Human Impact on Local Water Resources: An NGSS-Aligned High School Unit

Developed for the Teacher Professional Learning (TPL) Workshop:

A collaboration between the Natural Resources and Education Departments at the

University of Connecticut

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Presentation Overview

- Brief Overview/Introduction of Next Generation Science Standards (NGSS)
- Three-Dimensional Learning as Sensemaking
- Initial Modeling Lesson

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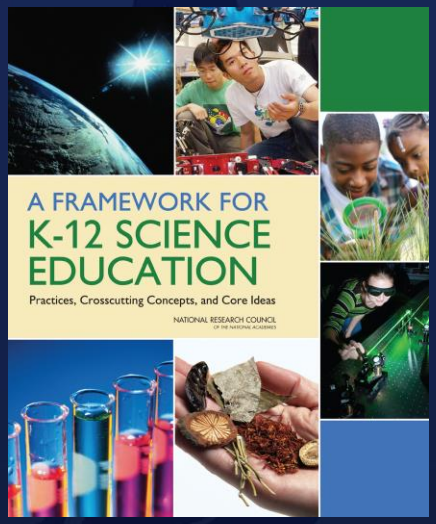
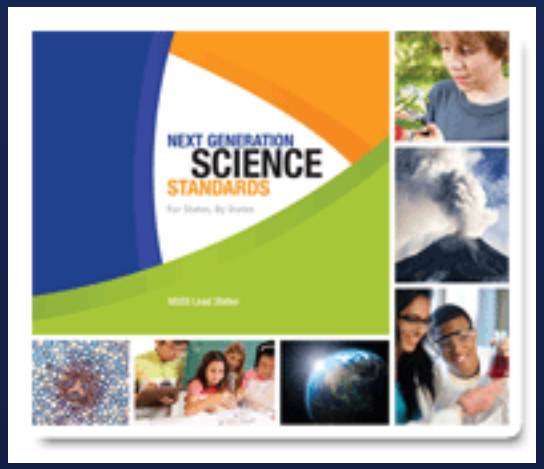
Framework and NGSS





The *Framework for K-12 Science Education* formed the basis for development of the *Next Generation Science Standards*.

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Three Dimensions of Science Learning Outlined in NRC Framework/Used to Frame NGSS

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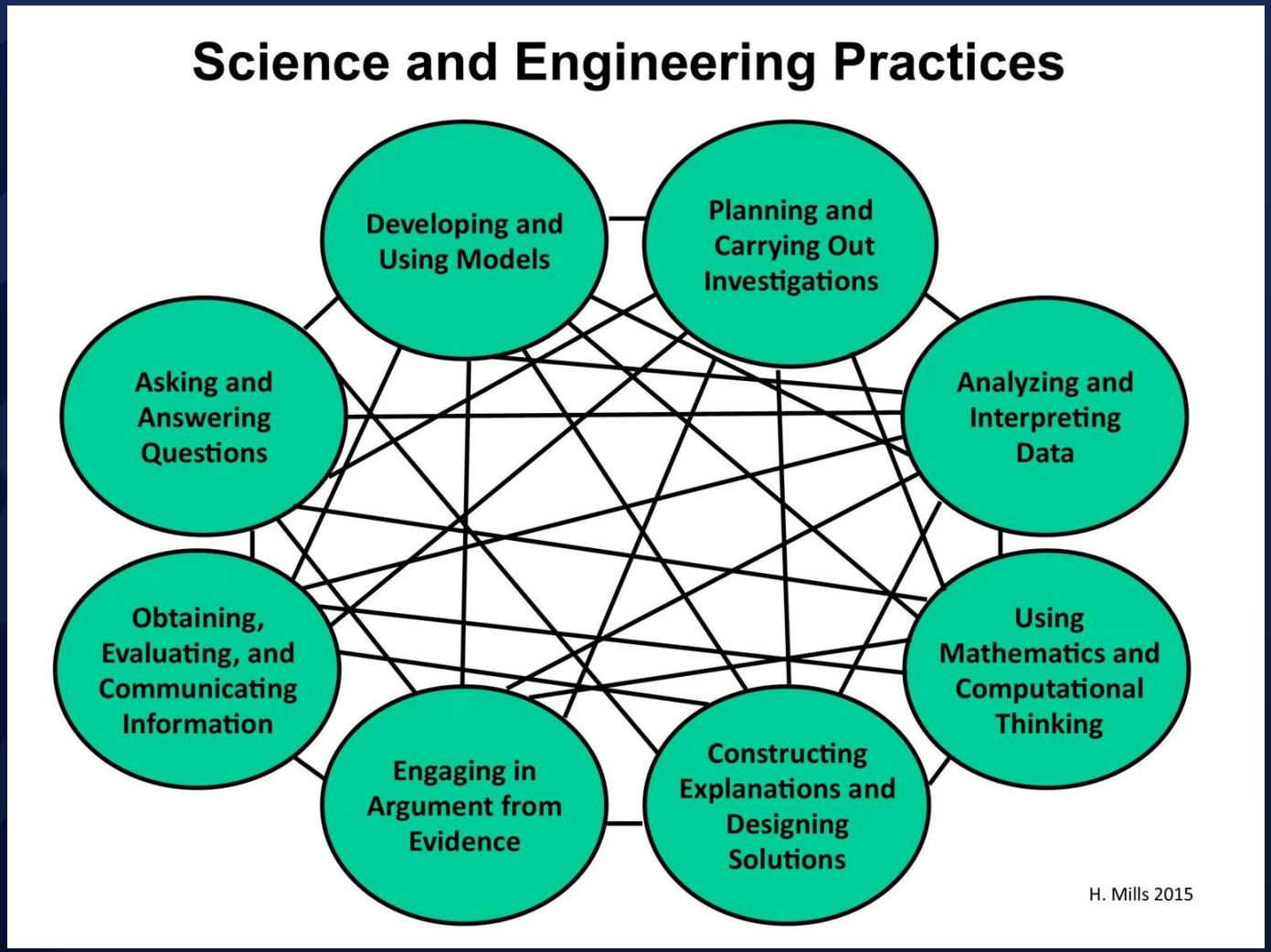
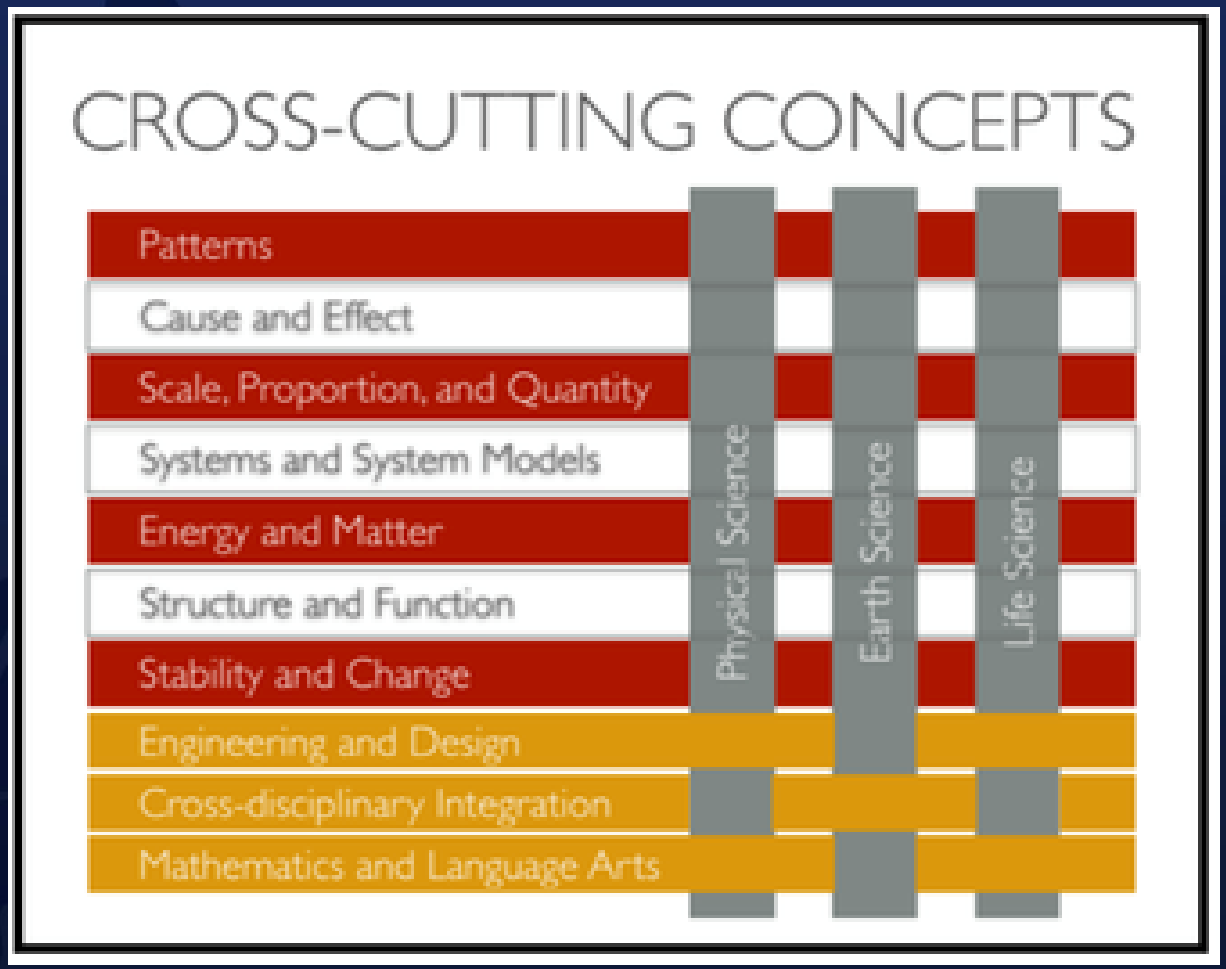
Science & Engineering Practices (SEPs)



Crosscutting Concepts (CCCs)



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Disciplinary Core Ideas (DCIs)

<u>Earth Science</u> - ESS3.C: Human Impacts on Earth Systems

❖The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

❖Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.

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Disciplinary Core Ideas (DCIs)

Life Science - LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.

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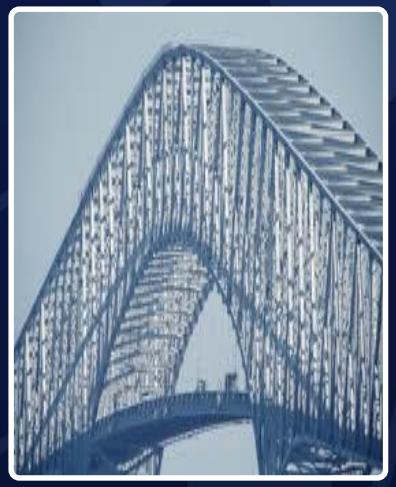
Disciplinary Core Ideas (DCIs)



Engineering Design - ETS1.B: Developing Possible Solutions

- When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. (secondary)

Integrating the Three Dimensions and Performance Expectations

HS-ESS3-3 Earth and Human Activity

Students who demonstrate understanding can:

HS-ESS3-3. **Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [*Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Using Mathematics and Computational Thinking
Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Create a computational model or simulation of a phenomenon, designed device, process, or system.

Disciplinary Core Ideas

ESS3.C: Human Impacts on Earth Systems

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Crosscutting Concepts

Stability and Change

- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- Modern civilization depends on major technological systems.
- New technologies can have deep impacts on society and the environment, including some that were not anticipated.

Connections to Nature of Science

Science is a Human Endeavor

- Science is a result of human endeavors, imagination, and creativity.

Connections to other DCIs in this grade-band:

Three-Dimensional Science Learning

Engaging in science and engineering practices to use disciplinary core ideas and crosscutting concepts to explain phenomenon or solve problems

Biggest Shifts in NGSS

Three-dimensional learning for the purpose of sensemaking through explaining phenomena or solving problems

Shifting from ‘learning about’ to ‘figuring out’!

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Starts with Phenomena!

A complex anchoring phenomenon is an occurrence or event that happen(ed) in our world

What is the state of your local water resource?

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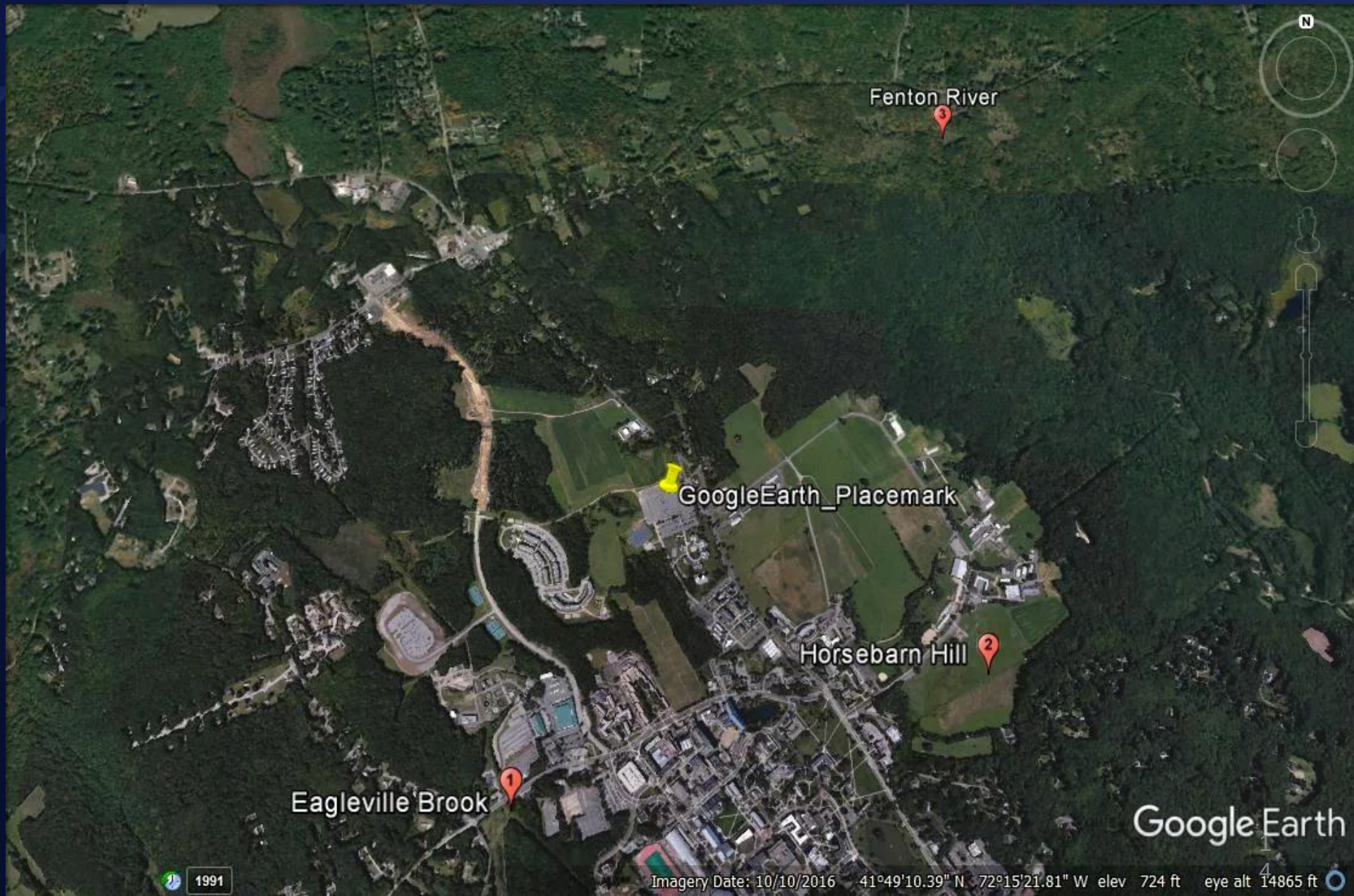
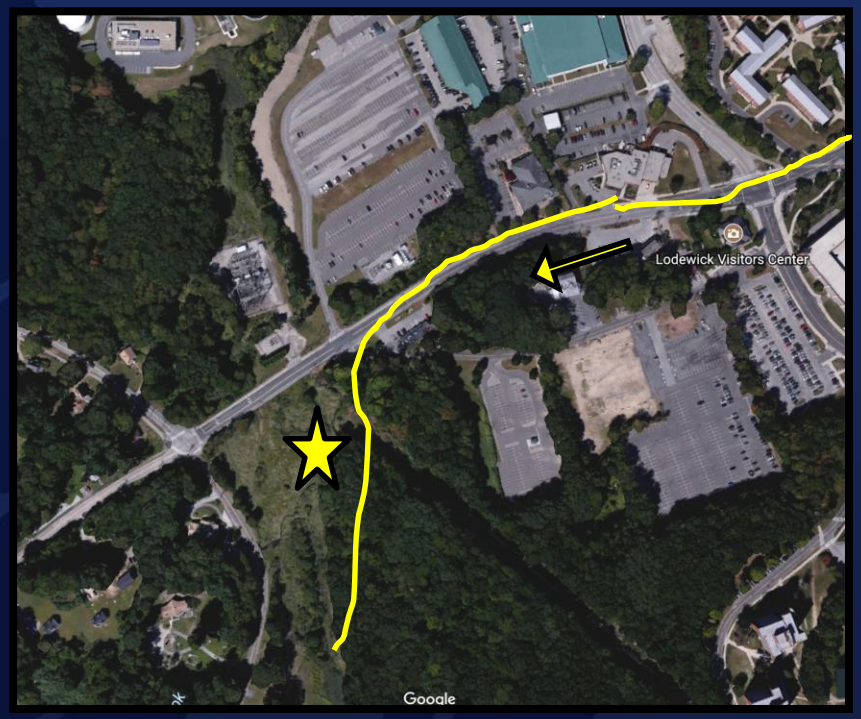
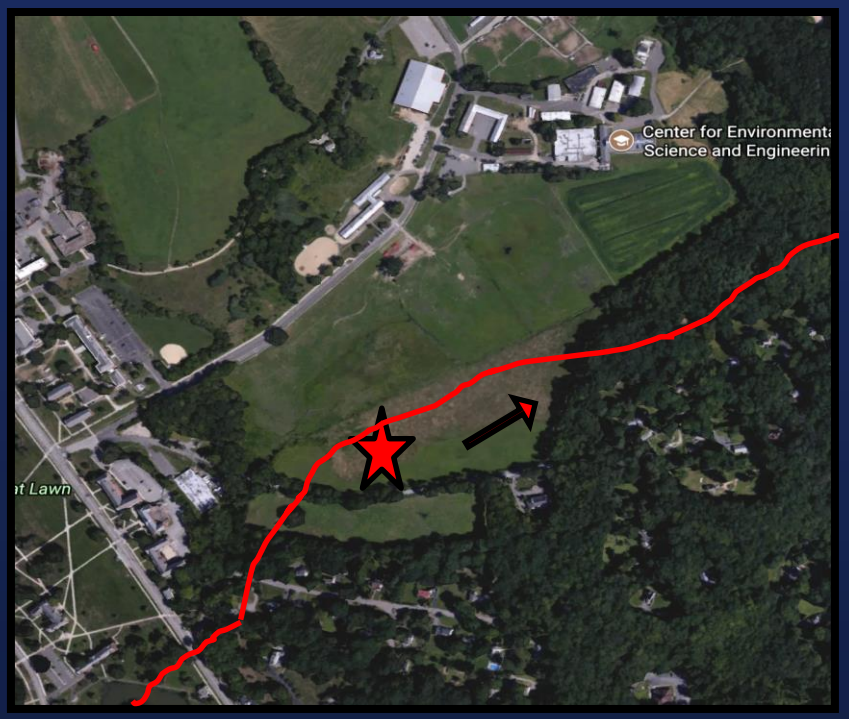
What do you predict is the state of each water resource and why?

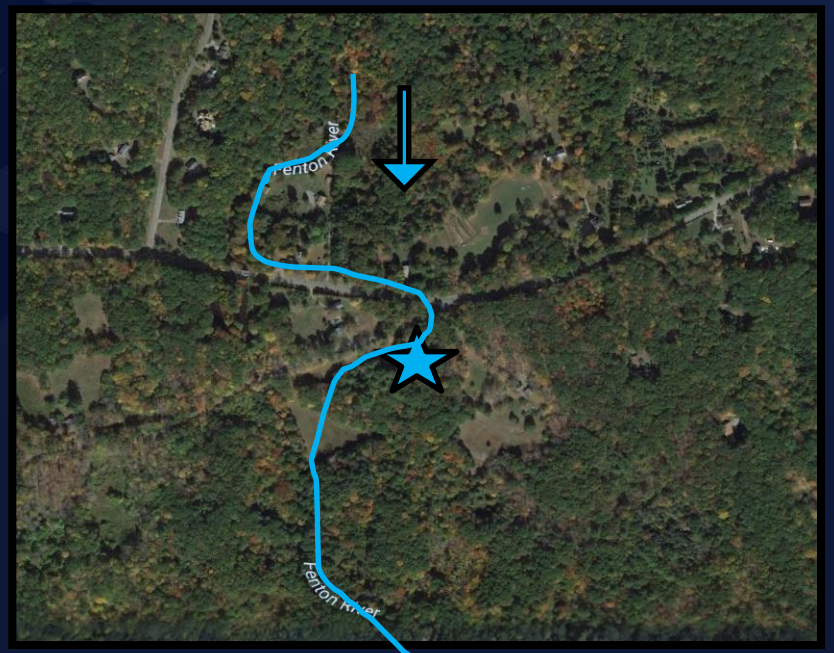




1. Eagleville Brook



2. Roberts Brook (Horsebarn Hill)



3. Fenton River

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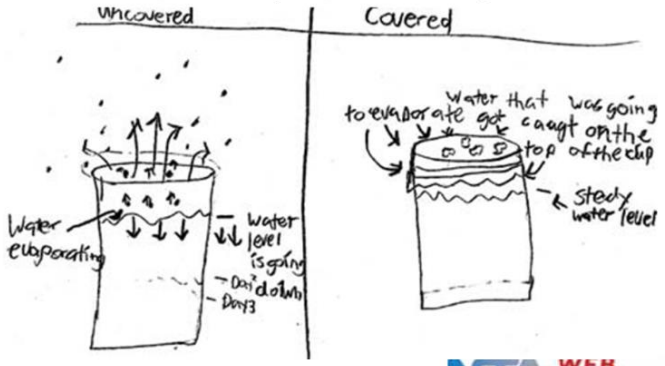
Science and Engineering Practice (SEP) Modeling

What is a Scientific Model?

- A Scientific Model
  - An abstract, simplified representation of a system that makes its central features explicit and visible
  - can be used to generate predictions and explanations for natural phenomena
  - Mental (internal) and conceptual (expressed) models



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