Resource Management

Protecting your Drinking Water

INTRODUCTION:

In almost any town, a large variety of chemicals and wastes are used or disposed of in day-to-day life. We are now learning that if things like gasoline, road salt, pesticides or sewage are not used or discarded wisely, they can contaminate a town's water supply.

We are also learning that some sources of water are easier to contaminate than other sources. Whether or not your town's supply is ***vulnerable*** to contamination depends on many different factors. These factors may add together to protect the supply, or to leave it very vulnerable to contamination.

To estimate the vulnerability of the ground water flowing under an area of land, a *hydrogeologist* measures several factors which affect how quickly rain water moves through the ground in that area. Pollutants will usually move in the same way as rain water.

Once you know something about each of these factors, you will be able to decide what must be done to be sure your drinking water will always be safe.

OBJECTIVE:

In this activity, you will use a simple mathematical model of *ground water vulnerability* to estimate the vulnerability of a small town's water supply.

Table 1
Estimated Value of Five Factors Affecting Groundwater Vulnerability

FACTOR	VALUE	
1. Yearly Rainfall (Total amount of rain that falls in one year)	3 2 1	...if more than 40 in. ...if from 15 to 40 in. ...if less than 15 in.
2. Depth to Water (Vertical depth from surface to aquifer)	3 2 1	...if less than 10 ft. ...if from 10 to 75 ft. ...if greater than 75 ft.
3. Aquifer Type (Type of soil/rock aquifer passes through)	3 2 1	...if sand or gravel ...if limestone ...if bedrock
4. Soil Type (Main type of soil and rock above aquifer)	4 3 2 1	...if sand or gravel ...if limestone ...if loam or silt ...if clay or shale
5. Lay of the Land (The general slope of surface of the land)	3 2 1	...if flat ...if gently rolling hills ...if steep hills/mountains

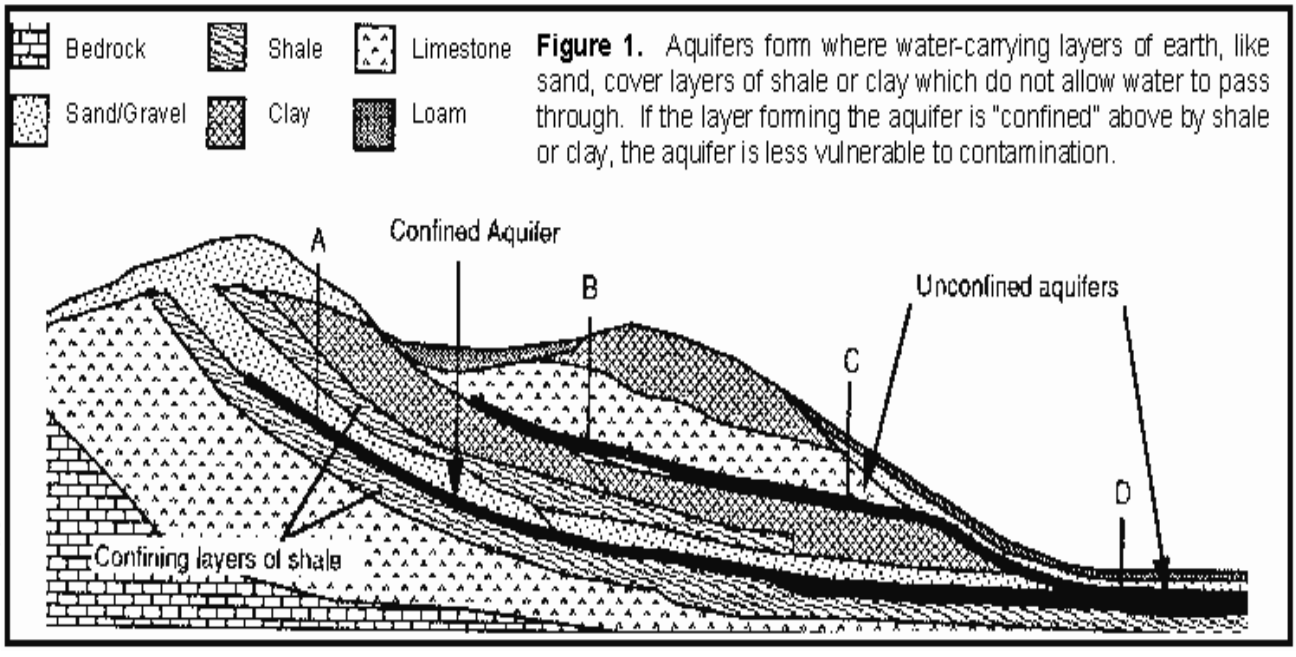


Figure 1. Aquifers form where water-carrying layers of earth, like sand, cover layers of shale or clay which do not allow water to pass through. If the layer forming the aquifer is "confined" above by shale or clay, the aquifer is less vulnerable to contamination.

MODEL OF GROUND WATER VULNERABILITY:

There are many factors affecting the vulnerability of a water supply, but we will only look at the five factors described in **Table 1**. A value of 1 means it is harder for rain water (and pollutants) to reach the supply, while a value of 3 means it is easier. It may be easy to see that the greater the depth to water, the longer it will take rain water to reach the supply. But how does a steep slope make the area less vulnerable? Figure 1 shows how some of these factors affect the vulnerability of various aquifers.

DIRECTIONS:

Use **Table 1** to find out how many points should be given for each of the five factors.

For example, **Table 1** tells you that if the depth to water is less than 15 ft, you should give 3 points for this factor in Quadrant 1. Values from **Table 1** may be averaged.

Fill in the rest of the blanks for each factor, then add them up to find the vulnerability of each quadrant.

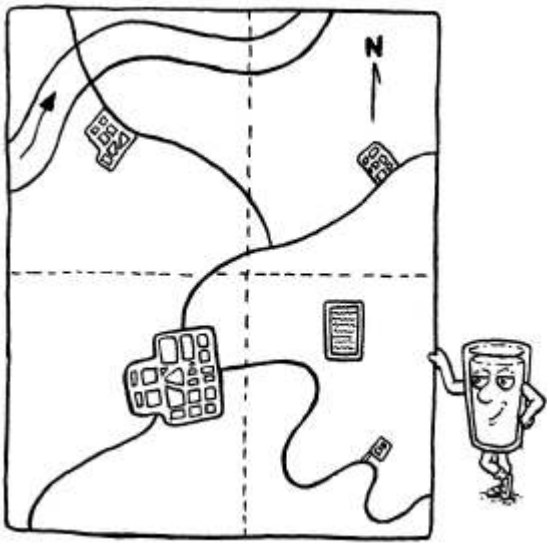
Table 2

Quadrant 1		
Depth to Water	12ft	3
Yearly Rainfall	45”	
Aquifer Type	Sand/Gravel	
Soil Type	Loam/Sand	
Lay of the Land	Flat	
VULNERABILITY SCORE		
Quadrant 2		
Depth to Water	40ft	
Yearly Rainfall	45”	
Aquifer Type	Limestone	
Soil Type	Limestone/Loam	
Lay of the Land	Gentle Slope	
VULNERABILITY SCORE		
Quadrant 3		
Depth to Water	60ft	
Yearly Rainfall	38”	
Aquifer Type	Limestone	
Soil Type	Limestone/Clay	
Lay of the Land	Rolling Hills	
VULNERABILITY SCORE		
Quadrant 4		
Depth to Water	100ft	
Yearly Rainfall	34”	
Aquifer Type	Sand/Gravel	
Soil Type	Shale/Clay	
Lay of the Land	Steep Hills	
VULNERABILITY SCORE		

HOW TO USE THE MODEL:

You can get a rough idea of the vulnerability of the underlying aquifer in each of Priceford’s four quadrants. By using these five factors to give each quadrant a “score” on how easy it would be for a pollutant to pass through the ground to contaminate the aquifer.

Follow the instructions for filling out **Table 2**, then use your results along with the map of the Priceford area to answer the questions at the bottom of the page. **Give your reasons for each answer!**



QUESTIONS:

1. Discuss how factors 2-5 described in **Table 1** affect the vulnerability of water supplies at Points B, C and D in Figure 1. If three towns get their water supplies at Points B, C and D, which supply would be the most vulnerable? The least vulnerable?

2. Use **Table 3** below to interpret the vulnerability scores you calculated in **Table 2**. Which town’s water supply would be most likely to be contaminated if a larger tanker truck full of a toxic chemical spilled its contents during a traffic accident on the nearest road?

3. Compare the vulnerability values you calculated in the four towns in the above map to Points A, B, C and D in Figure 1. Which of these towns is most likely to be located at which of these Points?

4. How would one town’s pollutants affect the other town’s supplies? If a wood preserving chemical is found in Smalltown’s water, but not in Riverville’s, where is the most likely area where the source of contamination might be found?

Table 3.
Vulnerability Score

5	7.5	10	12.5	15
very low		moderate		very high

Relative Vulnerability