Discussion questions

1. In the space below, list all of the samples that are downstream of the suspected source site. There are a total of _____downstream samples.

2. In the space below, list all of the samples that are upstream of the suspected source site. There are a total of _____upstream samples.

3. The results show that ____out of ____downstream samples were contaminated. This also means that _____ % of downstream samples were contaminated.

4. The results show that ____out of ____upstream samples were contaminated. This also means that _____ % of upstream samples were contaminated.

5. Do the results suggest the suspected source site is contaminating the watershed? Explain.

6. Based on the results of this study, what actions would you recommend?

7. Does contamination appear to be species-dependent? For each species, explain if the results are conclusive or inconclusive, and why.

Bass

The results show that ____out of ____ downstream bass samples were contaminated. This also means that _____ % of downstream bass samples were contaminated.

The results show that ____out of ____ upstream bass samples were contaminated. This also means that _____ % of upstream bass samples were contaminated.

Conclusive or Inconclusive Explain:

Catfish

The results show that ____out of ____ downstream catfish samples were contaminated. This also means that _____ % of downstream catfish samples were contaminated.

The results show that ____out of ____ upstream catfish samples were contaminated. This also means that _____ % of upstream catfish samples were contaminated.

Conclusive or Inconclusive Explain:

Carp

The results show that ____out of ____ downstream carp samples were contaminated. This also means that _____ % of downstream carp samples were contaminated.

The results show that ____out of ____ upstream carp samples were contaminated. This also means that _____ % of upstream carp samples were contaminated.

Conclusive or Inconclusive Explain:

Sunfish

The results show that ____out of ____ downstream sunfish samples were contaminated. This also means that _____ % of downstream sunfish samples were contaminated.

The results show that ____out of ____ upstream sunfish samples were contaminated. This also means that _____ % of upstream sunfish samples were contaminated.

Conclusive or Inconclusive Explain:

Figure 5. Connecting to the NGSS and Common Core State Standards

Dimension	Classroom Connections
Science and Engineering Practices	
Analyzing and Interpreting Data	Students must analyze the results of the entire sample set and interpret upstream/downstream and species comparisons
Engaging in Argument from Evidence	Students must draw conclusions based on evidence, with emphasis on both positive and negative test results
Obtaining, Evaluating, and Communicating Information	Students must collect, share, and critically analyze the results of the entire sample set. Instructors have ample opportunities for allowing students to communicate their conclusions.
Disciplinary Core Ideas	
Natural Resources (ESS3A)	Students consider watersheds and aquatic species as natural resources
Human Impacts on Earth Systems (ESS3C)	PCBs are man made chemicals—students consider the impact of these chemicals on the health of a watershed
Crosscutting Concepts	
Cause and Effect • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1; HS-ESS3-4)	Students consider the importance of positive and negative results when reaching conclusions about cause and effect—in the presence of a cause, an effect must be observed, and in the absence of the cause, the effect must no longer be observed. This reasoning is why experimental design incorporates the usage of controlled variables and why both sets of results—positive and negative—are critical in deriving conclusive determinations.