What Killed the Fish?

Case #102WKF

Background

The Oldman River is a river in southern Alberta, Canada. It flows roughly west to east from the Rocky Mountains, through the communities of Fort Macleod, Lethbridge, and on to Grassy Lake, where it joins with the Bow River to form the South Saskatchewan River, which eventually drains into the Hudson Bay.

The Oldman River contains fish species such as rainbow trout, cutthroat trout, bull trout, brown trout, hybrid trout species ("cutbow" rainbow and cutthroat cross), mountain whitefish, pike, walleye, lake sturgeon, catostomidae, goldeye, and minnows.

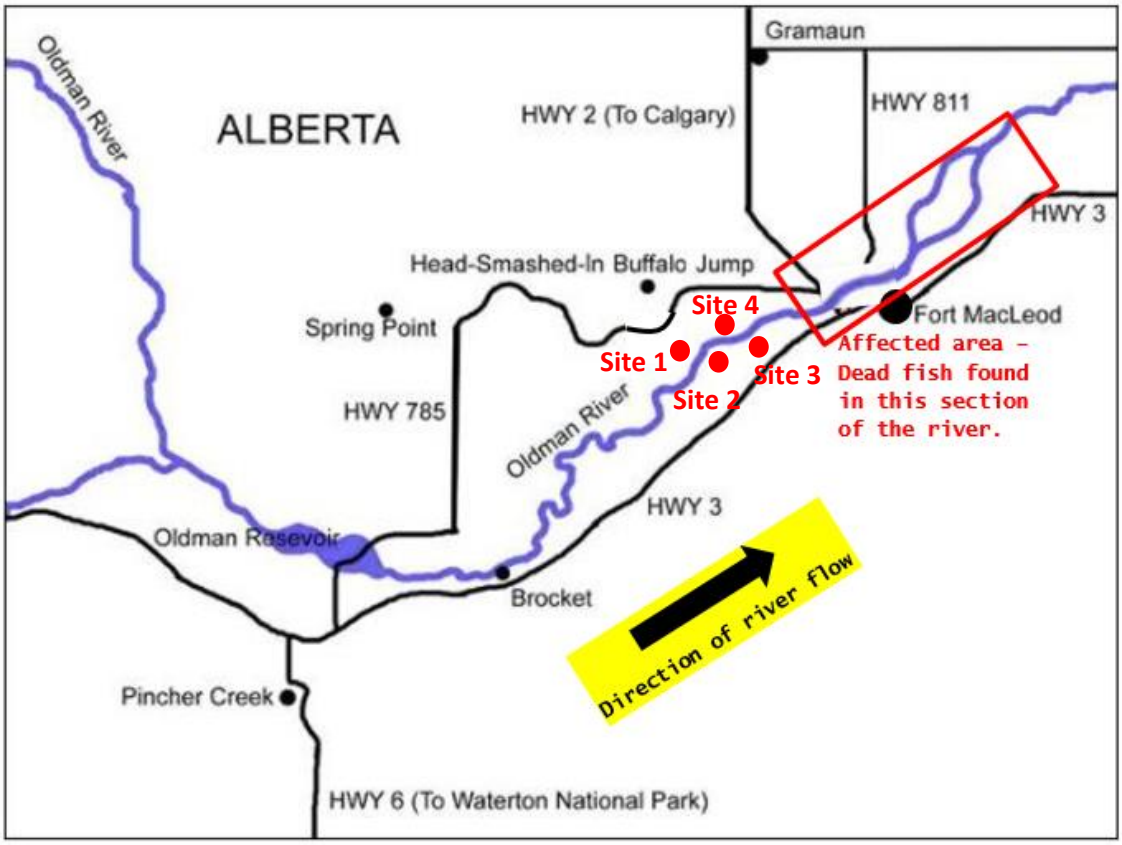
Issue

Officials are trying to determine what is causing a catastrophic fish kill along the Oldman River. Hundreds of dead fish have been reported downstream of Fort MacLeod. The river is one of the best white-water trout stream in the province. Damage to this river will deplete the food supply for many people, harm the local tourist industry, and cause more deaths of aquatic organisms.

You and your colleague have been hired by Alberta Fish and Wildlife to determine the cause of the fish deaths. To do your job, you are provided with a map of the Oldman River showing the section where dead fish have been found, and the 4 sites upstream of the fish kill that may have contributed to the problem. Additionally, chemical and biological tests were carried out at each of the 4 sites. The data collected are provided to you on the following pages.

New terms: "**Upstream**" and "**Downstream**"
Pollutants affect organisms <u>downstream</u> from wherever they entered the stream. For example, fish upstream of the red x would be unaffected by pesticides dumped into the stream at the red x.

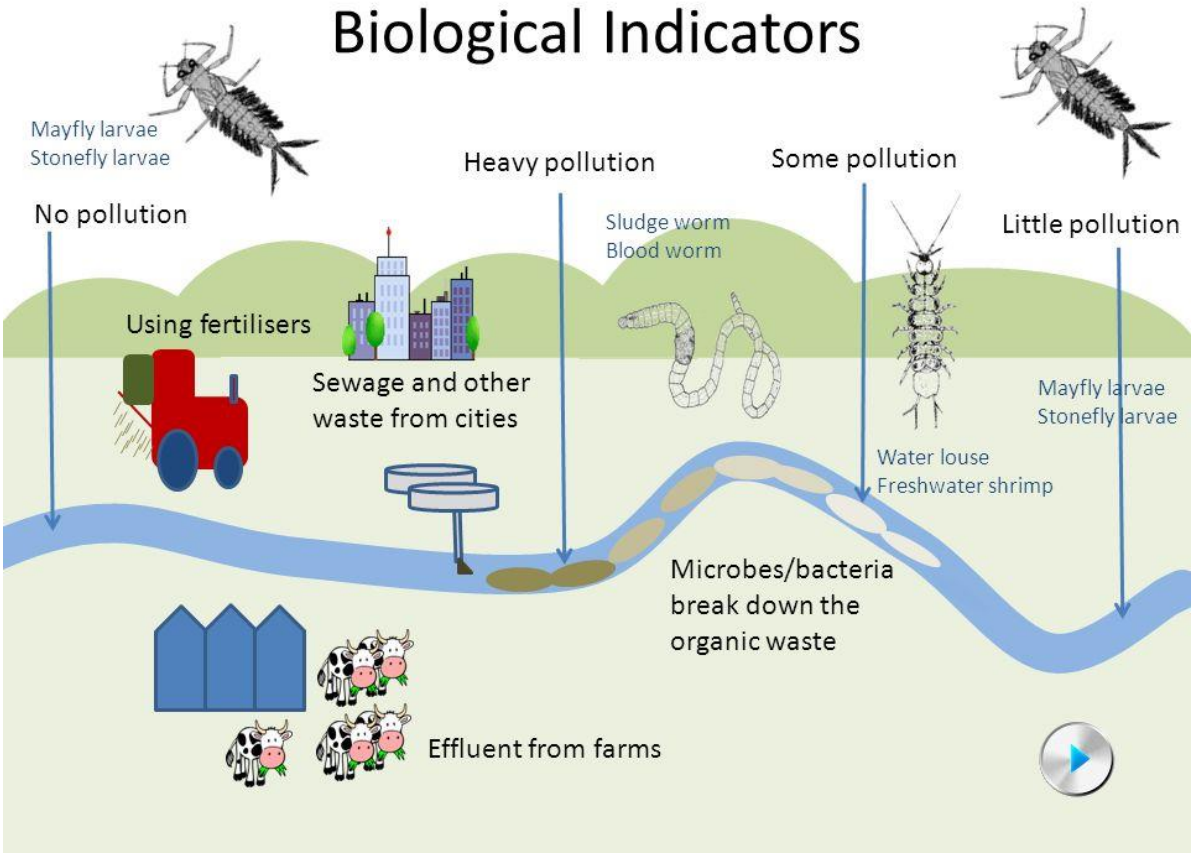
A. Map of the Oldman River



RESULTS OF BIOLOGICAL AND CHEMICAL TESTING

B. Biological Indicators of Water Quality

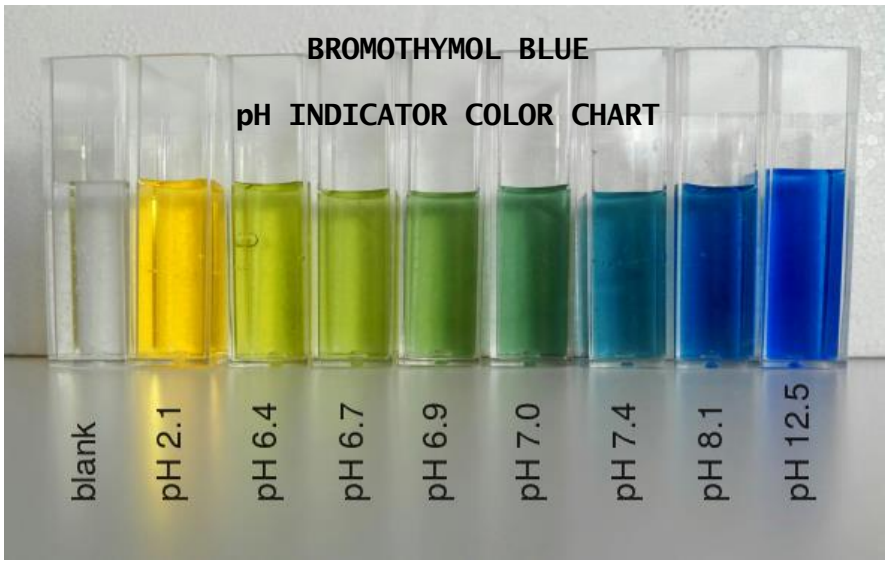
Invertebrate	Number of Organisms in a Sample			
	Site 1	Site 2	Site 3	Site 4
Mayfly nymphs	187	0	35	233
Stonefly nymphs	155	0	23	162
Caddisfly larvae	34	0	6	27
Midge larvae	110	159	133	97
Worms	15	142	58	23

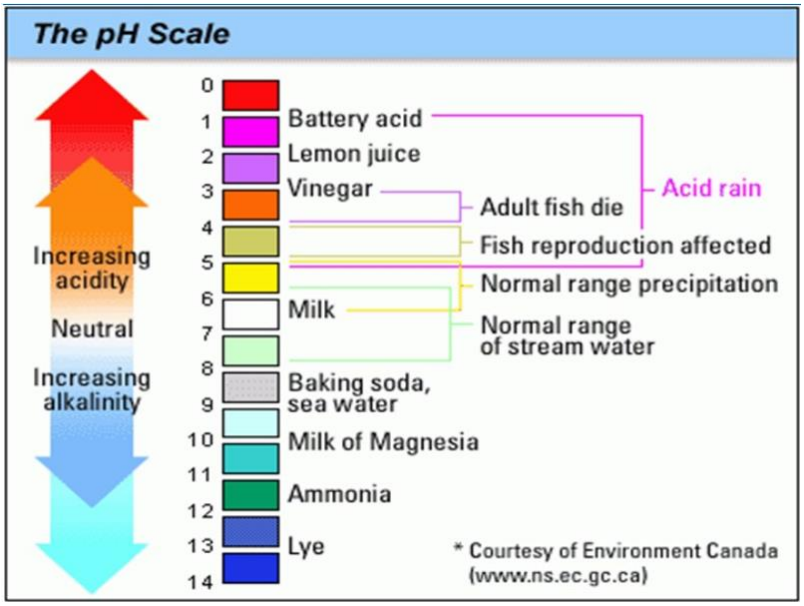


C. Chemical Indicators of Water Quality

The following volumes of dissolved oxygen and phosphorus were detected in a 1200mL water sample taken from each site. As well, bromothymol blue was used to test the pH at each site.

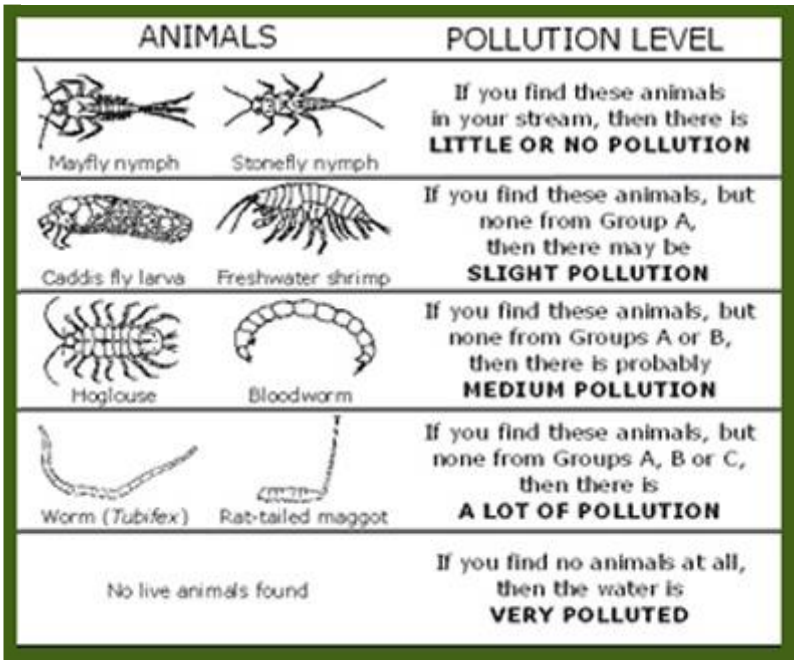
Chemical	Volumes Present (mL)			
	Site 1	**Site 2**	**Site 3**	**Site 4**
Dissolved Oxygen	.0095	0.0026	0.0033	0.0038
Phosphorus Content	0.0026	0.0098	0.0091	0.0071
pH (using Bromothymol Blue)				





Your Task

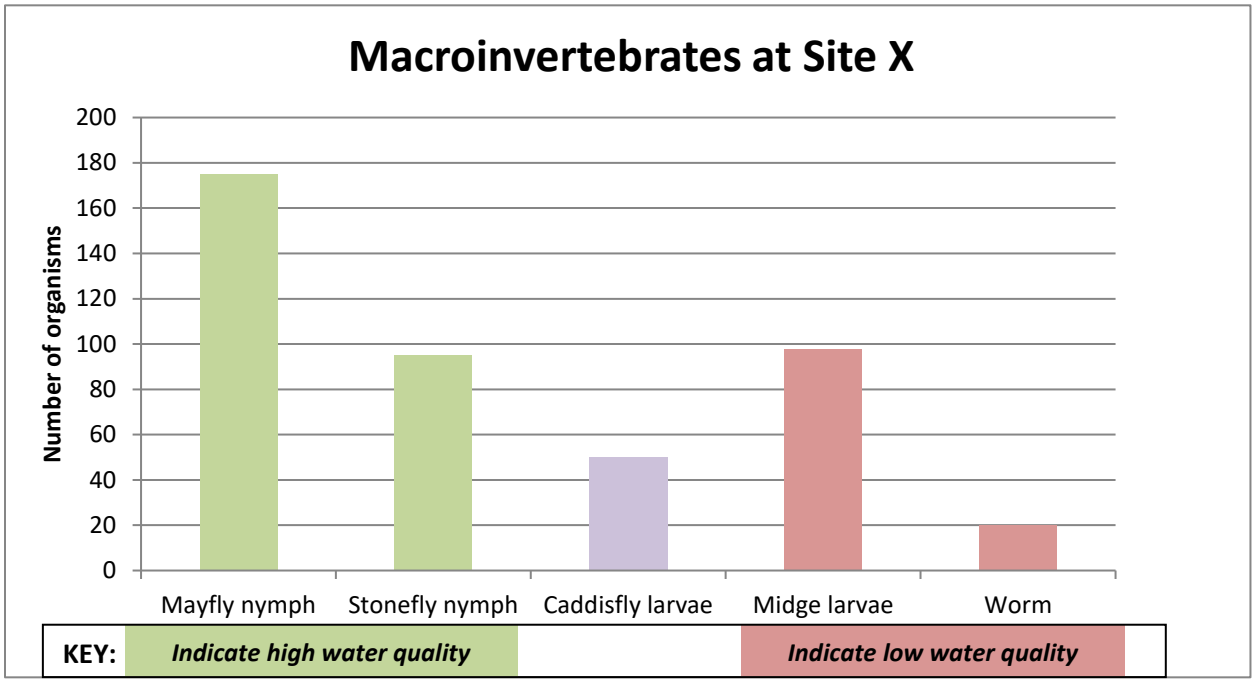
A. Discuss **bioindicators** of water quality with your colleague – What types of organisms suggest a high water quality? What types of organisms suggest a low water quality?



B. For the macroinvertebrate data, **create a bar graph for each site** that visually shows how many of each species were observed. Be sure to include

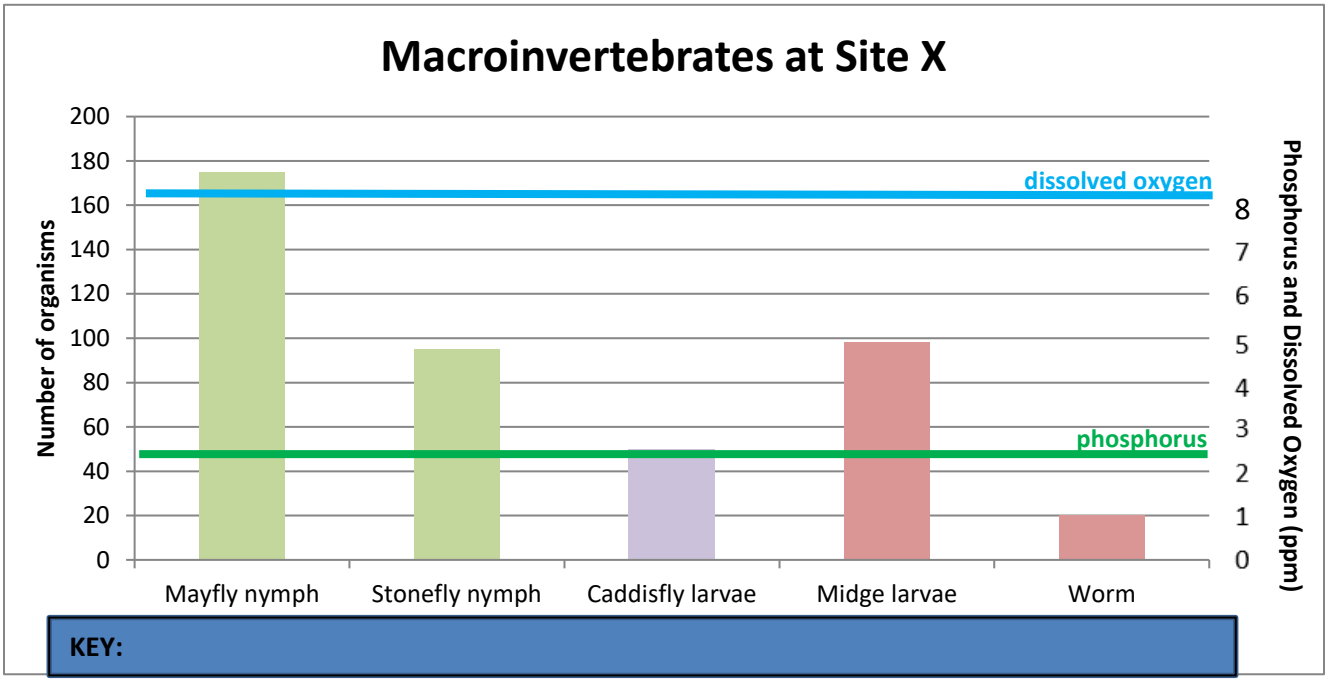
   a. **a title**
   b. **labelled axes**
   c. **appropriate values for each axis – you should take up as much of the graph as possible, and it should be as "zoomed-in" as possible**
   d. **a legend/key**

   Look at the example on the next page to guide you.



C. The data for dissolved oxygen and phosphorus content was given to you in mL, but you need to know the content in parts per million (ppm) in order to make an accurate assessment. **Calculate the ppm** for dissolved oxygen and phosphorus at each site. Record your calculations on the second last page of the handout.

D. For each bar graph, add a **line** for dissolved oxygen content and a line for phosphorus content. Use the y-axis on the right side of each graph to indicate your values in ppm. **Use the example on the next page to guide you.**



E. With your colleague, discuss dissolved oxygen, phosphorus, and pH as **chemical indicators** of water quality.

   a. What measure of dissolved oxygen (in ppm) is ideal?
   b. Should phosphorus levels be relatively high or relatively low?
   c. What pH range is best for high species diversity?

F. **Grade** the water quality at each site based on the data shown in your graphs.

   4 (excellent), **3** (good), **2** (poor), or **1** (very poor).

   Note: *You may give the same grade to two different sites if you feel their tests yielded similar results.*

   Record your grade for each site at the bottom of the graph page by putting a check mark in the appropriate box.

G. Complete the **conclusions & recommendations** page.

CASE #102WKF
FISH KILL ALONG THE OLDMAN RIVER
ALBERTA, CANADA

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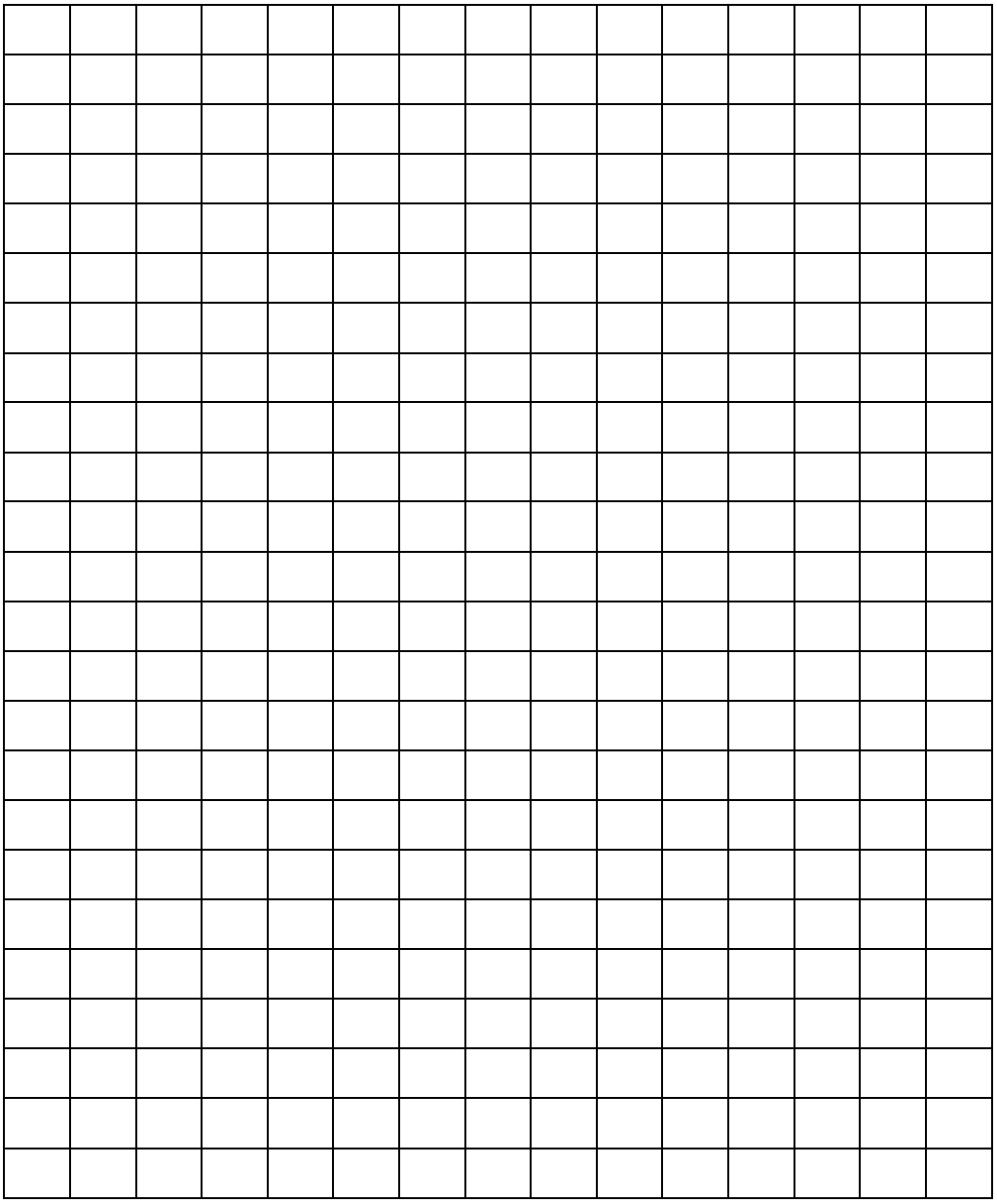
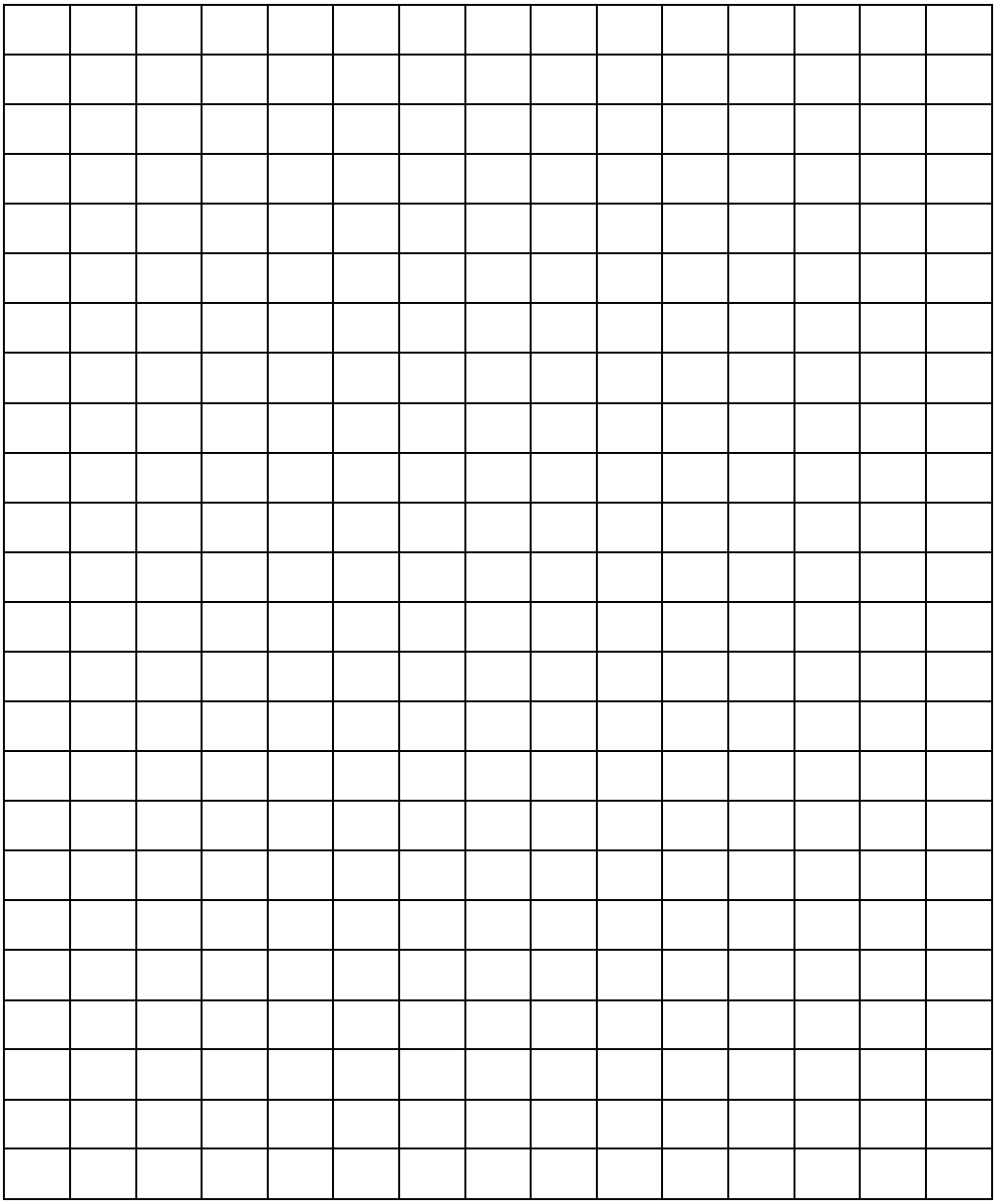


Grade: 4☐ Excellent 3☐ Good 2☐ Poor 1☐ Very Poor



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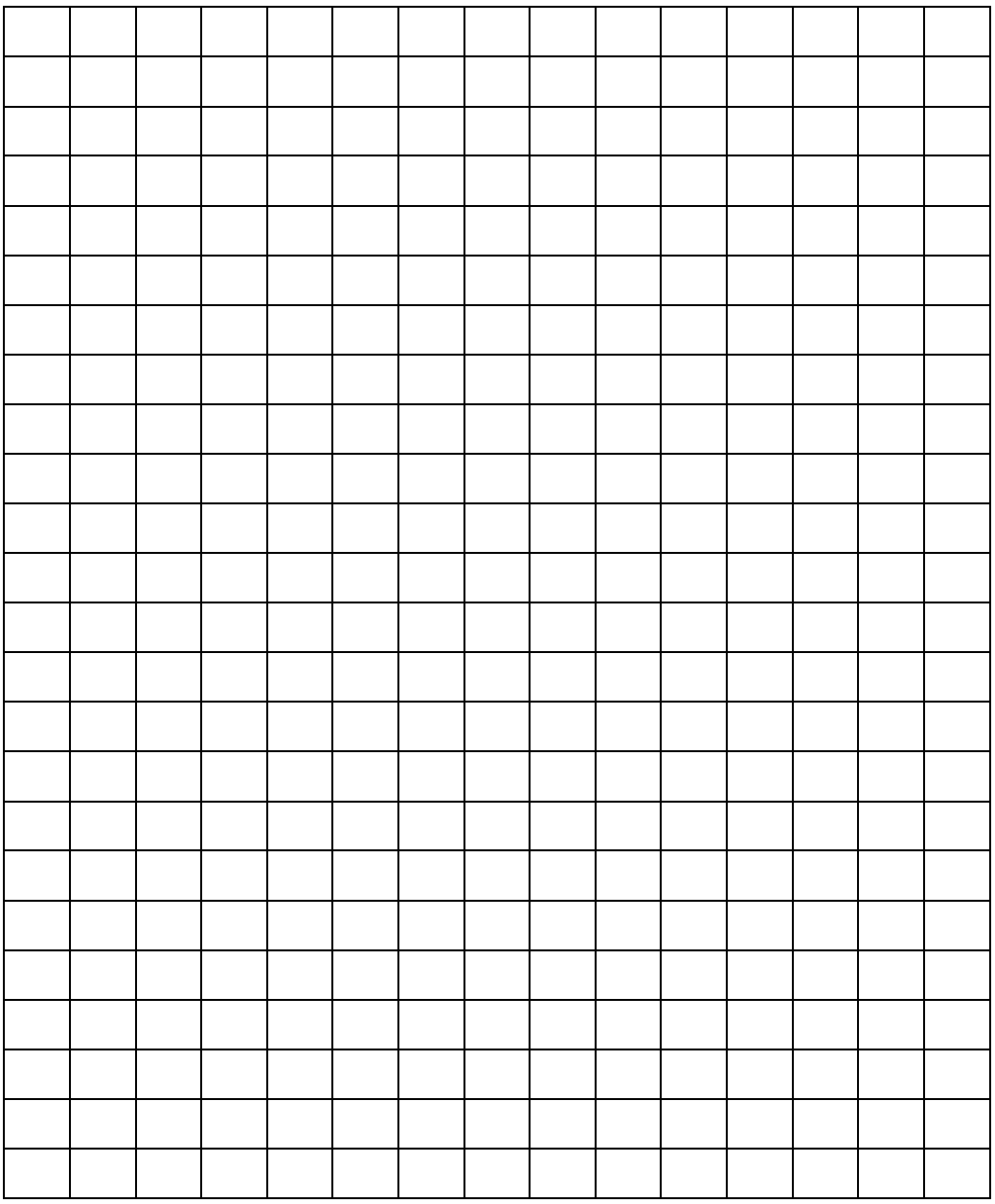

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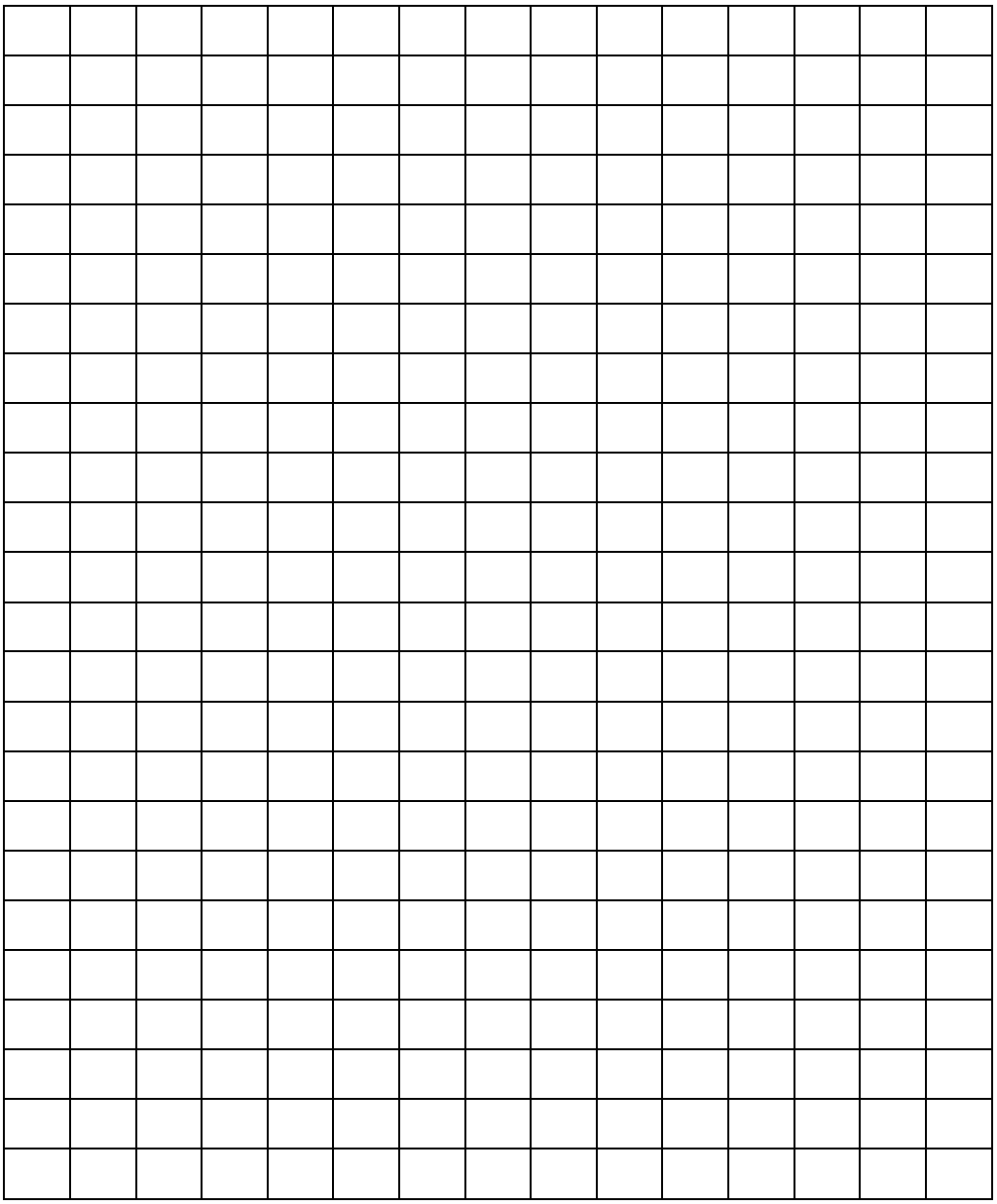

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PPM CALCULATIONS

SITE 1 **DISSOLVED OXYGEN:** **PHOSPHORUS:**	**SITE 2** **DISSOLVED OXYGEN:** **PHOSPHORUS:**
SITE 3 **DISSOLVED OXYGEN:** **PHOSPHORUS:**	**SITE 4** **DISSOLVED OXYGEN:** **PHOSPHORUS:**

CASE #102WKF
CONCLUSIONS & RECOMMENDATIONS

Site Most Likely Responsible for Fish Deaths:

_____

Possible Land Use Causes of Fish Deaths:

_____

_____

Land Use	Activities	Potential Pollution Problems
Agriculture	tillage, cultivation, pest control, fertilization, animal waste	sediment, nitrate, ammonia, phosphate, pesticides, bacteria
Construction	land clearing and grading	sediment
Forestry	timber harvesting, road construction, fire control, weed control	sediment, pesticides, gas and oil
Land Disposal	septic system, land fills	bacteria, nitrate, phosphate, gas and oil, toxic waste, hazardous materials
Recreation	ATV's, boating, hiking, camping, fishing	sediment, gas and oil, garbage
Roads	clearing trees, soil compaction, dirt excavation	Sediment, gas and oil
Surface Mining	dirt, gravel, and mineral excavation	sediment, heavy metals, acid drainage, nutrient
Urban Storm Runoff	lack of automobile maintenance, lawn and garden care, painting	oil, gas, antifreeze, nutrients, pesticides, paints

Recommended Further Tests/Information Required to Determine Exact Cause:_____

_____

Analysis Completed By: _____

Date: _____