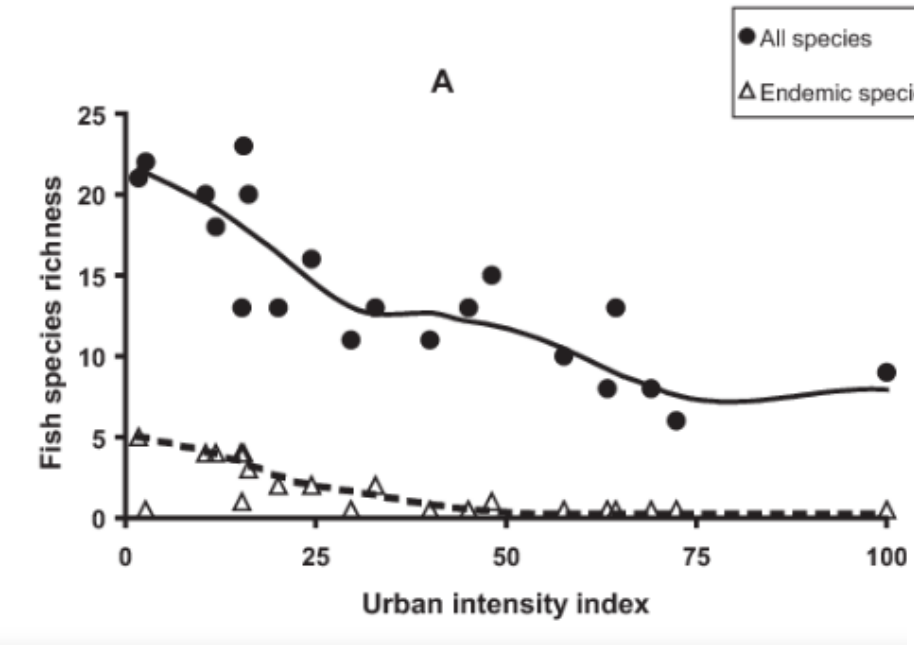

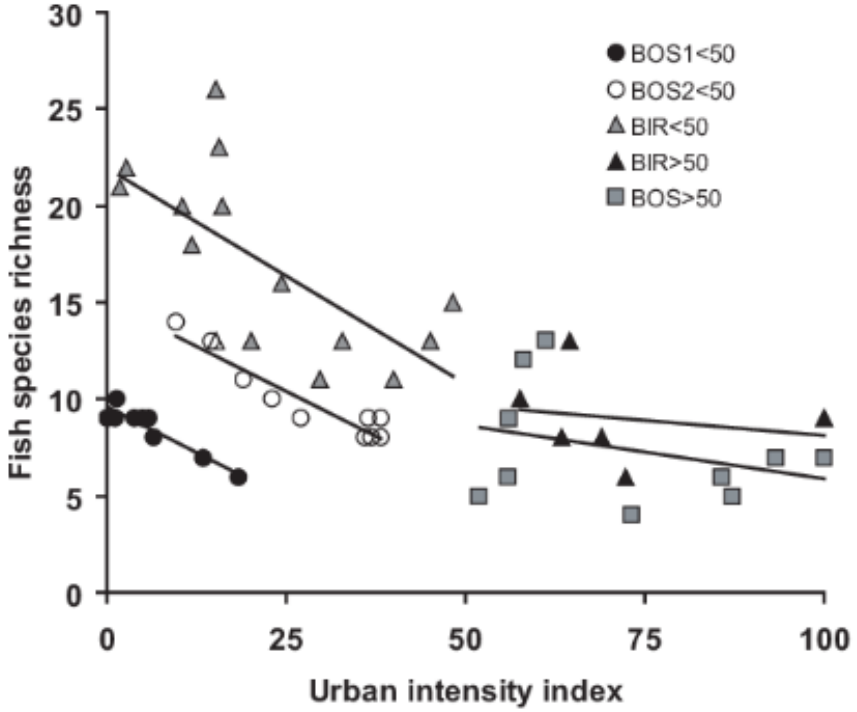

Meador, M.R., Coles, J.F., & Zappia, H. (2005). Fish Assemblage Responses to Urban Intensity Gradients in Contrasting Metropolitan Areas: Birmingham, Alabama and Boston, Massachusetts.

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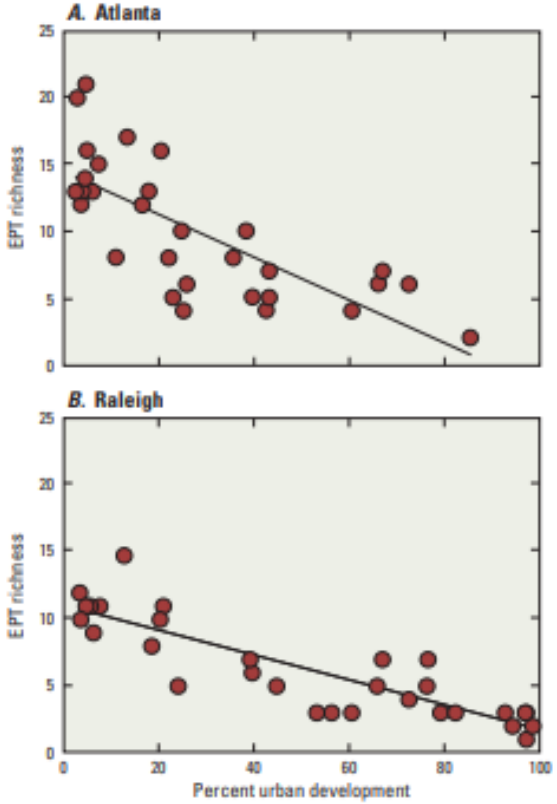
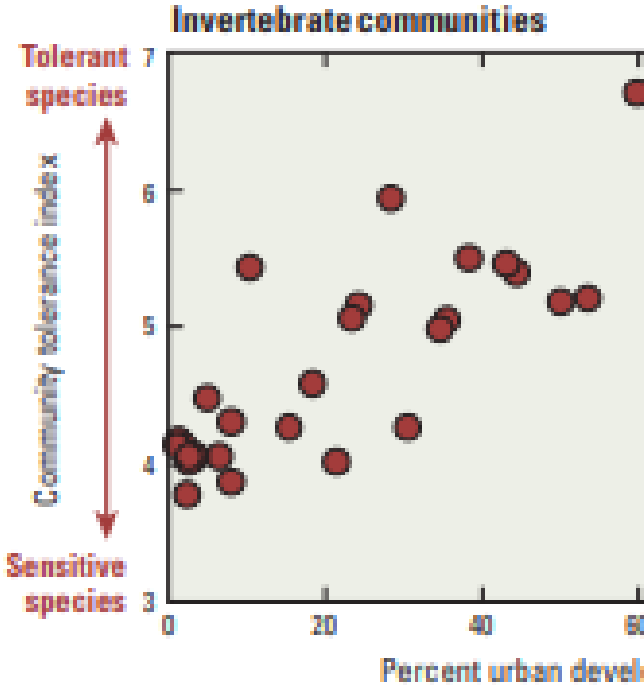


Figure 5–6. Urban development resulted in the loss of Ephemeroptera, Plecoptera, and Trichoptera (EPT) species, many of which are sensitive to contaminants, changes in streamflow, and other stressors. These examples from the Atlanta and Raleigh study areas show EPT richness decreasing with urban development, but the rate of loss, seen by the slope of the line, was greater in Atlanta.

Figure 5–7. The upward trend in the community tolerance index in the Boston study area indicates that sensitive species were lost and the percentage of pollution-tolerant invertebrate species increased as levels of urban development increased.



Coles, J.F.,et al., 2012, Effects of urban development on stream ecosystems in nine metropolitan study areas across the United States: U.S. Geological Survey Circular 1373, 138 p., available at https://pubs.usgs.gov/circ/1373/.

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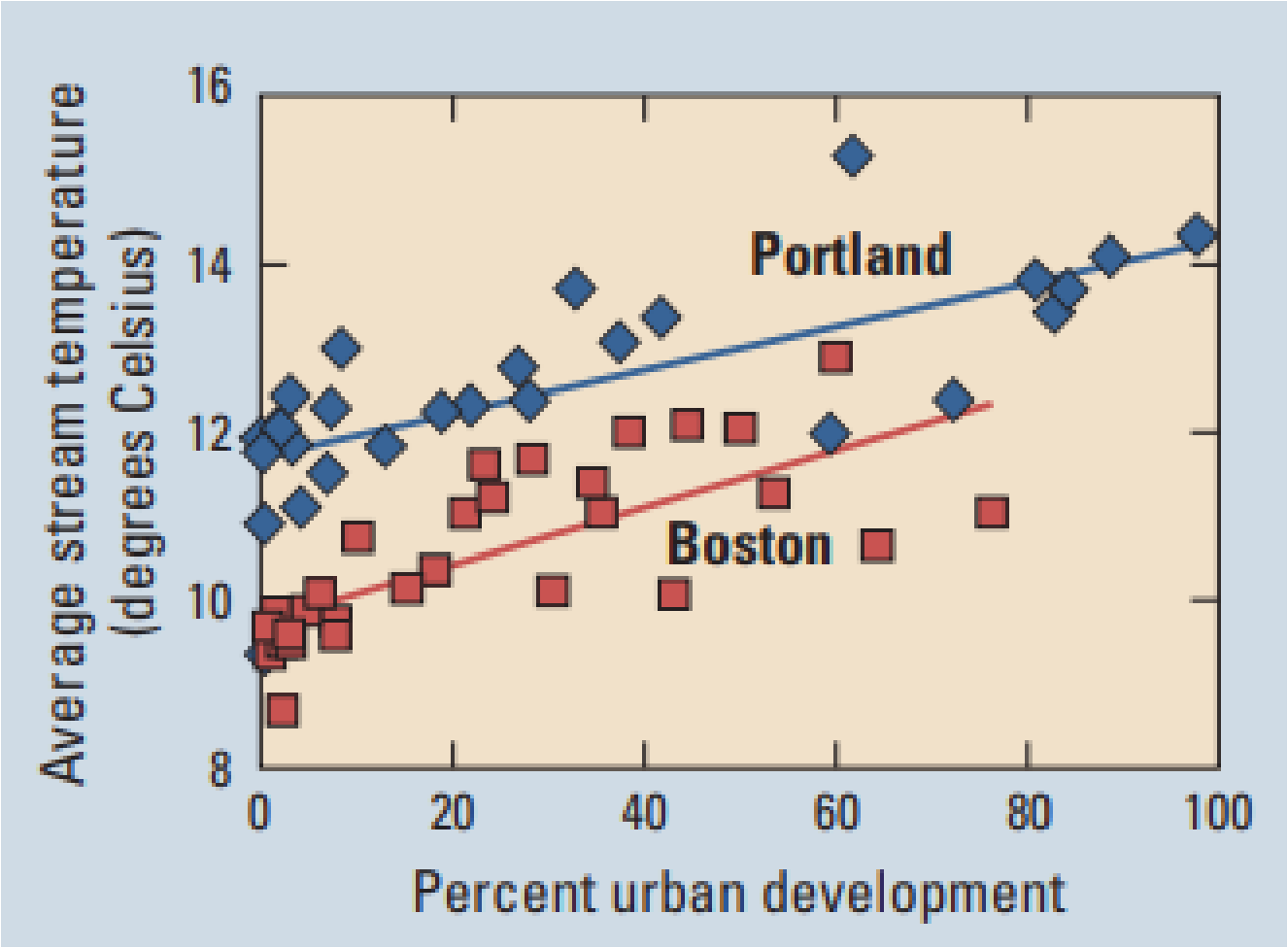

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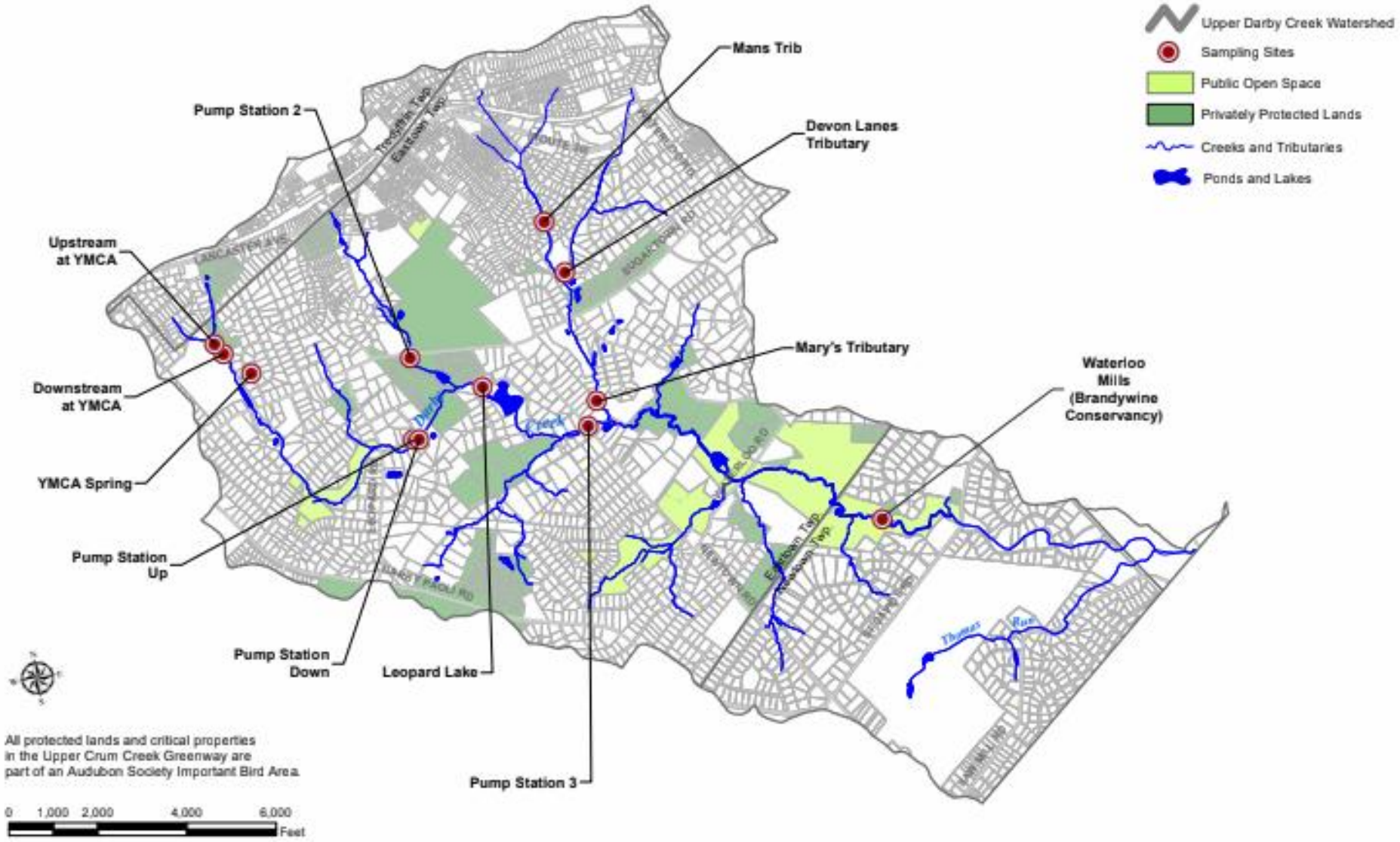
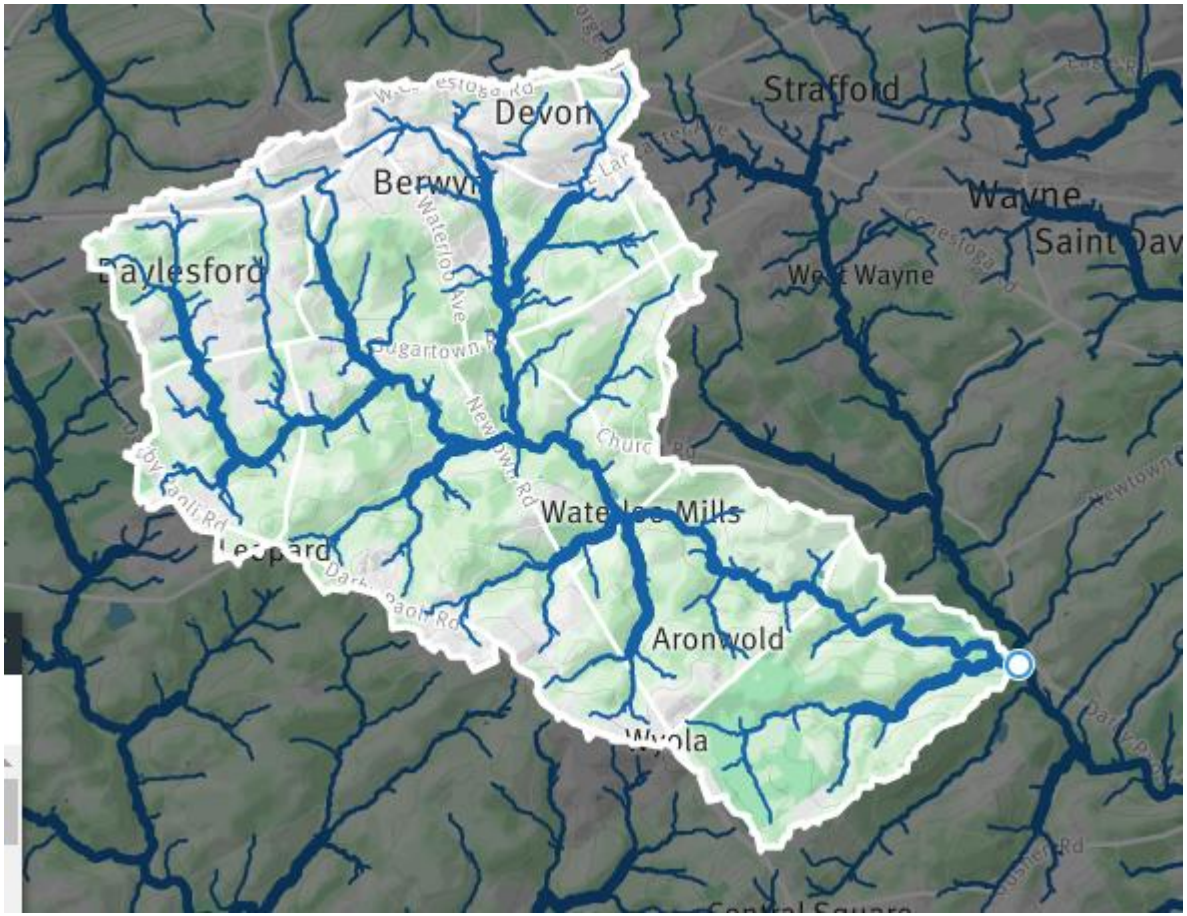


Landscape Conditions

Watershed boundary



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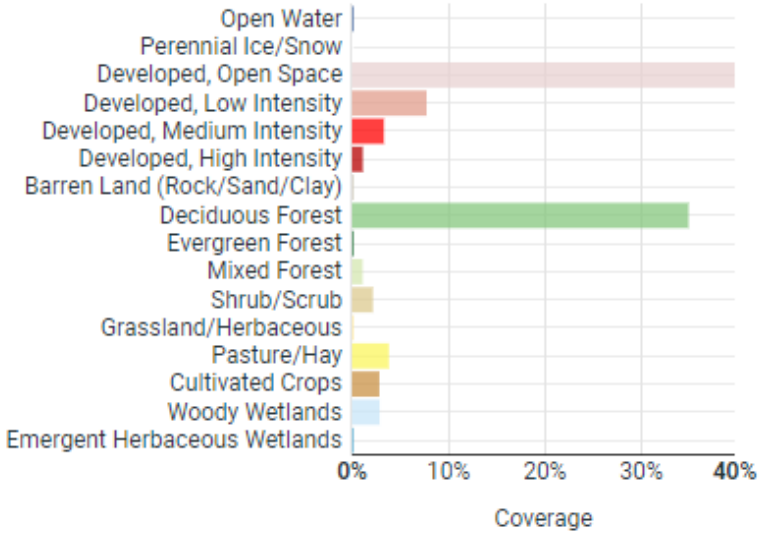
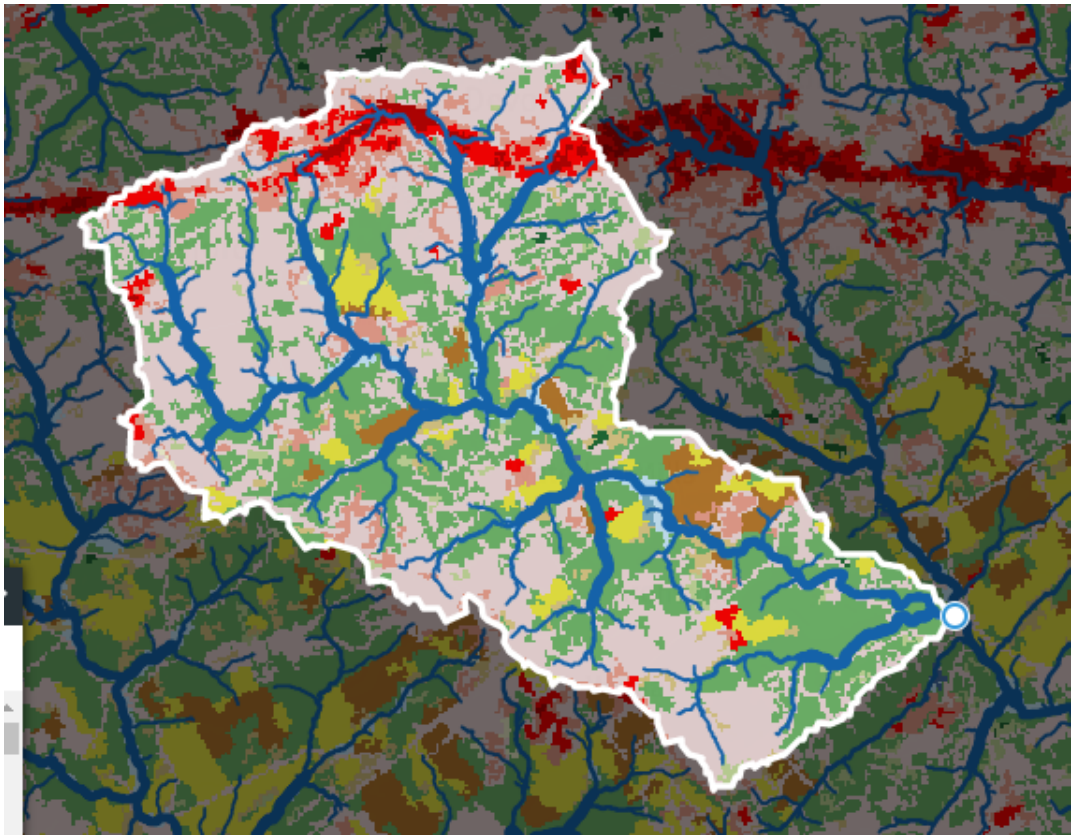
Landscape Conditions

Land Use/Land Cover





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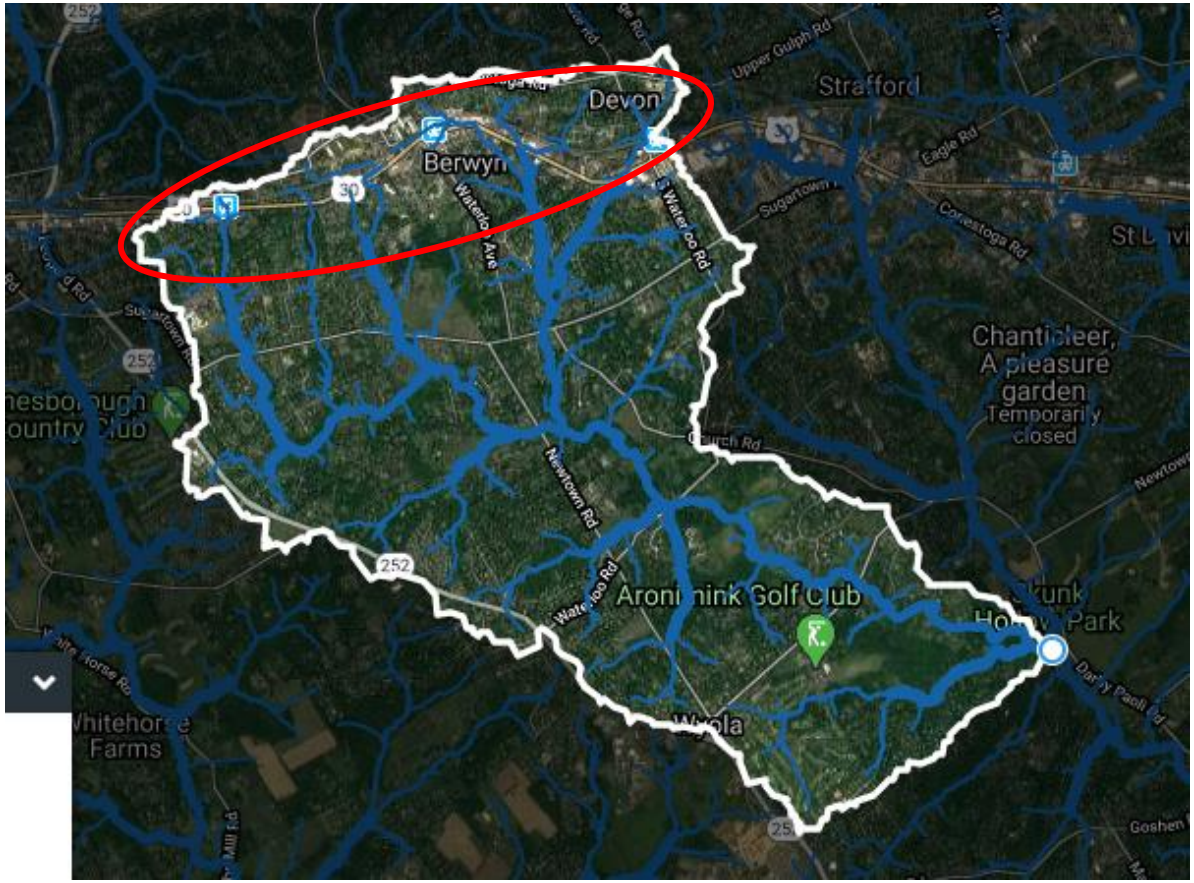
Landscape Conditions

Areal maps



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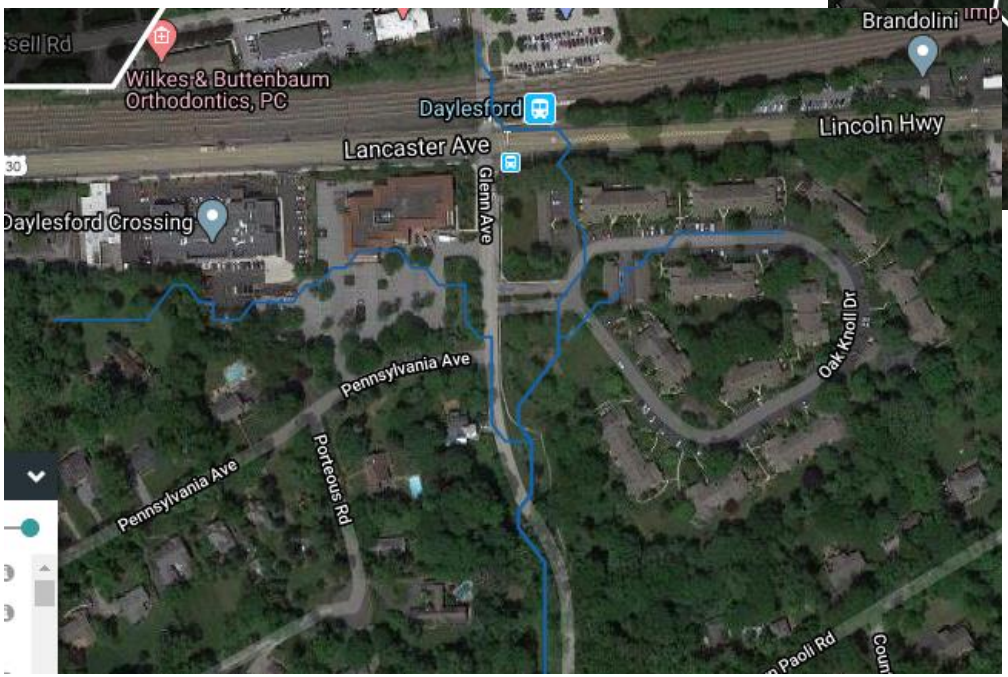
Landscape Conditions

Aerial maps



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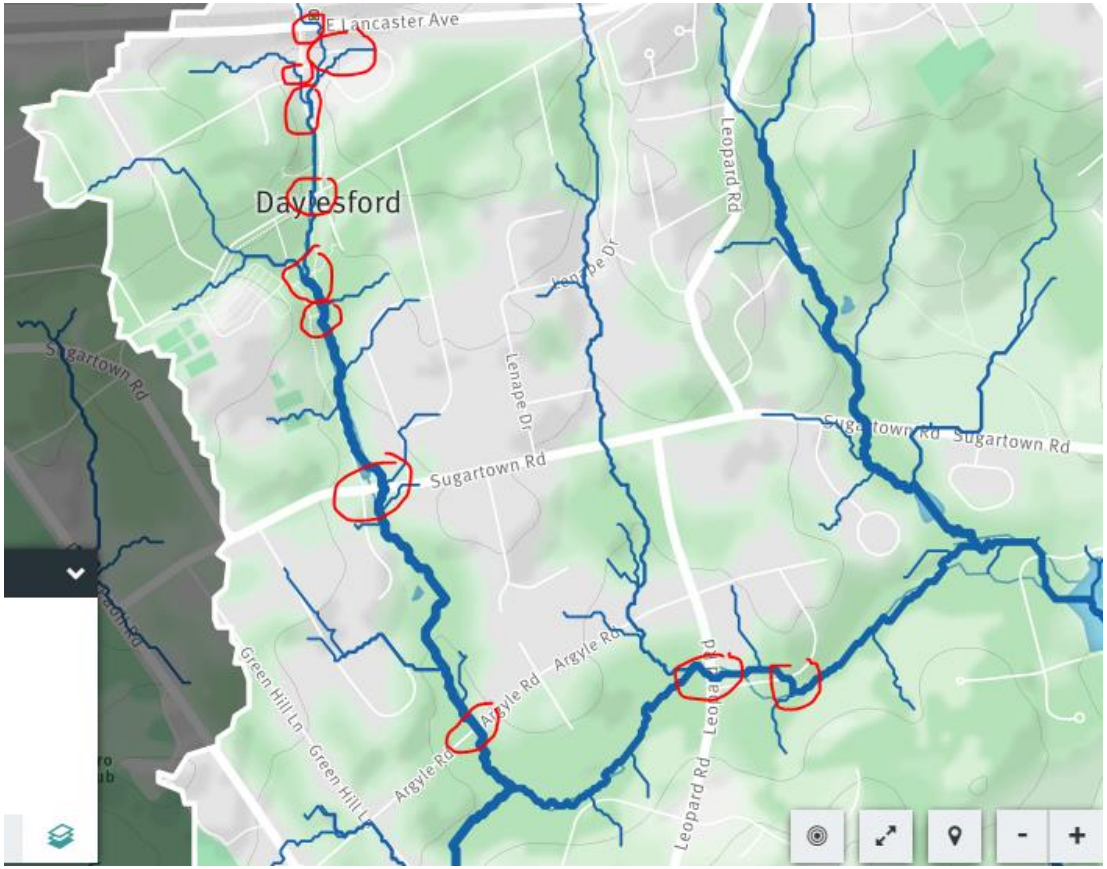
Landscape Conditions

Road crossings



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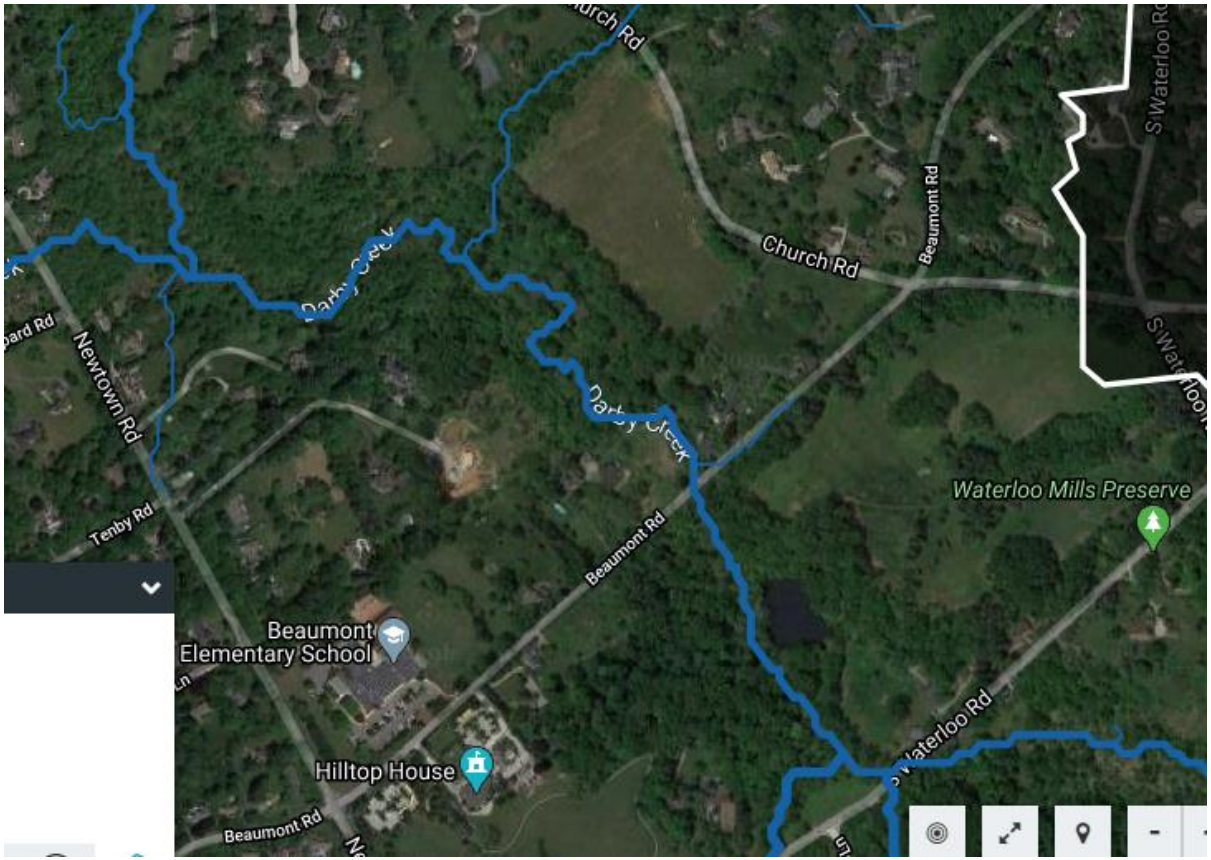
Landscape Conditions

Natural/forested areas



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