



# FORESTS AND FINS

## FIELD STUDY TRIP

### **OUTCOMES:**

1. Students will develop awareness and understanding of the importance of riparian zones, water quality, stream channel and macro-invertebrates. They will start to understand some of the stressors on the forest/stream environment: pollution, habitat destruction.
2. Students will develop an understanding of how living and non-living aspects of an ecosystem interact.
3. Students will develop understanding that human actions can disturb an ecosystem.
4. Students will develop ideas about what they can do to protect salmon habitats and why salmon are considered a keystone species in the NW forest ecosystem.
5. Students will develop observational, research, teamwork and presentation skills.

**GRADE LEVEL:** 5th - 8th

**TIME:** 3.5 hours

**LOCATION:** Tiger Mountain State Forest, High Point parking lot, Exit #20 off of I-90

### **MATERIALS:**

Items provided by Greenway Education Program:

- Greenway event sign
- Jigsaw Group Report Cards (x4)
- 4 backpacks with the following contents:

#### **MACRO-INVERTEBRATES**

4 laminated information cards

1 clipboard with a worksheet

Macro-invertebrate guide book

Macro-invertebrate Picture Key

Ice tray or collection jar

Bag of stream bug cards

Pencils

Tiger Mt. Tradition Plateau map

#### **STREAM CHANNEL**

4 laminated information cards

4 clipboards, each with a worksheet

Pencils

Tiger Mt. Tradition Plateau map

## **RIPARIAN ZONE**

- 4 laminated information cards
- 2 clipboards, each with a worksheet
- Native Plant ID books
  - 2 – 4 Invasive Plants Sheets
- Two 20 ft. lengths of rope
- Pencils
- Tiger Mt. Tradition Plateau map

## **WATER QUALITY**

- 5 laminated informaton cards
- 4 clipboards, each with a worksheet
- Container to collect water
- 1 Water Temperature Test Kit with:  
Directions card, water sample canister, 1 high range thermometer and 1 low range thermometer
- 1 Dissolved Oxygen Test Kit with:  
Directions card, 2 small test tubes, 4 DO TesTabs, 1 color chart
- 1 pH Test Kit with:  
Directions card, 10 ml. test tube, 1 pH Wide Range TesTab, 1 color chart
- 1 Nitrate Test Kit with:  
Directions card, one 10 ml test tube, 1 Nitrate TesTab, 1 color chart
- 1 Phosphate Test Kit with:  
Directions card, one 10 ml test tube, 1 Phosphate TesTab, 1 color chart
- 1 Turidity Test Kit with:  
Directions card, conversion chart, 1 turbidity tube, 1 crimp
- Pencils
- Tiger Mt. Tradition Plateau map

**PROCEDURE:** (Adapt questions and language up or down depending on grade level.)

### **1 WELCOME ON BUS**

Meet group in parking lot and board bus. Welcome students and parents to Tiger Mountain and tell them to bring: their warm clothes, raingear, drinks and food. Explain that we will be out on the trail for 3 to 4 hours and they will need all the items just mentioned. They will have a chance to eat snacks and lunch on the trail. This is the last chance to use bathrooms until we return to the bus. After gathering their gear and using the bathroom, we will all meet in the Interpretive Shelter, or other area as directed.

### **2 INTRODUCTION IN INTERPRETIVE SHELTER**

Show map of Greenway and talk about what a Greenway is. Give overview of day: 1) interpretive walk about the forest, lake and stream habitat, 2) lunch, and 3) stream survey. Emphasize essential question: ***What makes a healthy forest/stream environment?*** Talk about how everything in nature is connected. Explain logistics of field trip. Discuss "Trail Etiquette." Ask students if they know some of the "do's" and "dont's" of hiking on forest trails. (Make sure the following are included: stay on the trail and within sight of your chaperone; respect plants by not stepping on or trampling anything; respect animals by not disturbing them; respect each other by not throwing anything or hitting each other; be safe by not running on trails; respect others and wildlife by not littering or using loud voices.)

Have students and chaperones get into their four groups, and pass out backpacks to each of the four groups. Explain that we won't be using these materials until we do the stream survey, but point out the trail map in the front pocket of the backpack.

### 3 INTERPRETIVE WALK

These stops are specific to the Around the Lake Trail. Adapt to the trail you are on.

**Stop 1: 1st lake view pull-out** Ask students to name the four parts of a forest stream habitat that they learned in class (macro-invertebrates, riparian zone, stream channel, and water quality). Ask them to show you a riparian zone. Define riparian zone. Remind them what a macro-invertebrate is. Ask them to say the stages of the salmon lifecycle. As they walk to the next stop, ask them to look at the environment and see what salmon stages might thrive here. While walking on the road, do a mini-lesson on invasive plants.

**Stop 2: 2nd lake view pull-out.** *Let students look at view. Ask if this lake would be a good habitat for any of the lifecycles of salmon. Review lifecycles.* Discuss: lake would not be a good place for salmon to lay eggs (no gravel beds with cold fast-moving water flowing over), but good place to swim into after they get big enough to find food, hide from predators and grow bigger. There are no salmon in Tradition Lake because there is no outlet stream below the lake, so therefore the salmon cannot swim out to the ocean or back to spawn. Ask what other forest animals may live in the lake or depend on the lake for some part of their habitat? Review biologist field report on what lives at Tiger Mt.

**Stop 3: Around the Lake Trail head.** Ask group if they want to do an absolutely silent walk. Ask each student to pick one animal to be while we walk on the forest trail.

"If you are a predator or a prey animal, would you be noisy or quiet in the forest?" Ask them to be absolutely silent as they walk for the next five minutes, so they can experience the forest from the point of view of the animals. Ask them to pay special attention to what they hear, smell, feel and see in the forest. Get group into single file.

**Stop 4: 1st animal track sand box.** Ask students and chaperones what they observed or felt on the silent walk. Ask if students know what the sandbox is for. Explain that animals make trails through the forest that they follow, just like we do. Where do you think they are going when they cross our trail at this point? (the lake)

**Stop 5: Bench along Trail.** Talk about how lake was formed from a glacier. Ask students if they know what trees are around us and help them identify Douglas-fir and Western red cedar. Explain that different trees and plants dominate the "upland" forests (define) and wetland forests in riparian areas. Ask if these trees are "evergreen" or "deciduous." Define these terms, if necessary. Ask them if they are "coniferous" or "broad-leaf" trees. Define if necessary. Ask them to pay close attention to how the trees change as we walk from here to the stream we will survey.

Walk to Tradition Creek. Give students lunch break at the creek. **Orient chaperones to their group's materials, the topic they are going to help students with, and the Jigsaw Group organization.**

**Each survey group should have 4 worksheets. If you haven't already, write the letters A, B, C or D at the top of each copy of the group worksheet packets. This will make the transition to Jigsaw Groups smooth.**

### 4 STREAM SURVEY

Ask students how plants/trees look different around the stream compared with the upland forest. Explain that each of the four groups will survey one part of the forest stream habitat, just like we did in class.

Explain how to use the survey materials in the backpacks. Each backpack has clipboards with worksheet packets on them. Follow the directions in the worksheet packets. The directions will tell you how to set up your survey activities, collect and record data

(information), and fill out the worksheets. All the materials you will need are in your backpacks. Pencils are in the zipper pouch.

**Stress the importance of not damaging the creek or creek-side vegetation during their work.**

Show each group where they should work:

Riparian Zone on either end of the bridge, Macro-invertebrates on ground in pull out, Stream Shape on bridge, Water Quality at pull out before the bridge.

Give groups 20-30 minutes to complete surveys and worksheets.

invasive plants etc.). Ask if there is anything they or others could do to help restore this stream and/or prevent it from degrading further (e.g. plant more trees, keep dogs on leashes, don't allow people to go into the stream, talk to local landowners about not using chemicals on their land that could seep into stream water, etc.) Encourage them to get involved in stream restoration projects in their neighborhoods. **Review the 4 R's and have them give examples of each.** (Reduce, Reuse, Recycle and Rethink) Invite them to return to the Greenway.

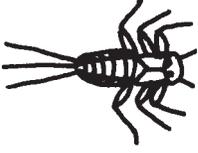
## **5 JIGSAW GROUPS**

When all groups are done with their stream survey, tell the students that they will get into their Jigsaw Groups. They will know which other students are in their group by looking at the letter on the front page of their worksheet packet: A, B, C or D. Explain that their task is to teach each other what they learned in the stream survey and to fill out the Jigsaw Group Report Card.

## **6 WRAP UP**

When all groups are finished, collect their stream survey worksheets and Jigsaw Group Report Cards. Gather everyone together. Asks someone to report the overall quality of the stream habitat they just studied: is it excellent, medium or poor? What could be done to improve this habitat for salmon?

Ask them to think of activities going on at or near the stream that may be degrading it (e.g. people and their dogs trampling plants along the stream banks and going in the stream, fertilizers and pesticides draining into the stream from nearby homes and farms,



## TRADITION CREEK STREAM SURVEY

# MACRO-INVERTEBRATES

## DIRECTIONS

We are trying to answer the BIG question: *What makes a healthy forest/stream environment for salmon?* You are studying one part of the forest/stream environment, **macro-invertebrates**.

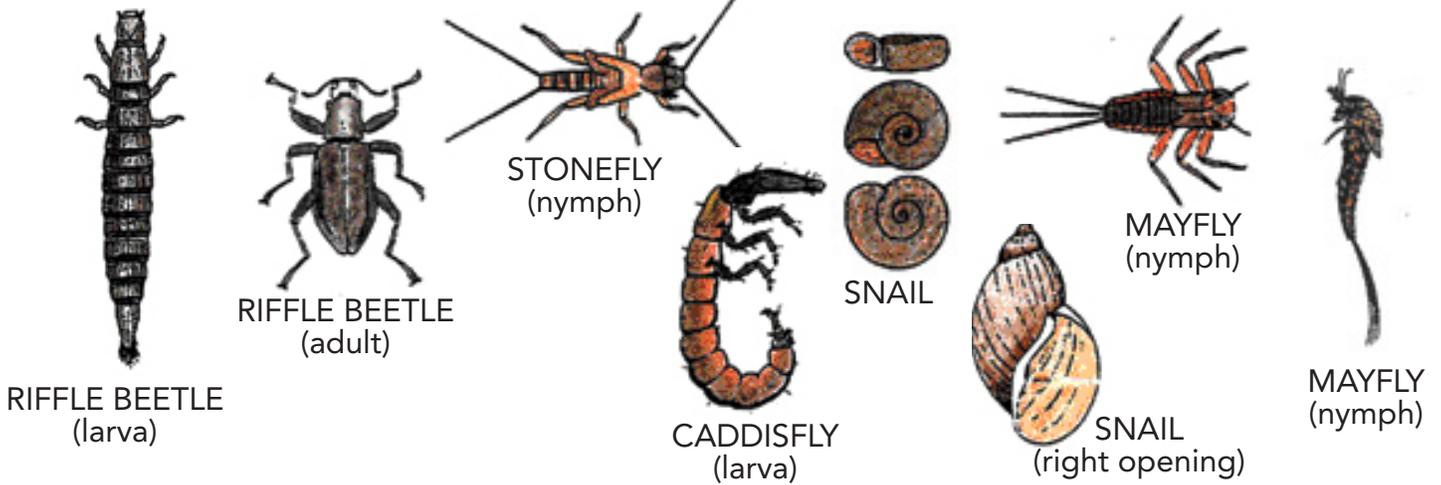
The type of macro-invertebrates (bugs) you find in a stream is an indicator of the health of a stream. You are measuring the health of the forest/stream, not the health of the bugs. Once you have completed this exercise find your Greenway educator to help you explore the stream for macro-invertebrates.

- 1) **Take out** the deck of cards from your group backpack. These represent a sample of macro-invertebrates that were caught in a net placed on the bottom of this stream. **This is a matching game. Match** the macro-invertebrates on the cards with the correct group: Group 1, Group 2 or Group 3 found on the **"Macro-invertebrates Groups Picture Key."**
- 2) After you have finished matching, **count** the macro-invertebrates in each group. **Record** how many macro-invertebrates you found in each group on the **Analysis Table**.
- 3) Work as a group to **answer** the questions on the **Survey Summary**. Each of you will teach your jigsaw group about macro-invertebrates.
- 4) Once you are done with all of these steps, find your Greenway educator. They will show you how to look for macro-invertebrates in the stream.

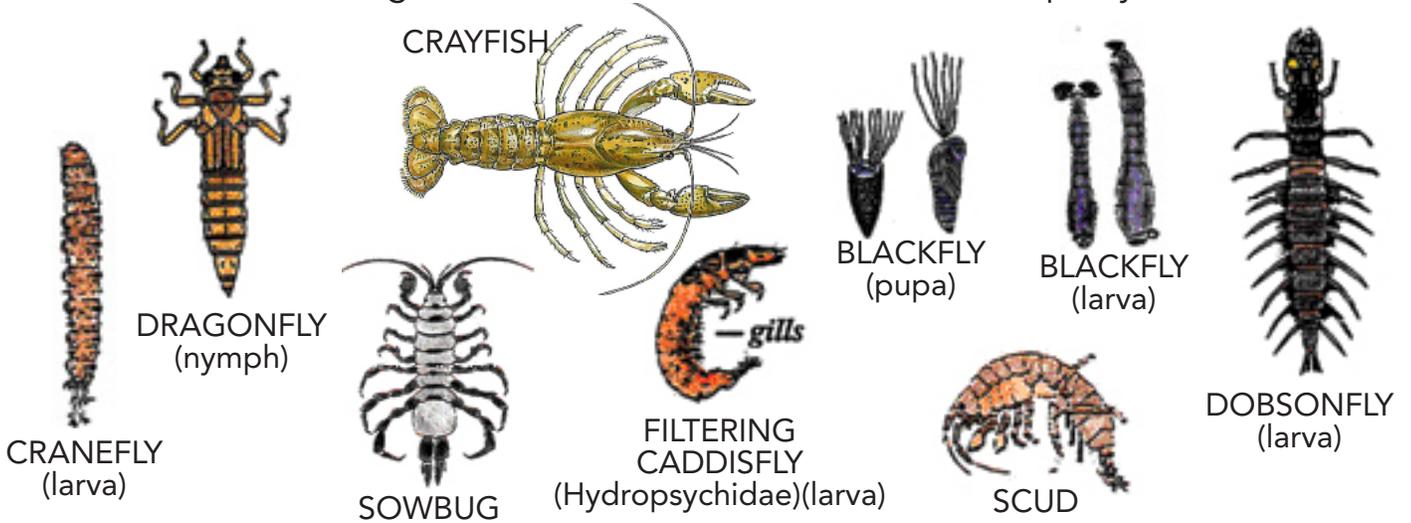
# MACRO-INVERTEBRATE GROUPS

## BEGINNER'S PROTOCOL PICTURE KEY

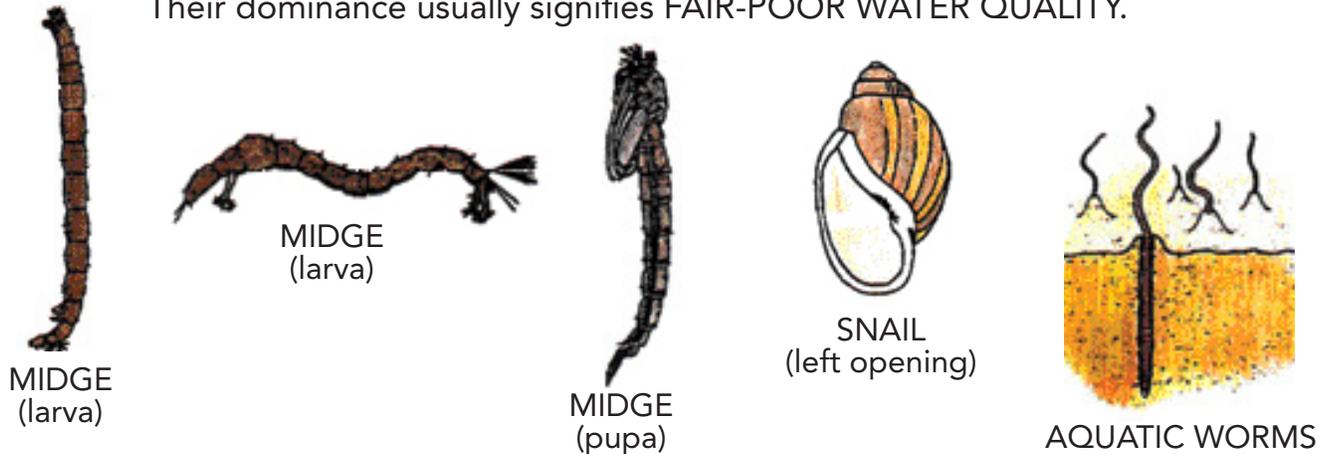
**GROUP 1** - These organisms are generally pollution-intolerant. Their dominance generally signifies EXCELLENT-GOOD WATER QUALITY.



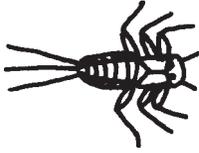
**GROUP 2** - These organisms exist in a WIDE RANGE of water quality conditions.



**GROUP 3** - These organisms are generally tolerant of pollution. Their dominance usually signifies FAIR-POOR WATER QUALITY.



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# MACRO-INVERTEBRATES

## ANALYSIS TABLE

Representative Name(s): \_\_\_\_\_

Location: \_\_\_\_\_ Date: \_\_\_\_\_

1) Record how many macro-invertebrates you counted in each group:

Group #1 \_\_\_\_\_

Group #1 \_\_\_\_\_

Group #1 \_\_\_\_\_

2) **Circle** the choice that best fits the Tradition Creek data:

	EXCELLENT	MEDIUM	POOR
<i>The stream sample has:</i>	Mostly Group 1 macro-invertebrates	Mostly Group 2 macro-invertebrates	Mostly Group 3 macro-invertebrates

3) Based on the analysis table, the water quality of Tradition Creek is:

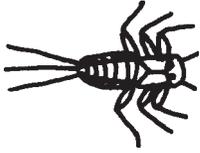
**EXCELLENT**

**MEDIUM**

**POOR**

4) Work as a group to **answer** the questions on the **Survey Summary** (on the back of this page). Each of you will teach your jigsaw group about macro-invertebrates.

5) When you are finished with the **Survey Summary**, ask your Greenway educator about looking for macro-invertebrates in the stream.



# MACRO-INVERTEBRATES

## SURVEY SUMMARY

- What is a macro-invertebrate?
- Explain the difference between Group 1, Group 2 and Group 3 macro-invertebrates.
- What is an indicator species?
- Based on your data and analysis table, is the water quality of this stream excellent, medium or poor?
- What variable(s) might be affecting the type of bugs the you found in stream?
- How does knowing which bugs live in this stream tell us what the quality of the salmon habitat is?



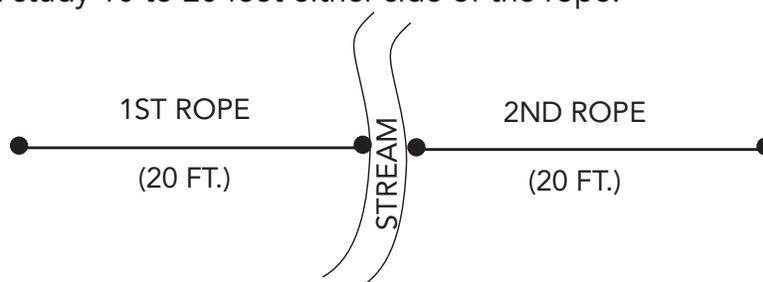
## TRADITION CREEK STREAM SURVEY

# RIPARIAN ZONE

## DIRECTIONS

We are trying to answer the BIG question: *What makes a healthy forest/stream environment for salmon?* You are studying one part of the forest/stream environment, **riparian zone**.

- 1) Go to your group backpack and **find** the two 20-foot long ropes. **Divide** the riparian zone study team into two smaller groups and give each group half of the materials in the backpack. Your Greenway Educator will direct you to your area of study.
- 2) **Set up** transect lines on both sides of the stream:
  - Have one student take one end of the rope and very carefully walk to the stream bank, trying not to step on any plants.
  - Place the end of the rope near the stream's edge and hold on to it.
  - Have another student take the other end of the rope and walk in a perpendicular line from the stream's edge away from the stream (see diagram below).
  - You will study 10 to 20 feet either side of the rope.



- 3) **Draw a map** of the plants along your transect line on the page in your worksheet packet labeled **Map of Streamside Plants**. Take about 10 minutes to do this and then move on to the rest of the activity.
- 4) **Take out** the Native Plant ID book and the Invasive Plants or Alien Invaders sheet in your group backpack. Use these to **identify** the plants found along your transect line. **Label** the plants on your map.
- 5) **Complete** the **Analysis Table** to determine the quality of this riparian zone.
- 6) Work as a group to **answer** the questions on the **Survey Summary**. Each of you will teach your jigsaw group about the riparian zone.

# MAP OF STREAMSIDE PLANTS





TRADITION CREEK STREAM SURVEY

**RIPARIAN ZONE  
ANALYSIS TABLE**

Representative Name(s): \_\_\_\_\_

Location: \_\_\_\_\_ Date: \_\_\_\_\_

1) Circle the choices that best fit your Tradition Creek survey results:

	<b>EXCELLENT</b>	<b>MEDIUM</b>	<b>POOR</b>
<b>a) <i>Native plants growing along stream bank:</i></b>	Mostly trees & shrubs	Some trees & some grass	All grass or bare soil
<b>b) <i>Trees &amp; shrubs hanging over the stream bank:</i></b>	Yes, on both sides of the stream	Yes, but only on one side of the stream	No
<b>c) <i>Amount of woody debris in the stream:</i></b>	Many pieces	A few pieces	None
<b>d) <i>Invasive species growing near the stream bank:</i></b>	None	A few	Lots

2) Based on the analysis table, the quality of this riparian zone is:

**EXCELLENT                      MEDIUM                      POOR**

3) Work as a group to **answer** the questions on the **Survey Summary** (on the back of this page). Each of you will teach your jigsaw group about the riparian zone.



## TRADITION CREEK STREAM SURVEY

# RIPARIAN ZONE

## SURVEY SUMMARY

- What is the difference between invasive and native plants?
  
- Why are invasive species of plants a problem for the ecosystem?
  
- Are there any trees or bushes hanging over the stream? If so, why is this important for salmon habitat and forest health?
  
- Is there any woody debris (duh-bree) in the stream? Name at least 3 reasons this is important to salmon habitat and forest health:
  - 1.
  - 2.
  - 3.
  
- Based on your data and analysis table, is the quality of this riparian zone excellent, medium or poor?
  
- Describe what could improve this riparian zone.



## TRADITION CREEK STREAM SURVEY

# STREAM CHANNEL

## DIRECTIONS FOR TRADITION LAKE TRAIL

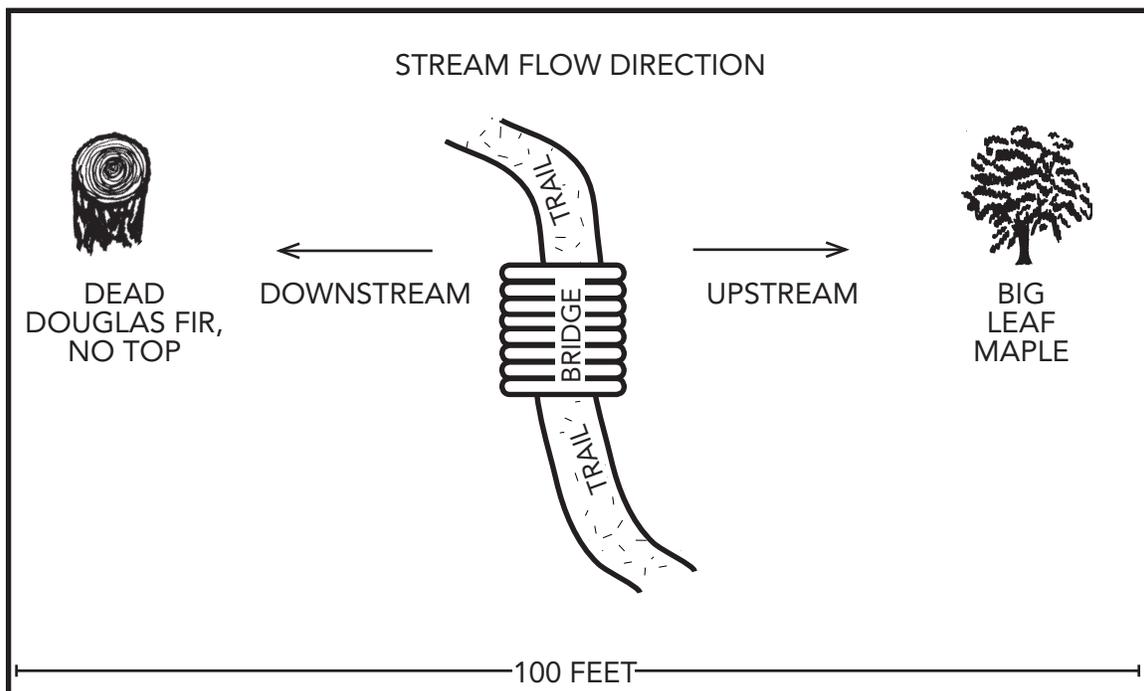
We are trying to answer the BIG question: *What makes a healthy forest/stream environment for salmon?* You are studying one part of the forest/stream environment, **the stream channel**.

You will be surveying what this stream looks like from an overhead view (like from a bird's eye) as well as what the stream bottom looks like. Please follow the directions and answer the questions.

### STREAM CHANNEL TOP VIEW

Your stream survey site is 100 feet long. It begins at the bigleaf maple tree with many trunks upstream from the bridge and it goes downstream, past the bridge, and ends at the broken-top Douglas-fir on the right hand side of the stream.

- 1) **Stand on the bridge and draw a picture** of what your 100-foot stream section would look like to a bird flying over it. Draw and label the location of gravel bars, riffles, pools and woody debris in your diagram. Use the box below.





2) Count the sections of pools and riffles on your diagram:

Number of pools: \_\_\_\_\_ Number of riffles: \_\_\_\_\_

### STREAM CHANNEL BOTTOM VIEW

Find a gravel bar that you can see clearly from the bridge. Draw what the rocks look like in the box below.

Find a pool that you can see clearly from the bridge. Draw what the rocks, sand, silt or mud look like on the bottom of the pool in the box below.



## TRADITION CREEK STREAM SURVEY

# STREAM CHANNEL

## SURVEY SUMMARY

- Why is it important for salmon to have a curvy stream?
  
- Is there any woody debris (duh-bree) in the stream? Name at least 3 reasons this is important to salmon habitat and forest health:
  - 1.
  - 2.
  - 3.
  
- Why is it important to have an equal number of pools and riffles?
  
- Why do you think it is better for salmon to lay their eggs in gravel and cobble instead of sand?
  
- Based on your data and analysis table, is the quality of this riparian zone excellent, medium or poor?
  
- Describe what could improve this riparian zone.



## TRADITION CREEK STREAM SURVEY

# STREAM CHANNEL

## ANALYSIS TABLE

Representative Name(s): \_\_\_\_\_

Location: \_\_\_\_\_ Date: \_\_\_\_\_

1) Circle the choices that best fit your Tradition Creek survey results:

	EXCELLENT	MEDIUM	POOR
<b>TOP OF STREAM:</b> <b>a) Shape:</b>			
<b>b) Woody Debris:</b>	Many pieces	A few pieces	None
<b>c) Equal number of pools and riffles?</b>	Yes	Close to equal	No, there are many more of one than the other
<b>BOTTOM OF STREAM:</b> <b>a) Amount of cobble, gravel sand:</b>	 cobble 80%   gravel 20%   sand 0%	 cobble 40%   gravel 30%   sand 30%	 cobble 40%   gravel 10%   sand 50%

2) Based on the analysis table, the quality of this stream channel is:

**EXCELLENT                      MEDIUM                      POOR**

3) Work as a group to **answer** the questions on the **Survey Summary** (on the back of this page). Each of you will teach your jigsaw group about the stream channel.



### BACKGROUND INFORMATION

Gravel bars are areas of the stream that are made up mostly of cobble and gravel. Here are what the different kinds of rocks, called "particles," on the stream bottom look like:

Silt



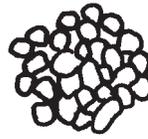
Very small  
(shown actual size)

Sand



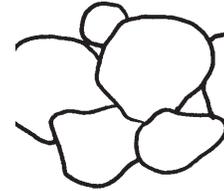
less than  
0.1 inch  
(shown actual size)

Gravel



0.1-2 inches  
(shown 1/4 size)

Cobble



2-10 inches  
(shown 1/4 size)

**Riffles** ("riff-ulz") are small rapids in the stream where water moves quickly and bubbles over big rocks and sticks. The fast-moving water carries silt and sand (the small particles on the stream bottom) downstream, leaving only the bigger and heavier gravel and cobble for spawning salmon to lay their eggs in. It's important for salmon eggs to have cobble that is not buried in sand and silt to lay their eggs in, so they get the oxygen they need to grow.

**Pools** are deeper places in the stream where water moves more slowly than in the riffles. Young salmon fry live in the pools after they leave the gravel bed. Out of the fast-moving current, fry can hide from predators in pools and find food.

**Woody debris** ("duh-bree") are the logs, branches and sticks that fall into the stream from streamside plants. They help create pools and riffles, and they add nutrients to the water as they decompose (or break down), providing food for the stream insects that salmon eat.





## TRADITION CREEK STREAM SURVEY

# WATER QUALITY

## DIRECTIONS

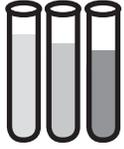
We are trying to answer the BIG question: *What makes a healthy forest/stream environment for salmon?* You are studying one part of the forest/stream environment, water quality.

- 1) **Divide** your group into 4 smaller teams. **Open** the Greenway backpack and each team should take out one of the clipboards and water testing equipment in the plastic bags. One team will test the temperature and dissolved oxygen, one team will test the pH, one team will test the nutrients, and one team will test the turbidity.

**Look** at the label on your bag to discover which part of water quality you will examine.

My team will test: \_\_\_\_\_

- 2) The team testing water temperature and pH will **collect** a water sample in the white jar after reading the directions on their yellow card. All the other teams will **start reading the directions** on the yellow cards and will wait for the water temperature team to bring water from the stream. Collecting the water sample should be done right away, before taking the temperature.
- 3) **Perform** your experiments using the water from the white jar that the temperature team brings to you. **Follow** the directions on your yellow card.
- 4) While you are waiting for your results, **STUDY THE INFORMATION ON THE BACK OF THIS PAGE. YOU WILL NEED TO EXPLAIN THIS INFORMATION TO YOUR GROUP AND TO THE CLASS.**
- 5) **Record** your results in the **Analysis Table**. You'll need to collect data from the 3 other Water Quality teams.
- 6) When all the teams have finished their tests, come back together as a group. Work as a group to **answer** the questions on the **Survey Summary**. Each of you will teach your jigsaw group about water quality.



## BACKGROUND INFORMATION

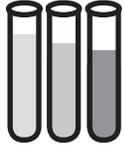
**Water Temperature** - Human beings are “warm-blooded” animals, which means that our body temperature stays the same as the air around us, no matter how warm or cold it is. But fish are “cold-blooded” animals. They are always the temperature as the water they live in, so if the water temperature of their stream gets colder or warmer, so do they. Salmon like cold water best, because cold water has lots of oxygen in it. (See “Dissolved Oxygen” description below.)

**What is pH?** - Most of you have heard of acids. Acids can eat through things, or sting your tongue a little bit, like lemon juice. The opposite of an acid is called a base. We can measure how acidic all liquids are. The acids in liquids, such as the stream water salmon spawn in, is measured on a pH scale from 0 to 14, where 0 is the most acidic and 14 is the most basic. Salmon need to live in water that is in the middle of acid and basic (called neutral), in a pH measurement of 7 or 8.

**What is Dissolved Oxygen?** - Fish breathe oxygen dissolved in water through their gills. We breathe oxygen from air through our lungs. Salmon need a certain amount of dissolved oxygen (DO) in the water to survive. DO is measured in “parts per million” (ppm). DO levels in stream water increase where the water bubbles over small rapids called riffles (“riff-ulz”). Cold water has more oxygen in it than warm water.

**What are Nitrate and Phosphate?** - Nitrate and phosphate are nutrients needed for growth by all plants and animals who live in streams. They are added naturally to stream water by decomposing plants and animals. Sometimes, though, too much nitrate and phosphate enter streams from sewage leaks, factories, or from fertilizers running into streams from people’s lawns, gardens, or farms. Too much nitrate and phosphate in stream water can reduce the amount of oxygen in the water that is available to salmon. (See the Dissolved Oxygen description above.)

**What is Turbidity?** - Turbidity is the measure of the clarity of water. When water looks cloudy we describe it as being turbid. The cloudiness is caused by little particles, often of soil and/or plant materials, that are suspended (floating) in the water. These particles can come from erosion, urban runoff, algal blooms, and people, animals, and boats in the water. Plants and animals can’t live in turbid water for long periods of time. The particles (often soil and plant materials) can clog the gills of fish, which makes it harder for the fish to breathe (think how hard it would be for us to breathe in a sandstorm). Most of the particles settle on the stream bottom like a blanket and can smother fish eggs and macro-invertebrates (stream bugs). Don’t confuse the color of the water with turbidity. Water can be a dark color and be clear (not turbid). Remember, the cloudier the water is, the more turbid it is.



TRADITION CREEK STREAM SURVEY  
**WATER QUALITY**  
**ANALYSIS TABLE**

Representative Name(s): \_\_\_\_\_

Location: \_\_\_\_\_ Date: \_\_\_\_\_

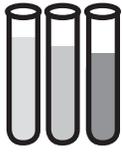
1) Circle the choices that best fit your Tradition Creek survey results:

	<b>EXCELLENT</b>	<b>MEDIUM</b>	<b>POOR</b>
<b>a) Temperature:</b>	Between 5-12°C	Between 13-20°C	Above 20°C
<b>b) DO (Dissolved Oxygen):</b>	More than 9 ppm	6-8 ppm	Less than 6 ppm
<b>c) pH:</b>	6.5-8.5	4.5-6.4 or 8.5-10	Less than 4.5 or higher than 10
<b>d) Nitrate:</b>	0-4 ppm	5-15 ppm	16-40 ppm
<b>e) Phosphate:</b>	0-2 ppm	3-4 ppm	more than 4 ppm
<b>f) Turbidity:</b>	0-50 NTU	51-100 NTU	Above 100 NTU

2) Based on the analysis table, the water quality of Tradition Creek is:

**EXCELLENT**                      **MEDIUM**                      **POOR**

3) Work as a group to **answer** the questions on the **Survey Summary** (on the back of this page). Each of you will teach your jigsaw group about water quality.

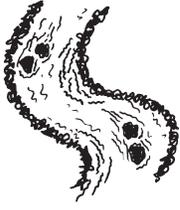


## TRADITION CREEK STREAM SURVEY

# WATER QUALITY

## SURVEY SUMMARY

- What does **ppm** stand for?
- Why is stream temperature important to salmon?
- When you measure the pH of water, what are you measuring?
- Name one way that dissolved oxygen gets into the water.
- Explain what happens when excessive (too much) nutrients get into waterways (streams, lakes and oceans).
- What might account for the level of turbidity found?
- Based on your data and analysis table, is the water quality of Tradition Creek excellent, medium or poor?
- Describe what could improve the water quality.



## TRADITION CREEK STREAM SURVEY

# STREAM CHANNEL

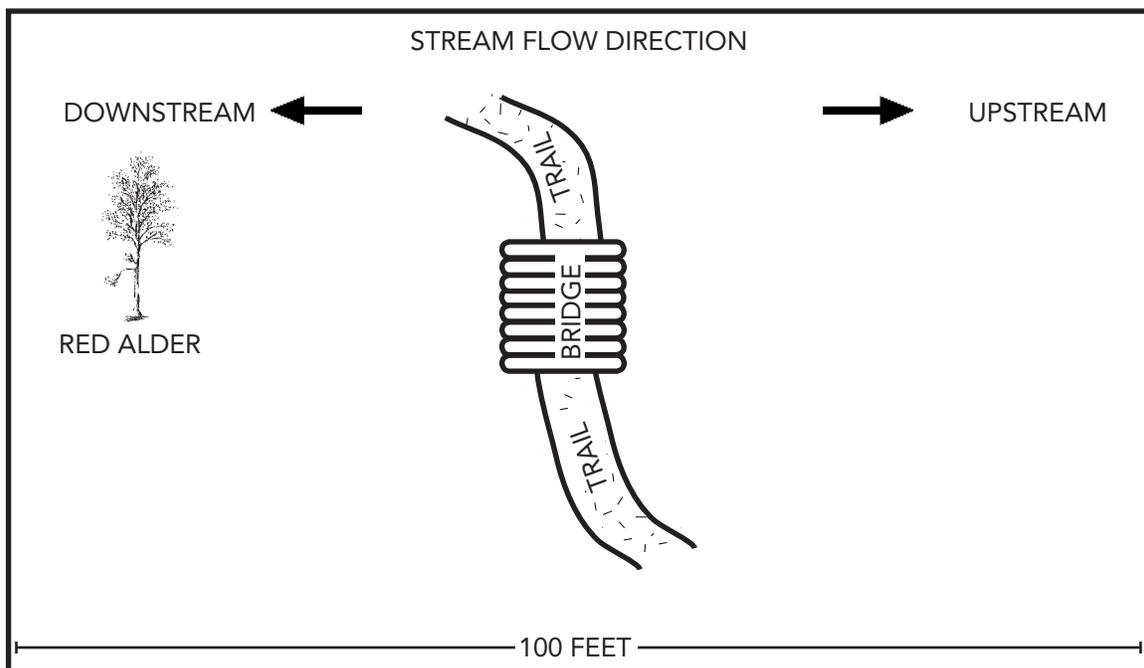
## DIRECTIONS FOR BUS TRAIL

We are trying to answer the BIG question: *What makes a healthy forest/stream environment for salmon?* You are studying one part of the forest/stream environment, **the stream channel**.

You will be surveying what this stream looks like from an overhead view (like from a bird's eye) as well as what the stream bottom looks like. Please follow the directions and answer the questions.

Your stream survey site is 100 feet long. It begins at the big Red alder tree downstream from the bridge (on the right side of the stream bank) and it goes upstream, past the bridge, and ends where the stream curves hard left.

- 1) Stand on the bridge and draw a picture of what your 100-foot stream section would look like to a bird flying over it. Draw and label the location of gravel bars, riffles, pools and woody debris in your diagram. Use the box below.





2) Count the sections of pools and riffles on your diagram:

Number of pools: \_\_\_\_\_ Number of riffles: \_\_\_\_\_

**STREAM CHANNEL BOTTOM VIEW**

Find a gravel bar that you can see clearly from the bridge. Draw what the rocks look like in the box below.

A large, empty rectangular box with a black border, intended for drawing a gravel bar.

Find a pool that you can see clearly from the bridge. Draw what the rocks, sand, silt or mud look like on the bottom of the pool in the box below.

A large, empty rectangular box with a black border, intended for drawing the bottom of a pool.

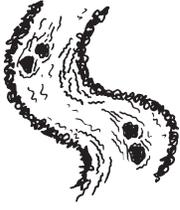


## TRADITION CREEK STREAM SURVEY

# STREAM CHANNEL

## SURVEY SUMMARY

- Why is it important for salmon to have a curvy stream?
  
- Is there any woody debris (duh-bree) in the stream? Name at least 3 reasons this is important to salmon habitat and forest health:
  - 1.
  - 2.
  - 3.
  
- Why is it important to have an equal number of pools and riffles?
  
- Why do you think it is better for salmon to lay their eggs in gravel and cobble instead of sand?
  
- Based on your data and analysis table, is the quality of this stream channel excellent, medium or poor?
  
- Describe what could improve this stream channel.

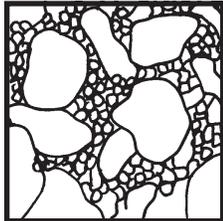
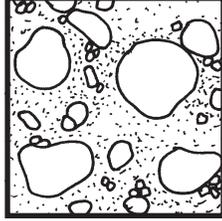


## TRADITION CREEK STREAM SURVEY STREAM CHANNEL ANALYSIS TABLE

Representative Name(s): \_\_\_\_\_

Location: \_\_\_\_\_ Date: \_\_\_\_\_

1) Circle the choices that best fit your Tradition Creek survey results:

	<b>EXCELLENT</b>	<b>MEDIUM</b>	<b>POOR</b>
<b>TOP OF STREAM:</b> a) <i>Shape:</i>			
b) <i>Woody Debris:</i>	Many pieces	A few pieces	None
c) <i>Equal number of pools and riffles?</i>	Yes	Close to equal	No, there are many more of one than the other
<b>BOTTOM OF STREAM:</b> a) <i>Amount of cobble, gravel sand:</i>	 cobble 80%   gravel 20%   sand 0%	 cobble 40%   gravel 30%   sand 30%	 cobble 40%   gravel 10%   sand 50%

2) Based on the analysis table, the quality of this stream channel is:

**EXCELLENT                      MEDIUM                      POOR**

3) Work as a group to **answer** the questions on the **Survey Summary** (on the back of this page). Each of you will teach your jigsaw group about the stream channel.



## BACKGROUND INFORMATION

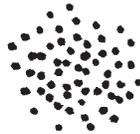
Gravel bars are areas of the stream that are made up mostly of cobble and gravel. Here are what the different kinds of rocks, called "particles," on the stream bottom look like:

Silt



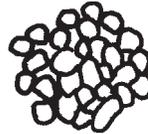
Very small  
(shown actual size)

Sand



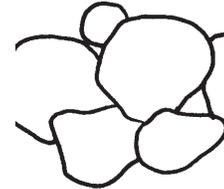
less than  
0.1 inch  
(shown actual size)

Gravel



0.1-2 inches  
(shown 1/4 size)

Cobble



2-10 inches  
(shown 1/4 size)

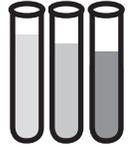
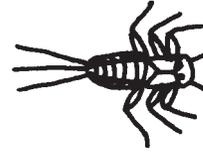
**Riffles** ("riff-ulz") are small rapids in the stream where water moves quickly and bubbles over big rocks and sticks. The fast-moving water carries silt and sand (the small particles on the stream bottom) downstream, leaving only the bigger and heavier gravel and cobble for spawning salmon to lay their eggs in. It's important for salmon eggs to have cobble that is not buried in sand and silt to lay their eggs in, so they get the oxygen they need to grow.

**Pools** are deeper places in the stream where water moves more slowly than in the riffles. Young salmon fry live in the pools after they leave the gravel bed. Out of the fast-moving current, fry can hide from predators in pools and find food.

**Woody debris** ("duh-bree") are the logs, branches and sticks that fall into the stream from streamside plants. They help create pools and riffles, and they add nutrients to the water as they decompose (or break down), providing food for the stream insects that salmon eat.



# JIGSAW GROUP REPORT CARD



Jigsaw Group Members: \_\_\_\_\_

Date: \_\_\_\_\_

1) Circle the choices that best fit the Tradition Creek data.

<b>Water Quality:</b>	<b>EXCELLENT</b>	<b>MEDIUM</b>	<b>POOR</b>
<b>Stream Channel:</b>	<b>EXCELLENT</b>	<b>MEDIUM</b>	<b>POOR</b>
<b>Riparian Zone:</b>	<b>EXCELLENT</b>	<b>MEDIUM</b>	<b>POOR</b>
<b>Macro-Invertebrates:</b>	<b>EXCELLENT</b>	<b>MEDIUM</b>	<b>POOR</b>

2) Based on your steam survey, the overall quality of Tradition Creek is:

**EXCELLENT                  MEDIUM                  POOR**

3) Do you think salmon would live in Tradition Creek? Explain your thinking.

4) What would your group say was the poorest measurement? Describe what could improve this.