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MOUNTAINS to Sound GREENWAY
NATIONAL HERITAGE AREA

Forests and Fins

Science Journal

This journal belongs to:

_____

My teacher is:

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My school is:

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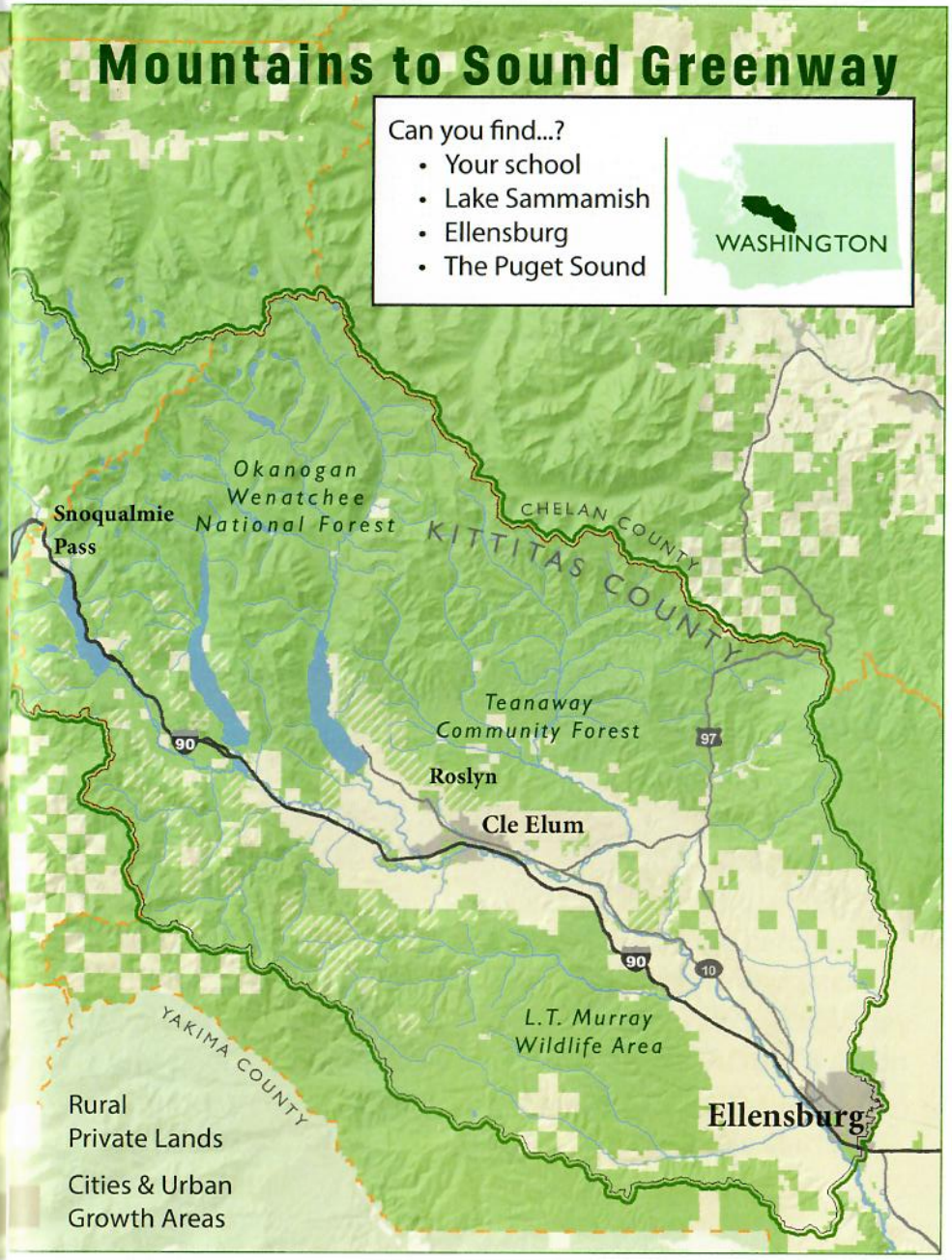
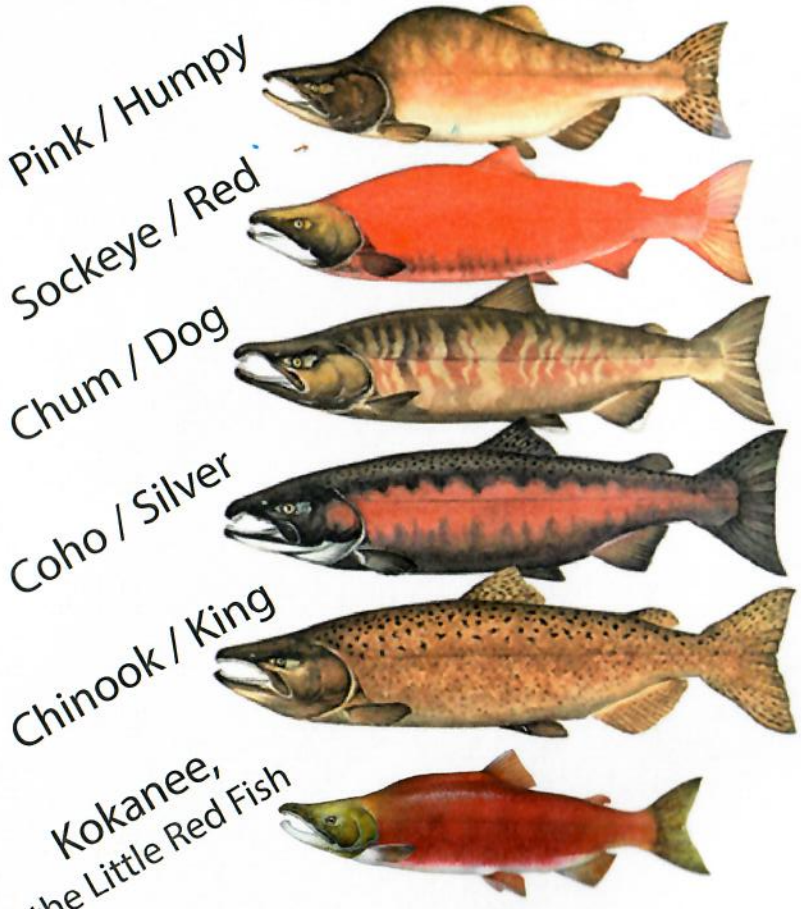
Welcome to the Greenway!

mtsgreenway.org

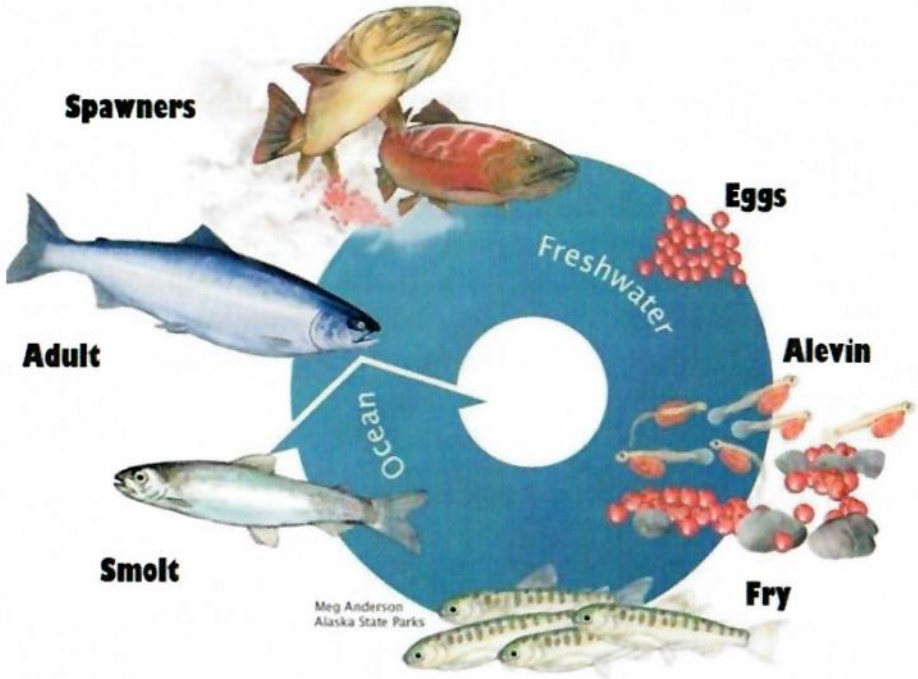


Pacific NW Salmon Species

Ask your Greenway Educator how to remember the species using your hand.



Salmon Life Cycle



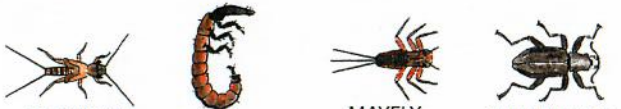
Salmon begin their life as **EGGS** in a freshwater stream. The baby fish that hatch from the eggs are called **ALEVIN**. They get all their nutrients from their yolk sac and stay in their nest (redd), safe in the gravel and cobble at the bottom of the stream. When their yolk sac is used up, they leave their redd as **FRY** and spend their time catching macro-invertebrates (bugs) and hiding from predators. Salmon swim downstream to the estuary as **SMOLT**; they are about 5 inches long, shiny and silvery. **ADULTS** live in the ocean for 2-5 years. Then they return to the stream as **SPAWNERS,** lay their own eggs, and the cycle starts all over again!

MACROINVERTEBRATES Background Info

Macroinvertebrates are small animals that are big enough to see without a microscope (*macro* = "big") and that have no backbone (*invertebrate* = "no backbone"). Macroinvertebrates include snails, insects, worms, and crayfish.

One way we can determine the health of the stream is by studying which types (species) of macroinvertebrates live in the stream. They are called an **indicator species** because their presence shows how healthy the stream is. Some species of macroinvertebrates can live in polluted water and some can only live in very clean water.

Group 1 macroinvertebrates are pollution intolerant. They can only live in very clean water.



Group 2 macroinvertebrates are somewhat pollution tolerant, meaning they can handle some pollution.

Group 3 macroinvertebrates are pollution tolerant. They can live in a wide range of water quality.

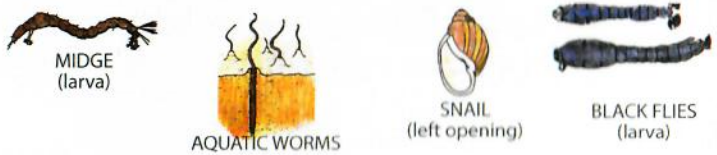


Image source: Dieter Tracey, IAN Image Library (ian.umces.edu/imagelibrary)

MACROINVERTEBRATES Directions

Today, you are going to collect and identify macroinvertebrates to learn about the health of this stream. Remember: You are measuring the health of the stream habitat, not the health of the bugs.

1. **Collect and identify**: You will need the dip nets, ice trays, macroinvertebrate ID sheet from the Greenway backpack.

   Your Greenway Educator will show you where and how to collect macroinvertebrates from the stream. Do your best to figure out what they are called and which group they are in.

   Record your findings on page 7.

2. **Analyze:** Use the tables on page 8 to calculate your data and determine the health of this stream.

3. **Get ready to present**: Work as a group to answer the Thinking Questions on page 9 and practice your group presentation.

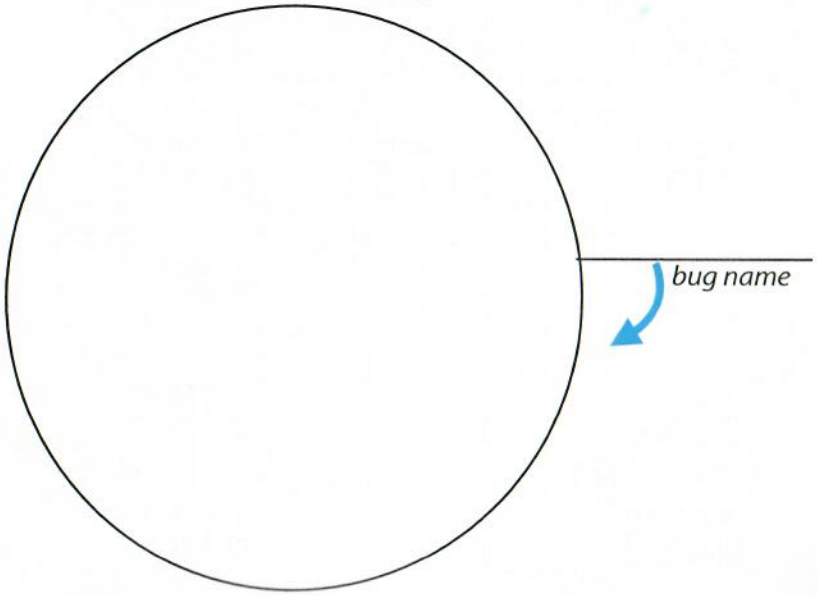
MACROINVERTEBRATES Data Collection

Stream: _____ **Date:** _____

1. **Record your data:** Check off each species of macroinvertebrates you found.

Group 1	Group 2	Group 3
☐ Stoneflies	☐ Water Boatmen	☐ Black Flies
☐ Mayflies	☐ Scuds	☐ Aquatic Worms
☐ Caddisflies	☐ Dragonflies	☐ Midges
☐ Riffle Beetles	☐ Crayfish	☐ Left-Opening Snails

2. **Draw a quick sketch** of one of the macroinvertebrates your group collected before releasing them back into the stream.



MACROINVERTEBRATES Data Analysis

3. **Calculate your data:**

	Number of Species	Multiply
Group 1		x3=
Group 2		x2=
Group 3		x1=
	Total=	

4. Based on your data, what is the quality of this stream? (Circle one):

HIGH	**MEDIUM**	**LOW**
(total: 15+)	(total: 6-14)	(total: 0-5)

5. **Get ready to present**: Work as a group to answer the Thinking Questions on the next page. Practice your group presentation.

MACROINVERTEBRATES Thinking Questions

1. What is a macroinvertebrate?

_____

2. Explain the difference between Group 1, Group 2, and Group 3 macroinvertebrates.

_____

_____

_____

_____

3. Why are macroinvertebrates called an indicator species?

_____

_____

_____

4. What was the most interesting thing you observed?

_____

_____

5. Based on your data, how healthy is this salmon stream?

_____

6. Describe what could improve this salmon stream?

_____

_____

_____

RIPARIAN ZONE Background Info

A **riparian** (rie-PARE-ee-en) **zone** is where land and water meet, such as along stream banks and lake shores.

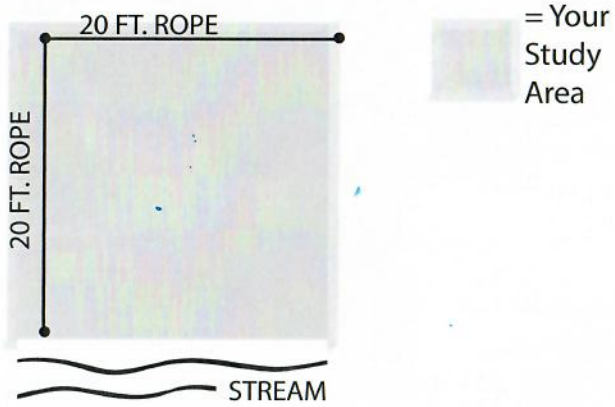
Healthy riparian zones are full of different kinds of **native trees and shrubs** that help keep the stream cold, clear, clean, and connected.

- Trees block the sun and provide shade to the stream, which helps maintain cold water temperatures.
- Woody material (logs and large branches) that have fallen into the stream capture gravel, create pools where salmon can rest, and provide protection from predators.
- Plant roots stabilize the stream bank by preventing erosion during floods and large storms. This helps keep sediment out of streams. (Extra sediment can smother salmon eggs).
- When it rains, plant roots help keep the stream water clean by collecting water like a sponge and filtering out sediment, toxic chemicals, and other pollutants.
- Leaves and stems from riparian plants fall into the stream and provide nutrients that support the salmon and stream bugs.

Damaged riparian zones usually have **introduced plants**, which are brought here from other ecosystems. They can outcompete native plants for water, nutrients, and sunlight. They are not as good as native plants at providing shade, creating pools and riffles, stabilizing the stream bank, filtering pollutants, or providing nutrients.

RIPARIAN ZONE Directions

1. **Set up your transect**: You will need the two 20-foot long ropes. Set up a transect so that it matches the diagram below. Try to not step on plants!



2. **Draw:** Spend about 10 minutes drawing the plants in your transect area on page 11.

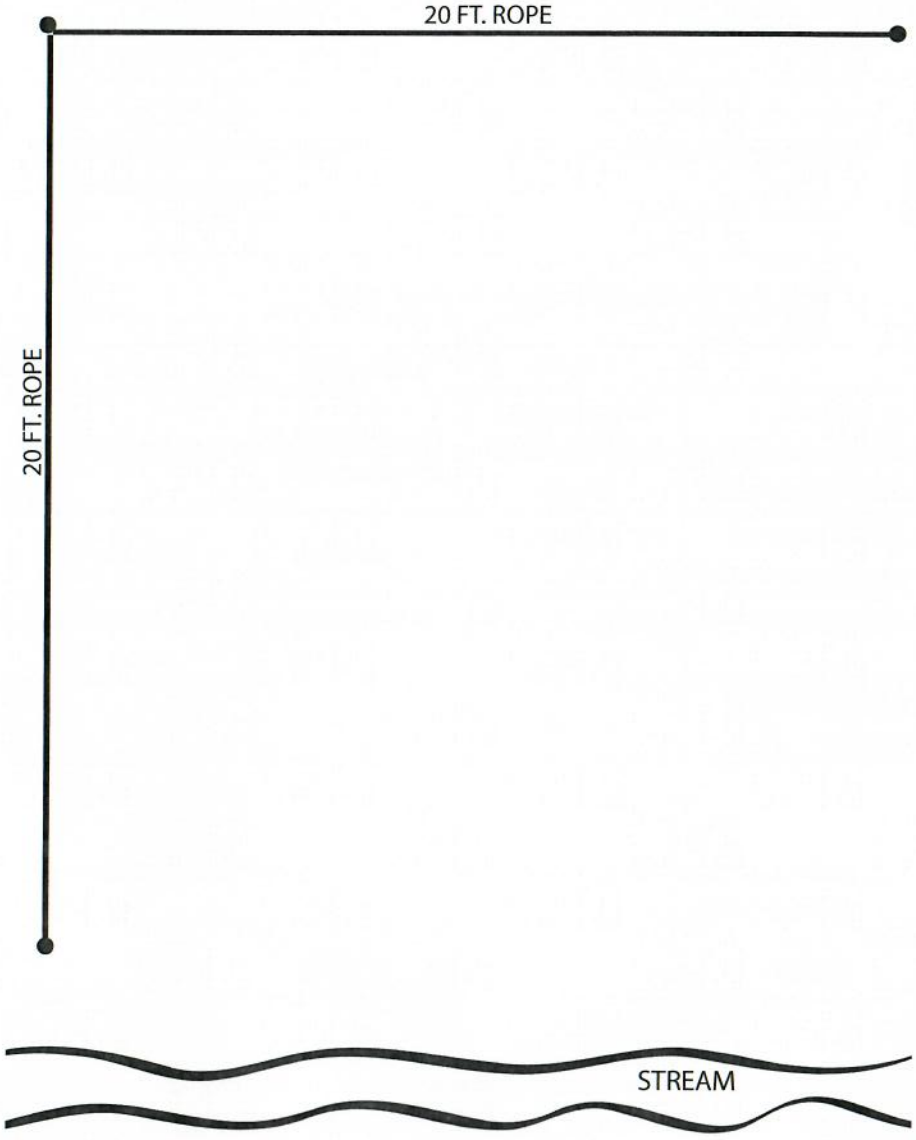
3. **Identify:** You will need the plant ID cards. Do your best to identify the plants in your transect. Label them on page 11.

4. **Analyze:** Use the chart on page 12 to determine the quality of this riparian zone.

5. **Get ready to present**: Work as a group to answer the Thinking Questions on page 13 and practice your group presentation.

RIPARIAN ZONE Drawing

Draw *and label* the plants in your area of study. You can choose to draw a map or individual plants. Do your best to identify them using the plant ID cards in your Greenway backpack.



RIPARIAN ZONE
Data Analysis

Stream: _____ **Date:** _____

1. Write the names of three plants you identified:

_____

_____

_____

2. Circle the choices that best fit your data:

	HIGH	MEDIUM	LOW
a) Trees & shrubs hanging over the stream	Yes, on both sides of the stream	Yes, but only on one side	No
b) Amount of woody material	More than 10 logs	0 - 10 logs	None
c) Native plants	Mostly trees & shrubs	Some trees & some grass	All grass or bare soil
d) Introduced plants	None	A few	Lots

3. Based on your data, what is the quality of this riparian zone? (Circle one):

HIGH **MEDIUM** **LOW**

4. **Get ready to present**: Work as a group to answer the Thinking Questions on the next page. Practice your group presentation.

RIPARIAN ZONE
Thinking Questions

1. Why are trees and shrubs hanging over the stream important for salmon habitat and stream health?

_____

_____

_____

2. Why are introduced plant species a problem for salmon and the ecosystem?

_____

_____

_____

3. Name 2 reasons that woody material is important for salmon:

- _____
- _____

4. What was the most interesting thing you observed?

_____

_____

5. Based on your data, how healthy is this riparian zone?

_____

6. Describe what could improve this riparian zone?

_____

_____

_____

STREAM CHANNEL Background Info

Pools are deep places in the stream where water moves slowly. Salmon fry live in the pools after they leave their nest (redd) in the gravel bed. Fry can hide from predators in pools and find food here.

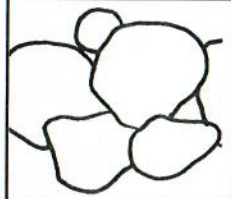
Riffles ("RIFF-ulz") are small rapids in the stream where water moves quickly and bubbles over gravel or logs. Riffles are excellent places for salmon to make their nests. The fast-moving water removes tiny sediment particles from the stream bed and adds oxygen to the water that salmon and their eggs breathe.

Woody material (logs and big branches) fall into the stream and help create pools and riffles. They also provide food for the stream bugs (macroinvertebrates) that the salmon eat.

The **velocity** of a stream is how fast the water is moving. If the water is flowing too quickly, spawning salmon might not be able to swim upstream, or their eggs could be washed away. If it is too slow, silt and sand could bury the eggs and suffocate them.

Erosion damages salmon habitat by carrying sediment from the stream bank into the stream, making the water cloudy and burying salmon redds. Evidence of erosion includes collapsing stream banks.

Sediment is rocks on the bottom of the stream. Here are what some of the different sizes look like:

Silt	Sand	Gravel	Cobble
			
Teeny tiny. Like mud.	Very small. Like at the beach.	Small. Like rocks in a fish tank.	The size of your fist.

STREAM CHANNEL Directions & Data Collection

Stream: _____ **Date:** _____

Draw the stream! Be sure to consider the following:

1. Which way is the stream flowing? How fast? Add arrows to your drawing to show the direction of flow.
2. Add any woody material (logs) you see. How many do you see?
3. Draw any pools and riffles you see. Which do you see more of?
4. How big is the sediment on the bottom of the stream? (Try looking through the polarized glasses in your Greenway backpack).
5. Do you see evidence of erosion, such as collapsing stream banks?
6. If you see any salmon or other wildlife, be sure to include them!

STREAM CHANNEL Data Analysis

1. Find the "Velocity" directions card in your Greenway backpack and measure the velocity as a group 3 times. (Use the back of your journal for calculations).
   Velocity 1: _____ Velocity 2: _____ Velocity 3: _____

2. Circle the choices that best fit your data:

	HIGH	MEDIUM	LOW
a) Shape:			
b) Woody material:	10 or more logs	0 - 10 logs	None
c) Pools and riffles	Many pools and riffles	Only a couple of riffles	No riffles or pools
d) Sediment on the stream bottom	Mostly cobble	Close to equal cobble/gravel/ sand	Mostly sand
e) Erosion (collapsing stream banks)	None	Some	Lots
g)Velocity	2 - 3 feet/second	1 - 2 feet/second	0 - 1 or >3 ft/sec

Based on your data, what is the quality of this stream channel? (Circle one):

HIGH **MEDIUM** **LOW**

1. **Get ready to present**: Work as a group to answer the Thinking Questions on the next page. Practice your group presentation.

STREAM CHANNEL Thinking Questions

1. Why is it important for salmon to have a curvy stream?

_____

_____

2. Name two reasons that woody material is important for salmon habitat and stream health.

_____

_____

3. Why is it important for a salmon stream to have lots of riffles?

_____

_____

4. Why is it better for salmon to lay their eggs in gravel and cobble instead of sand or silt?

_____

_____

5. What was the most interesting thing you observed?

_____

_____

6. Based on your data, how healthy is this stream channel?

_____

7. Describe what could improve this stream channel?

_____

_____

WATER QUALITY Background Info

What is Temperature? Fish are ectothermic animals. This means they are the same temperature as the water they live in, so if the water temperature of their stream gets colder or warmer, so do they. Salmon need cold water so they don't get too hot. Also, cold water has lots of oxygen in it!

What is pH? When we measure pH of a liquid, we are measuring how acidic or basic it is. pH is measured on a scale from 0 to 14, where 0 is the most acidic (like lemon juice) and 14 is the most basic (like bleach). Our blood has a pH of about 7, which is neutral. Salmon need to live in water that is neutral with a pH between 6.5 and 8.5.

What is Dissolved Oxygen (DO)? We breathe oxygen from the air using our lungs. Salmon breathe oxygen dissolved in the water using their gills. Dissolved oxygen levels in stream water increase where the water bubbles over small rapids called riffles. Colder and fast-moving water has more oxygen in it than warmer water.

What is Phosphate? Phosphate is a nutrient that all plants and animals need to grow. It is added naturally from decomposing (dead) plants and animals. Sometimes, though, too much phosphate enters streams from sewage leaks or from fertilizers running into streams from people's lawns or farms. Too much phosphate in stream water can reduce the amount of dissolved oxygen in the water that is available to salmon.

What is Turbidity? The turbidity of water is how clear or cloudy it is. The cloudier the water, the more turbid it is. The cloudiness is caused by little particles of soil and plants in the water. The particles makes it harder for fish to breathe (imagine trying to breathe in a sandstorm). Particles that settle on the stream bottom can smother fish eggs and macroinvertebrates (stream bugs). Don't confuse water color with turbidity: water can be a dark color and be clear.

What is ppm? ppm, or parts per million, is a way to measure how much of a nutrient is present in the water. For example, if we find 10 ppm of phosphate, that means there are 10 drops of phosphate in every one million drops of stream water.

WATER QUALITY Directions

1. **You will be given a water quality testing kit.** Circle what your team is going to measure:

   Temperature
   pH
   Dissolved Oxygen
   Phosphate
   Turbidity

2. **Temperature Team:**
   - Right away! **Collect** water from the stream using the white canister in the Greenway backpack.
   - **Distribute** the water to your teammates, and then hand off the white canister to the Turbidity Team.
   - Now, **read** your yellow directions card and take your measurements.

   All other teams: While you wait for your water sample, read your section of the Background Info (page 18) and read your yellow directions card.

3. **Record** all teams' measurements on page 20 (question 1).

4. **Analyze**: Use the table on page 20 (question 2) to figure out if the water quality of this stream is poor, medium, or excellent.

5. **Get ready to present**: Work as a group to answer the Thinking Questions on page 21 and practice your group presentation.

WATER QUALITY
Data Analysis

Stream: _____ **Date:** _____

1. Record your group's data:
   - Temperature: _____ °C
   - Dissolved Oxygen: _____ ppm
   - pH: _____
   - Phosphate: _____ ppm
   - Turbidity: _____ NTU

2. Circle the choices that best fit your data:

	HIGH	MEDIUM	LOW
a) Temperature	5-12°C	13-20°C	Above 20°C
b) DO (Dissolved Oxygen)	More than 6 ppm	4-6 ppm	Less than 4 ppm
c) pH	6.5-8.5	4.5-6.4 or 8.5-10	Less than 4.5 or higher than 10
e) Phosphate	0-2 ppm	3-4 ppm	Above 4 ppm
f) Turbidity	0-50 NTU	51-100 NTU	Above 100 NTU

ppm= parts per million

3. Based on your data, what is the quality of this water? (Circle one):

HIGH **MEDIUM** **LOW**

4. **Get ready to present**: Work as a group to answer the Thinking Questions on the next page. Practice your group presentation.

WATER QUALITY
Thinking Questions

1. Why do salmon prefer cold water?

_____

_____

2. When you measure the pH of water, what are you measuring?

_____

3. Name one way that dissolved oxygen gets into stream water.

_____

_____

4. How can too much phosphate impact a salmon stream?

_____

_____

5. Why do salmon need their water to be clear (low turbidity)?

_____

_____

6. Based on your data, how healthy is this salmon stream?

_____

7. Describe what could improve the water quality?

_____

_____