Watershed Management Lesson Plan

Grade level(s): 9 - 10

Standards Met:
4.1.10 B – Explain the consequences of interrupting natural cycles and research solutions to problems caused.

4.1.10 C – Describe the impact of industrial, agricultural, and commercial enterprises on an ecosystem.

4.2.10 A – Describe how vegetation affects water runoff. Investigate and analyze the effects of land use on the quality of water in a watershed.

4.2.10 B – Examine how human interactions impact wetlands and their surrounding environments. Describe how land use decisions affect wetlands.

Objectives:
Students will investigate how land use has changed in Indiana County over time and the subsequent impact on our watershed.

Students will make suggestions on improving land use practices to minimize runoff.

Students may develop a storm water plan for the High School

Materials:
Worksheet "Watershed Management Lab"
Colored pencils
Computer with access to internet
Google Sheets data document for runoff calculations.

Procedures:
Engage: Turn on the tap in the classroom. Ask "Where does this water come from?" Discuss Two Lick reservoir and the watershed surrounding Two Lick creek.

Explore: Students will examine three maps of Indiana County with land use broken down into simple categories. They will calculate the area of coverage for each category and the % makeup of the county as a whole. Student will be asked to answer some reflective and predictive questions. Students will then take that data and use a pre populated google sheet to calculate the amount of rain on each area in the event of a large rain event and how runoff will differ with each land use. Students will conclude by making a judgment on how land development in the county has been conducted.

Explain: As a class results will be discussed. Do we all come to the same conclusions as to how land use could be modified to reduce runoff? What are some of the tradeoffs? Everyone needs a place to live and food to eat as well as clean water to drink. How can a balance be found and how does something like city planning come into to play?

Elaborate: Students have the opportunity to research creative ways to manage storm water and propose a plan to mitigate the High School's parking lot run off.

Evaluate: Formative – Students participate in class discussions. Summative - Students have completed the maps and data collection tables in addition to thoughtfully and completely answering associated questions.

Anticipated Problems & Adaptations:
Students may struggle performing the calculations and using the google sheet document. Students may not know where there water is coming from or what a watershed is.

Watershed Management Lab -

Name_____PD

Lab Procedures:

Look at Maps A, B, and C. These maps represent changes in Indiana Coutny over a 100 year period. Use the Key for each map and designate each land area with a different color. For example color all forest areas green. Use the same colr choices for all three maps so you can compare the change land use over time easliy.

Compare the sizes of the different areas on each map, look at each type of land use and see if the way we use the land has changed over time. As you compare those maps answer the following questions in complete sentences:

1. What happens to the ammount of forested land as you go from Map A to Map C?

2. Which map has the most land devoted to human setlements?

3. Where are most of those human setelments located?

4. What effect might those human settlements have on the watershed? On wildlife?

Determine the land area on each of the maps, each unit in the grid represents one square kilometer. Some of the squares are not complet, if it is over ½ count as one. If the square is less than ½ do not count it.

For each map determine how much area is occupied by each type of land coverage. Record your answers in the area of land coverage chart below.

Area of Land Coverage						
Land Coverage	Map A – 100 years ago		Map B – 50 years ago		Map C - present	
	Km^2	%	Km^2	%	Km^2	%
Forest						
Grassland						
Wetland						
Residential						
Agriculture						

HINT - To calculate percentage, take # of square km per type of land coverage and divide by total amount of land then multiply by 100.

Imagine that we get a significant rain in a short period of time – 5 cm in the matter of a day. Answer the following questions with that in mind.

5. Looking at the changes in land coverage represented in Map A, B, and C. Do you think the amount of runoff would increase or decrease? Explain your answer.

6. Which absorbs more water – concrete, forests, wetland, or grasslands? Why?

7. Which map represents the watershed that is able to capture the most water? Why?

8. What problems could arise when water runs quickly over surface material, rather than moving slowly or soaking in?

9. How might the water quality of the stream be effected by changes in the watershed?

Use the provided google sheet to enter your land cover data. It will calculate for you the amount of water that falls on each type of land and the amount of runoff. This is imagining that 5 cm of rain fell evenly over the entire county. Record the results in the data table below.

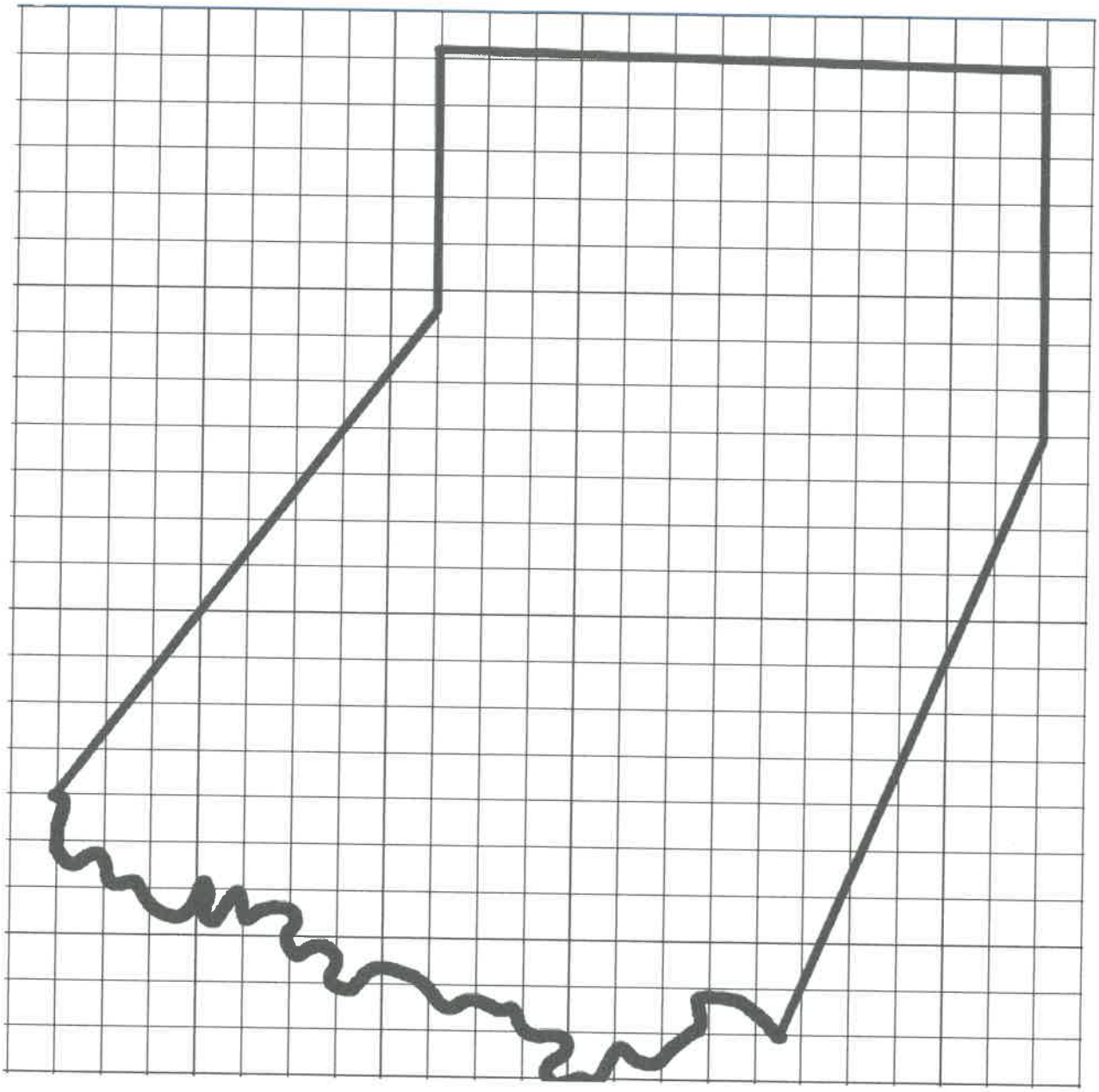
Results of a 5cm Rain Event						
Land Coverage	**Map A – 100 years ago**		**Map B – 50 years ago**		**Map C - present**	
	Volume of water that falls	Volume of water that runs off	Volume of water that falls	Volume of water that runs off	Volume of water that falls	Volume of water that runs off
Forest						
Grassland						
Wetland						
Residential						
Agriculture						

Looking at the runoff data answer the following questions:

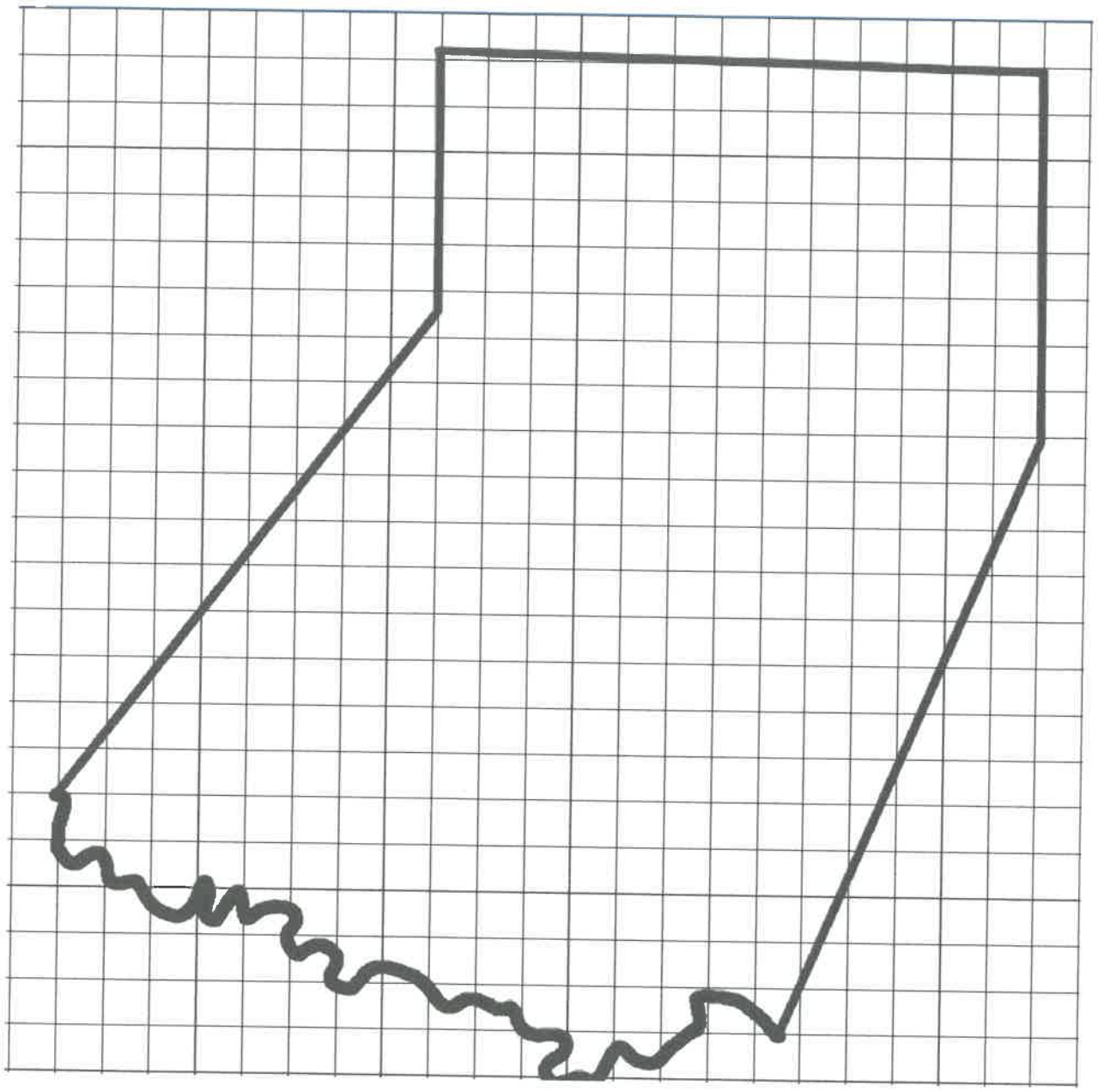
10. How could land development been handled differently?

11. How might runoff be controlled?

Map A



Map B



Map C