

Understanding Drinking Water Distribution using EPA Net

Stage 1 – Desired Results

Established Goal(s)/Content Standard(s):

•What relevant goals will this design address? NGSS: Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6) Students will use EPA Net 2.2 to describe/support claims about contamination points in a drinking water distribution system.
College Board AP Environmental Science Practices

 AP ENVIRONMENTAL SCIENCE Science Practices			
Practice 1	Practice 2	Practice 3	Practice 4
Concept Explanation 1 Explain environmental concepts, processes, and models presented in written format.	Visual Representations 2 Analyze visual representations of environmental concepts and processes.	Text Analysis 3 Analyze sources of information about environmental issues	Scientific Experiments 4 Analyze research studies that test environmental principles
SKILLS			
1.A Describe environmental concepts and processes. 1.B Explain environmental concepts and processes. 1.C Explain environmental concepts, processes, or models in applied contexts.	2.A Describe characteristics of an environmental concept, process, or model represented visually. 2.B Explain relationships between different characteristics of environmental concepts, processes, or models represented visually: - In theoretical contexts - In applied contexts 2.C Explain how environmental concepts and processes represented visually relate to broader environmental issues.	3.A Identify the author's claim. 3.B Describe the author's perspective and assumptions. 3.C Describe the author's reasoning (use of evidence to support a claim). 3.D Evaluate the credibility of a source (<i>not assessed</i>): - Recognize bias - Scientific accuracy 3.E Evaluate the validity of conclusions of a source or research study (<i>not assessed</i>).	4.A Identify a testable hypothesis or scientific question for an investigation. 4.B Identify a research method, design, and/or measure used. 4.C Describe an aspect of a research method, design, and/or measure used. 4.D Make observations or collect data from laboratory setups (<i>not assessed</i>). 4.E Explain modifications to an experimental procedure that will alter results.

Understanding (s)

Students will understand that:

- What are the big ideas? Many variables affect the nature of drinking water transport and safety.
- What specific understandings about them are desired? Understanding the dynamic nature of water movement related to demand, use and time of day.
- What misunderstandings are

Essential Question(s):

- What provocative questions will foster inquiry, understanding, and transfer the learning? How does a municipality ensure its water is delivered in a safe manner? What factors affect the nature in which contaminants may move through the drinking water distribution network?

predictable? Students may have a simplistic understanding of the drinking water distribution network.	
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Student objectives (outcomes):

Students will be able to:

- What key knowledge and skills will students acquire as a result of this unit? Students will acquire a deeper knowledge of the workings of the drinking water network, they will see how a simulation will show the transport of contamination at various points along the system. They will confirm their predictions as to what factors may affect the movement of the contamination.
- What should they eventually be able to do as a result of such knowledge and skill? Understand the nature of water and possible contamination movement in a system.

Stage 2 – Assessment Evidence**Performance Task(s):**

- Through what authentic performance task(s) will students demonstrate the desired understandings? Students will make predictions about a water distribution network with various contamination points using EPANET 2.2.
- By what criteria will “performances of understanding” be judged? For each point of contamination, students will make predictions about the movement of the contamination and after the simulation runs, they will reflect about their predictions.

Other Evidence:

- Through what other evidence will students demonstrate achievement of the desired results? Students will be able to discuss their predictions as a group and will gain a deeper understanding of the possible variations within the drinking water system.

Stage 3 – Learning Plan**Learning Activities:**

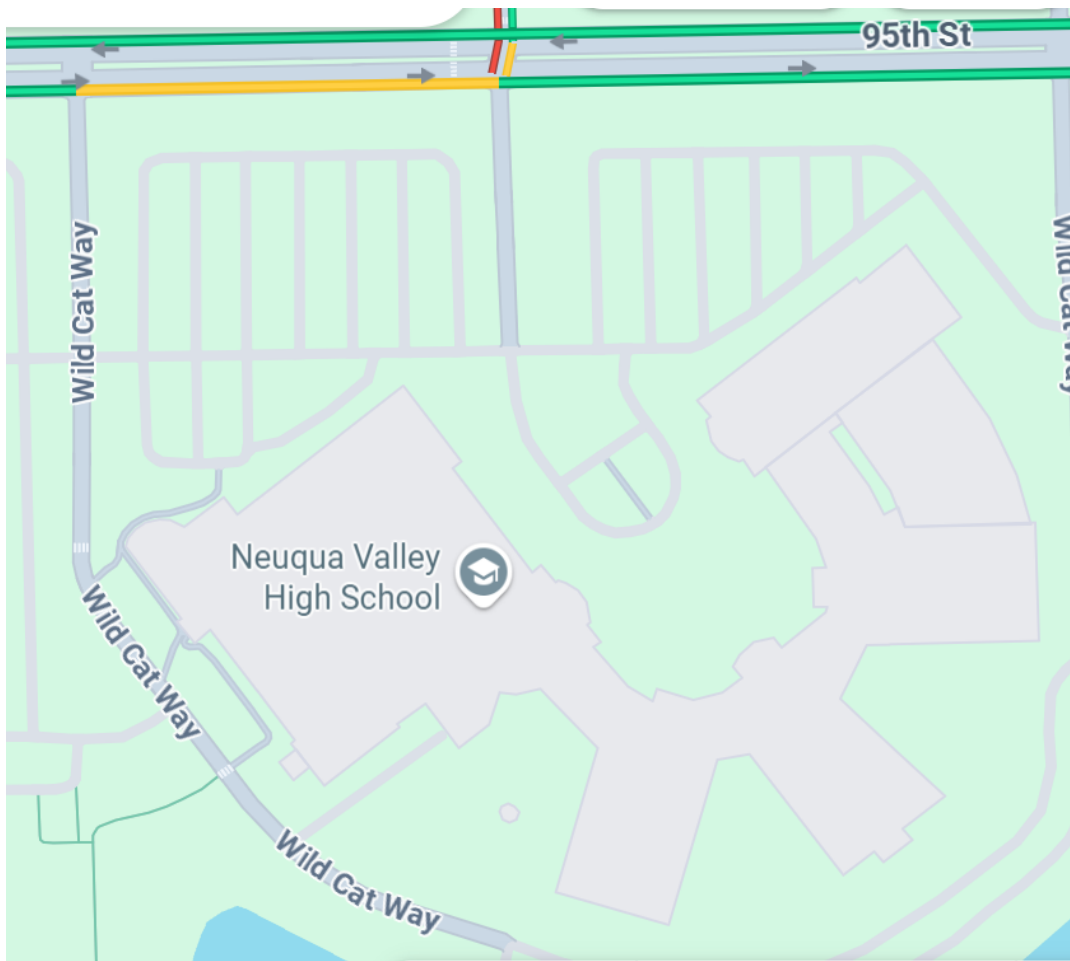
- W= Where the unit is going? Deeper understanding of safely distributing drinking water.
- H= Hook and hold interest - Connect with recent lead in water in Aurora, IL by reading [article](#) and watching short video. Ask students how/why do municipalities detect contaminants. How many points need to be tested regularly? What affects the way the contaminants spread?
- E= Equip all students with their prior knowledge of fundamental drinking water understanding
- R= Rethink and Revise their understanding the complexity of the system may need revision. The technical means (simulations/monitoring) need to be further explored.
- E= Evaluate their work listen to their reasoning/predictions while exploring the EPA NET simulations.
- T= Tailored learning (personalization to needs) allow students to alter the system if they have further inquiry questions - encourage them to explore graphing options and changing contaminant locations.
- O= Organized to maximize engagement connect with prior knowledge and current events, Present a class example and ask for predictions and then have students evaluate three separate events in groups of 2-3 students and they can discuss their predictions together.

APES Student Assignment
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I. PRIOR UNDERSTANDING

Using the map below, sketch a rough understanding of what you think may be located in the vicinity of our high school to ensure drinking water is provided properly.

- a. Where is the original source of this drinking water?
- b. What happens at the source location to ensure the drinking water is safe?
- c. What happens between the source and NVHS to ensure safety of the water?
- d. Are you aware of any issues that a US city has faced with their drinking water supply?



II. CURRENT EVENTS

Read the Article about drinking water in Aurora, Illinois and summarize below:

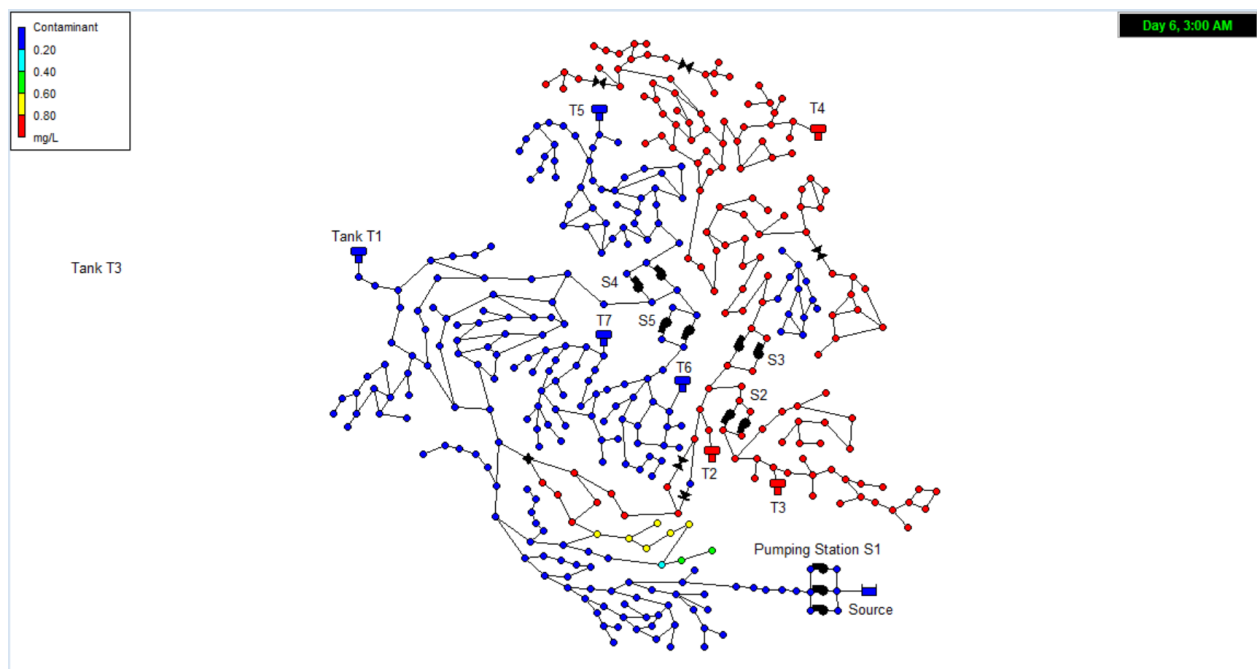
III. EPA NET 2.2 and PREDICTIONS

a. Use the space below to take notes about EPA Net.

- b. Using the network maps below and the legend, predict where a contamination point could have originated and why. After the simulations are run, take notes on actual source and possibilities of why the location was different than what was predicted.

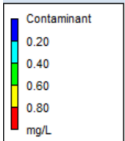
Scenario 1:

PREDICTION	AFTER SIMULATION RUN

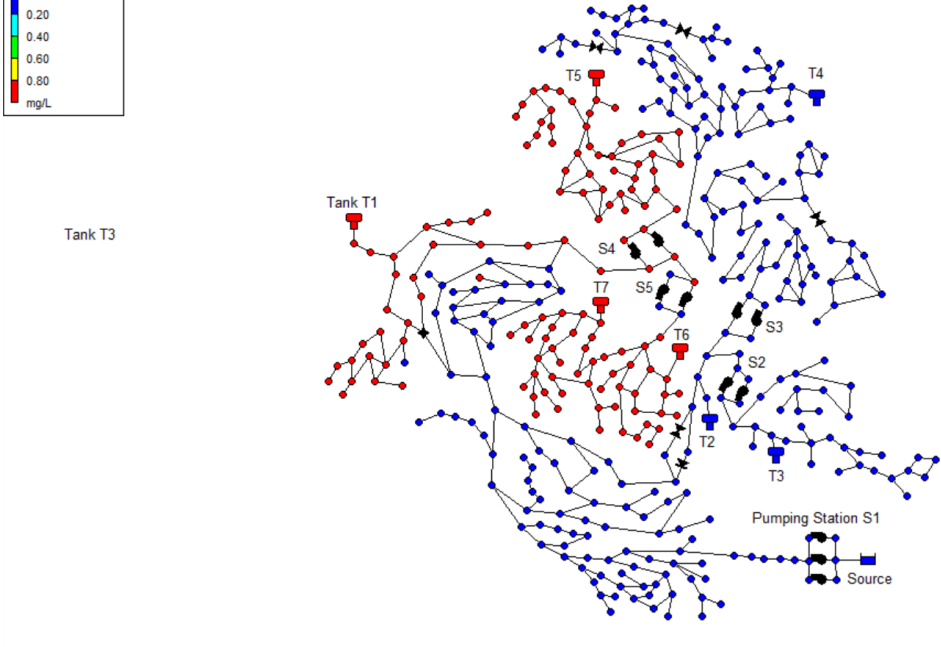


Scenario 2:

PREDICTION	AFTER SIMULATION RUN



Day 6, 3:00 AM



Scenario 3:

PREDICTION	AFTER SIMULATION RUN

