

Best Water Ways

Watershed Literacy, Stewardship, and Restoration Place-Based Learning Resources



Educator's Guide

By Stephanie Cottell, MSc Education for Ecological Sustainability



This initiative was inspired and developed within the unceded Traditional Territories of the Quw'utsun, Penelakut, Halalt, Malahat, Stz'uminus, and Lyackson People. Huy tseep q'u Siem! Thanks to you all with respect and honour!

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An Introduction to the *Best Water Ways* Resources

Greetings! If you are reading this guide you are likely a teacher or educator considering whether the *Best Water Ways* place-based learning resources have value, and may be useful to you and your class or learning group.

These resources have been created by the Cowichan Community Land Trust, with the input of a group of subject matter experts and educators like you. A brilliant team from Open School BC has provided their professional instructional design expertise to ensure that the resources are consistent with the curriculum objectives and are visually appealing.

The development and piloting of these resources has been made possible with funding from The Real Estate Foundation of BC, and the Pacific Salmon Foundation. We are most humbly grateful for opportunity to bring this vision into fruition.

The following backgrounder is intended to provide a bit of context around the *Best Water Ways* initiative, and will hopefully help you decide that “YES, these resources are just what we need!”

The Big Idea

As an educator, you are aware of the many challenges facing our Earth's biological systems. You teach students earth science/ecological concepts such as the 'Water and Carbon Cycles' and try to help learners connect these concepts to their lives and what is happening around us today.

Organizations like the Cowichan Community Land Trust have been involved with school and community learning for many years. For example, many local conservation groups organize Streamkeepers activities and provide resources for storm drain marking (think 'yellow fish' symbol). School groups often join in on planting or streamside clean-up days.

The Cowichan Community Land Trust was delivering a riparian restoration project recently that spontaneously involved a local grade nine group doing some planting. It was during this project that a beam of light came through the forest and illuminated the need for the *Best Water Ways* learning resources. Would it not be of great benefit to enrich these types of community stewardship and restoration activities with a deeper, place-based learning experience for students and educators? After-all, where and how our local water flows is about as place-based as it gets.

It is also vitally important that youth learn about their local watersheds, and how to protect, steward, and restore them.

Place-Based Learning

There has certainly been a lot of buzz about place-based learning recently. The theory and practice of place-based learning has emerged through the growing awareness that learning can be very engaging, meaningful, and effective when approached through direct exploration of our specific place in the world.

Ecós is the ancient Greek word for Home. Fittingly, the place-based learning approach is a great way to explore aspects of local ecology, such as watershed systems, and expand a learner's basic literacy around ecological themes. It also aligns beautifully with aims to nurture good citizenship and awareness of important sustainability issues we face, both locally and globally.

Place-based learning happens through inquiry-led, project-style, experiential activities that help learners understand overarching global macro-concepts by exploring through a tangible local lens.

For example, students might learn about water use and conservation by looking at, and becoming familiar with, their school population's water consumption. The group may then try different water conservation methods, analyzing any changes to water usage over time.

We highly recommend that you visit gettingsmart.com/placebasededucation for more information about the theory, practice, elements, and benefits of place-based learning.

Inquiry-led Learning

Place-based learning is predominantly led by the process of learner inquiry. The beauty of this approach means that a set of learning resources, such as these, can be used by a range of different age groups and different subject curriculum. For example, science and social studies can be integrated because the group will engage with the content at their own level, and from the thematic lens of their own inquiry.

The inquiry-based approach was selected because we want the *Best Water Ways* learning experience to be exciting, memorable, and empowering to participants (including you!). The aim is to connect participants' learning experiences organically, yet tangibly, with the related curriculum and competencies through their own process of inquiry, curiosity, and discovery.

The intention is also to nurture an awareness of our human relationship with the health of watershed systems, and to motivate on-going involvement in stewardship and restoration in the places we call home.

Inquiry-based activities are integrated into each session. They culminate with the “Shout Out and Share!” communication element. This activity is very self-directed, it lets learners hone-in on what they have connected with most tangibly during the sessions.

Indigenous Knowledge

The integration of local Indigenous knowledge in today's classrooms is invaluable because it broadly supports a holistic learning experience for students. In the context of local ecological sustainability, we have a great deal to learn about how to coexist better with nature, a theme which is central to Indigenous teachings. Our approach in *Best Water Ways* is to explore elements of local Indigenous knowledge throughout each session of the learning project.

We encourage you to connect with the Indigenous education department of your school district, and/or with the educational department of your local Indigenous community. They may be able to connect you with Elders and Knowledge/Culture-Keepers who can visit your classroom and/or join you on a field trip to a local water body.

Historically, Indigenous knowledge was spoken rather than written. However, many communities have published excellent local language dictionaries and other print-based materials. We have also added links to web-based First Languages resources that can be utilized in the session activities. These links can be found in the “Regional Resources” area of the *Best Water Ways* web page at cowichanlandtrust.ca/best-water-ways.

The Resources

The *Best Water Ways: Watershed Literacy, Stewardship, and Restoration Place-based Learning Resources* are a suite of six Educator's Guides with activity plans, and a Learner's Guide for each session. These resources can be used in a multitude of ways to facilitate learning about your local watershed, and how it can be protected and restored.

The suite of resources is designed to be delivered as five learning sessions (each approximately two-hours long). They culminate in (or begin with—but more on possibilities later!) a local restoration activity in a nearby stream, creek, lake, or wetland within your watershed. This restoration activity might involve an afternoon or a day-long clean-up or planting session. Or it might be a more intensive restoration project that takes from several days to a week, with learners contributing to the planning. This will depend on your context, grade, learning level, time, and capacity.

Ideally, you will be able to partner with a local group like the Cowichan Community Land Trust (there are many). They can help plan and facilitate the restoration activities and other learning session components that may be challenging for you. We have compiled a list of conservation groups and contacts, categorized by region. You can find this list on the [Best Water Ways web page](#). We are also sharing information about *Best Water Ways* with these groups, with the aim that they will be familiar with the initiative when you contact them.



All smiles after a satisfying riparian restoration session!

Photo: Stephanie Cottell

On Curriculum

We understand that teachers must meet grade curriculum and competency expectations. This can make offering an extended 6-session learning experience, with a focus on watersheds, seem challenging. Because the learning process is inquiry-based, the participants will engage with the content at their own level, allowing the resources to be adaptable to a wide range of ages and learning capacities.

It's important that any supplemental materials that are brought into the learning experience are grade or learning level appropriate for your group (i.e., text and reference books, articles, research papers).

The following table describes the most obvious areas in which the *Best Water Ways* place-based learning resources connect to the BC Provincial Grade 9-12 Science Core Curriculum. However, these resources can also be used in an elementary level learning context.

Grade Level and Subject	Big Ideas
Grade 9 Science	<ul style="list-style-type: none"> • The biosphere, geosphere, hydrosphere, and atmosphere are interconnected, as matter cycles and energy flows through them
Grade 10 Science <i>*special stand-alone sessions rather than the whole suite</i>	<ul style="list-style-type: none"> • DNA is the basis for the diversity of living things • Energy is conserved, and its transformation can affect living things and the environment • Indigenous classification of plants
Grade 11 Earth Science	<ul style="list-style-type: none"> • Earth materials are changed as they cycle through the geosphere and are used as resources, with economic and environmental implications • The distribution of water has a major influence on weather and climate
Grade 11 Environmental Science	<ul style="list-style-type: none"> • Complex roles and relationships contribute to diversity of ecosystems • Changing ecosystems are maintained by natural processes • Human practices affect the sustainability of ecosystems • Humans can play a role in stewardship and restoration of ecosystems
Grade 11 Science for Citizens	<ul style="list-style-type: none"> • Scientific processes and knowledge inform our decisions and impact our daily lives • Scientific understanding enables humans to respond and adapt to changes locally and globally

Grade Level and Subject	Big Ideas
Grade 12 Environmental Science	<ul style="list-style-type: none"> • Human actions affect the quality of water and its ability to sustain life • Human activities cause changes in the global climate system • Sustainable land use is essential to meet the needs of a growing population • Living sustainably supports the well-being of self, community, and Earth
Grade 12 Specialized Science	<ul style="list-style-type: none"> • Biodiversity is dependent on the complex interactions and processes between biotic and abiotic factors • Climate change impacts biodiversity and ecosystem health • Forces interact within fields and cause linear and circular motions

Curricular Competencies for 9-12 Sciences

- › **Questioning and predicting:** Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest
- › **Planning and conducting:** Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)
- › **Processing and analyzing data and information:** Experience and interpret the local environment and apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information
- › **Evaluating:** Consider social, ethical, and environmental implications of the findings from their own and others' investigations
- › **Applying and innovating:** Contribute to care for self, others, community, and world through individual or collaborative approaches
- › **Communicating:** Communicate scientific ideas and information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations and Express and reflect on a variety of experiences, perspectives, and worldviews through place

*For the **Grade 10 Science** applications, certain standalone elements within the learning resources package would be highly valuable, and appropriate to meet specific curriculum components for the upper level sciences.

More detailed information about each curriculum competency can be found at:
<https://curriculum.gov.bc.ca/curriculum/science>

These include:

- › **Natural selection and genetics**, explored through learning about adaptive differences between wild and hatchery raised fish
- › **Indigenous classification of plants**, explored through learning local Indigenous traditional medicinal plant names, and uses of species that grow in a riparian habitat

We plan to develop activity session plans that focus on these upper-level science core curriculum objectives to increase the accessibility and utility of these resources. Once complete, they will be accessible on the *Best Water Ways* web page.

The Resources: An Overview

The *Best Water Ways* suite of resources is made up of the following components:

Educator's Guide (EG)

The Educator's Guide contains

- › An introduction and overview
- › Six session guides providing a detailed look at each session's curriculum content and implementation methods
- › Six session activity plans: providing a quick bullet-form reference to assist in session flow
- › Complete list of "Words and Terms"
- › Materials for activities

Learner's Guide (LG)

The Learner's Guide resources are designed to be compiled as a workbook for participants if you are offering multiple sessions, or as individual session resources. The workbook can be handed in after each session for your review, making the "Watershed Reflection" component an effective evaluation tool.

Each Learner's Guide includes

- › An introduction to the session
- › Guidance through the content and activities
- › Related inquiry questions with space provided for their work
- › A complete list of "Words and Terms"
- › A "Watershed Reflection" component for learners to complete at the end of the session
- › Associated learning materials (e.g., cut-out labels for activities)

The Sessions: An Overview

Note: The sessions are numbered for your convenience but can be used in any order.

Session 1: Watershed Detectives	
Big Idea/Inquiry	What is our direct connection to our watershed?
Words and Terms	Interconnectedness, culverts, ditches, storm drains, perimeter drain, bridges, dikes
Session 2: Wading In	
Big Idea/Inquiry	What is a watershed?
Words and Terms	Watershed, water basin, surface water, ground water, river, tributary, riparian ecosystem, physiography, Indigenous knowledge, local Indigenous language word for water
Session 3: Mapping Our Watersheds	
Big Idea/Inquiry	What does our local watershed look like?
Words and Terms	Topographic map, elevation, contour lines and intervals, gully, valley, slope, watershed boundary, local Indigenous place names of mountains or other features
Session 4: Watersheds In Distress	
Big Idea/Inquiry	How is our watershed being harmed?
Words and Terms	Deforestation, contaminants, run-off, phosphorus, nitrates, invasive species, reciprocity
Session 5: Watershed SOS	
Big Idea/Inquiry	How can we protect and restore our watershed?
Words and Terms	Ecological literacy, ecological restoration, selective forestry, rain gardens, decontamination, mitigation, local Indigenous language words for willow and/or red-osier dogwood
Special Note	In the <i>Watershed SOS</i> session, learners are also guided in planning a “Shout Out and Share!” project communication element in preparation for riparian restoration activities. The integration of this element will provide an effective approach for evaluation of participant learning.

Session 6: Riparian Restoration Workshop	
Big Idea/Inquiry	How do you DO riparian restoration?
	<p>This session is a bit different than the others in the following ways:</p> <ul style="list-style-type: none"> • it will take more time • you will be coordinating with an ecological restoration specialist to facilitate this session and follow-up restoration activities
Words and Terms	Bioengineering, plant cuttings, live-staking, natural succession species, pruning saw, loppers, hand-pruners, planting bar, the local Indigenous language place name for the creek, stream, wetland, or lake where you are learning.
Special Note	<p>We have listed contact information for restoration professionals in each region who could deliver this session, as well as organizations who could potentially help write grants for funding from a variety of foundations and agencies. These are listed in the “Regional Resources” section of our project web page. We are also working on creating supplemental multimedia materials that could aid in the delivery of this session for those who are unable to connect with a professional.</p> <p>This session can be your final field activity or serve as the first day of an extended restoration project that will involve these techniques</p> <p>It may be more appropriate for you to do a stream clean up, planting session, storm drain marking, or other watershed restoration activity instead of offering this session. It’s up to you and what works for your situation!</p>

Tips for Implementation

Shout Out and Share!

Introduced in *Session 5: Watershed SOS*, this is the project communication element.

Learners will be doing their own information gathering for their chosen communication element throughout the riparian restoration activities. You will need to provide some additional class time for them to complete this component. We encourage you to organize a “Shout Out and Share!” event for participants to share about their learning experiences with the community. We also enthusiastically welcome anything that can be shared with our growing online community!

Go with Your Flow

These resources are structured and presented in a linear fashion, so that you could simply start at *Session 1: Watershed Detectives* and work through them in sequence. However, you may prefer to start with *Session 3: Mapping Our Watersheds*, or *Session 2: Wading In*. That is perfectly fine.

Watershed systems are interconnected networks and webs, without one official starting point. We encourage you to jump in where it works best for you, and proceed from there.

One idea is that you start with a stream clean-up activity to get the learners interested and connected to a tangible place. Then, you could end the learning project with more intensive restoration activities in the same location. There are many possibilities!

Evaluating the Learning

A game called the “Watershed Wiz Quiz” has been provided as an optional activity to assess the level at which learners have grasped the content. Giving learners in each group the chance to add insight as you play the game is a great way to let their learning about their “Word or Term” shine through. However, we recognize this type of game activity might not be the best fit for every age or group. We will leave that decision up to you!

The “Watershed Reflection” activity will be extremely valuable for your learners to connect with ideas and explorations that stood out for them during each session. It will also give you the chance to track and evaluate their learning process. We recommend that your learners hand in their Learner’s Guides after each session so you can review their reflections.

We strongly recommend that you also integrate the “Sharing Circle” so that your group can talk together about their learning experiences. Sharing with each other is an invaluable way for learners to practice communicating about their perceptions, listen to and consider the perception of others, and provide each other with feedback in dynamic conversation.

Accessing the Resources

The *Best Water Ways* learning resources are available to be downloaded and printed as comprehensive documents (complete Educator’s Guide and complete Learner’s Guide) and as individual sessions. Both Educator’s and Learner’s Guides can be accessed electronically using Adobe Reader and are text-fillable, giving you the option to use the resources online or offline.

Adaptability

We want you to be able to adapt the resource materials to your context. It is place-based learning after all! Feel free to use whatever pieces of the resources that are useful to you, whether it is a single activity, a full session or the whole guide.

Jump In

Now that you have a clearer idea of what the *Best Water Ways* place-based learning resources are all about, we hope you are ready to start exploring your local watersheds with your learners!

Enjoy!

Notes

[illegible]

Session 1

Watershed Detectives

Educator's Guide



Getting out into the neighbourhood, and exploring how water moves in the area surrounding your school, is a great way to get your students thinking about the watershed!



The Big Question:

What is our direct connection to the watershed?

Through the inquiry-based activities in this session, learners will become aware of the flow of water through the developed environment. The sense of interconnectedness emerges when learners begin to look more intentionally at the street gutters, water drains and culverts, bridges, and other elements they might pass by every day, but never really see.

By exploring their neighbourhoods through a watershed lens, learners discover that familiar things we know as common parts of human development (e.g., culverts, drains, bridges, and dikes) are part of a larger system called a watershed. They are also vulnerable parts of the watershed, because of all the human activity going on around them.

Indigenous Knowledge Element

Mukw' stem 'i utunu tumuhw, 'o' huliitun tst,
Everything on this Earth is what sustains us,
mukw' stem 'i 'utunu tumuhw 'o' slhiilhukw 'ul'.
everything on this Earth is connected together.

from a list of teachings worked on by Quw'utsun elders called "The Cowichan Teachings"

Ideally, you will have an Elder or Knowledge/Culture-Keeper come in a talk about interconnectedness. There is often a great deal of local knowledge about how the local river and stream systems flowed in the past. It is interesting to hear how Indigenous communities lived in the past, to harmonize with the flow of water. For example, many cultures had different village sites that they used in different seasons.

Preparation

Materials and resources that you will find useful/need for this session include:

- › An assortment of maps of your local neighbourhood. These include street maps, storm drain system maps, topographical, and historical maps
- › Grade-level appropriate textbooks and reference materials
- › *Why Fish Need Water* video from the Cowichan Watershed Board: youtu.be/ZsD4X1zPmTw
- › The label sheet for the *Watershed Detectives* session (*Learner's Guide—Session 1*, page LG1-7)
- › *Watershed Detectives* "Watershed Wiz Quiz" game cards (this guide, page AP1-4)

Learners will need:

- › Cameras or cell phones
- › Tools for making notes in the field (cell phones, notepads, pencils, etc.)

Introducing the Concept

Your students may have never considered that their everyday surroundings are part of a big, complex system like a watershed. We suggest getting them thinking about this by starting with some questions, such as:

- › Do you think we are in a watershed right now?
- › Where do you think a watershed starts?

After asking a few of these opening questions, direct your learners to read through the introductory section of the *Session 1: Watershed Detectives* Learner's Guide.

Learning the Content

Activity 1 turns your learners into local watershed detectives. In small groups, they will first learn the session words and terms in preparation for their detective work. Then they will explore the neighbourhood and look for urban watershed clues (which are the terms explored in this session). They will take pictures and make notes, bringing these back to the classroom for further discussion and comparison with local current and historical maps. Refer to the activity session plan for step-by-step guidance in this activity.

Words and Terms

Culvert a tunnel (with or without a pipe) carrying a waterway (stream or ditch) under a road or railroad.

Dikes a long wall or embankment built to prevent flooding from the sea or other bodies of water.

Ditches a narrow channel dug in the ground, typically used for water drainage alongside a road or the edge of a field.

Impervious or Impermeable a surface or substrate that does not allow fluid to pass through.

Interconnectedness the idea that all living and non-living things in the world are connected.

Perimeter Drains drainage system designed to collect the water that accumulates next to the foundation wall of a home. The drain is installed around the exterior or interior of a home to divert water away from the foundation and into the surrounding environment.

Pervious or Permeable a surface or substrate that allows fluid to pass through.

Storm-drains infrastructure designed to drain excess rain and groundwater from impervious surfaces such as paved streets, car parks, parking lots, footpaths, sidewalks, and roofs.

Evaluating the Learning

Watershed Wiz Quiz Game

This is an optional activity. For instructions, see session Activity Plan (page AP1-3).

Watershed Reflection

The “Watershed Reflection” activity gives learners the opportunity to process what they have learned and make connections to their own life and experience. It is also a valuable way to help you assess the level of learning and comprehension in your group, and to provide some guidance towards ideas you may want to revisit through the rest of the projects and beyond.

There are several key learning outcomes to look for within the reflection component of this session. Students will be able to:

- Express how we are connected to the watershed
- Explain the difference between a ditch and a culvert
- Explain the purpose of a storm drain
- Describe the purpose of a perimeter drain
- Understand the role of bridges and dikes

Sharing Circle

This valuable exercise involves taking a few moments to sit in a circle, and invite participants to share something from their “Watershed Reflection”.

Watershed Detectives: Grade Curriculum and Competency Connections

For detailed information visit <https://curriculum.gov.bc.ca/curriculum/science>

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 9 Science	<ul style="list-style-type: none">• Matter cycles within biotic and abiotic components of ecosystems• Sustainability of systems• First Peoples knowledge of interconnectedness and sustainability	<ul style="list-style-type: none">• Questioning and predicting• Planning and conducting• Processing and analyzing data and information• Evaluating• Applying and innovating• Communicating
Grade 9 Social Studies	<ul style="list-style-type: none">• Physiographic features of Canada	<ul style="list-style-type: none">• Use Social Studies inquiry processes and skills to ask questions; gather, interpret, and analyze ideas; and communicate findings and decisions

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 11 Earth Science	<ul style="list-style-type: none"> • The hydrologic cycle • First Peoples knowledge of climate change and interconnectedness as related to environmental systems • Water as a unique resource • First Peoples knowledge and perspectives of water resources and processes 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Environmental Science	<ul style="list-style-type: none"> • Energy of water flow through ecosystems • First Peoples ways of knowing and doing 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Science for Citizens	<ul style="list-style-type: none"> • Scientific processes and knowledge inform our decisions and impact our daily lives • Scientific understanding enables humans to respond and adapt to changes locally and globally 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Environmental Science	<ul style="list-style-type: none"> • Human actions affect the quality of water and its ability to sustain life • Human activities cause changes in the global climate system • Living sustainably supports the well-being of self, community, and Earth 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Specialized Science	<ul style="list-style-type: none"> • Biodiversity is dependent on the complex interactions and processes between biotic and abiotic factors • Climate change impacts biodiversity and ecosystem health 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Notes

[illegible]

Activity Plan

Session 1: Watershed Detectives



Big Idea/Inquiry

What is our direct connection to our watershed?



Time

Approximately 2.5 hours

Indigenous Knowledge Element: All Things are Connected

Mukw' stem 'i utunu tumuhw, 'o' huliitun tst,
Everything on this Earth is what sustains us,
mukw' stem 'i 'utunu tumuhw 'o' slhiilhukw 'ul'.
everything on this Earth is connected together.

from a list of teachings worked on by Quw'utsun elders called "The Cowichan Teachings"



Purpose

The purpose of the session is for students to learn how a watershed flows through developed areas, that the natural flow has often been greatly changed by human development, and that we are interconnected with the watershed.



Handouts/Materials

- *Learner's Guide—Session 1: Watershed Detectives*
- Grade-level appropriate text books and resources
- Maps from Municipality or Regional District
- Historical maps of your area (can often be found through community archives/historical societies, etc.)
- "Watershed Detectives" labels (see Learner's Guide, page LG1-7)
- "Watershed Wiz Quiz" game cards (in this guide, page AP1-4)



Equipment Needed

- Cameras or cell phones
- Note-taking materials



Learning Goals

- To become more aware of how natural watersheds are modified by conventional human development
- To understand some of the consequences of altering the natural flow of our watersheds
- To explore the idea of 'interconnectedness'

Learning Outcomes

Students will be able to:

- › Express how we are connected to the watershed
- › Explain the difference between a ditch and a culvert
- › Explain the purpose of a storm drain
- › Describe the purpose of a perimeter drain
- › Understand the role of bridges and dikes
- › Explain why watersheds are important to Indigenous peoples

Key Learning Points

- › Watersheds flow through every area, we often overlook them, but we are interconnected with watersheds
- › These are important habitats for fish and other creatures
- › Watersheds provide food, medicine, and natural protection for Indigenous peoples
- › Waterways in the urban environment are especially vulnerable, because they are exposed to more human impact
- › Altered and degraded watersheds impact humans through flooding and erosion

Introducing the Topic

Direct learners to read through the introductory section of their *Watershed Detectives* Learner's Guide either independently or in small groups.



Activity 1: Watershed Detectives

Part 1	<ol style="list-style-type: none">1. Break into small groups (2-3 learners) and have each group look up the session words and terms in preparation for their detective work2. Next, take a few minutes to look over the map of your neighbourhood as a group3. Then take a walk around your neighbourhood and identify the features of the watershed in your neighbourhood. If possible, split into groups of three and go in different directions.4. Direct learners to complete the "Watershed Detectives" activity questions in the Learner's Guide and have them take pictures and/or make notes of ditches, culverts, and storm drains.
Part 2	After you return from Activity 1, have each group share what they discovered and add the information to the maps using the session labels. If possible, compare what they discovered with historical maps from your area from 50-100 years ago. Note any changes in where rivers and streams flow.

Closing the Session

Summarizing and Reflecting Activities: Have learners complete the following activities.



Activity 2: Watershed Wiz Quiz (optional)

Play “Watershed Wiz Quiz” using the “Watershed Detectives” session cards.

- Think ahead about who will start, depending on works best for your group dynamics.
- To play, the learner picks a card (a vocabulary word or term) and matches it with an example on one of the maps.
- They briefly explain what it is in their own words (see the “Words and Terms” definitions in this Educator’s Guide, page EG1-3).



Activity 3: Watershed Reflection

Recommendations for transitioning to this activity:

- Share a bit about what you are reflecting on at this stage of the session.
- Direct learners to page LG1-6 of their Learner’s Guide to work independently through this activity.

Review each student’s entry to help in evaluative.



Activity 4: Sharing Circle

Take a few moments to sit in a circle and invite participants to share something from their “Watershed Reflection”.

Watershed Wiz Quiz

"Watershed Detectives" Words and Terms

Interconnectedness	Culvert
Ditch	Bridge
Dike	Impervious or Impermeable
Perimeter Drain	Pervious or Permeable
Storm Drain	

Session 2

Wading In

Educator's Guide



Learners will be taking some time to think about water as a mysterious, yet essential substance in our Earth's biosphere, and how water moves as cyclical systems through geo-physiological pathways known as watersheds.



The Big Question: What is a watershed?

The aim of this session is to get learners curious about this unusual substance called water, and how it moves through our lives and our world.

Some interesting facts about water that learners will encounter in their Session 2 Learner's Guide include:

- › The human body is made up of about 60-65% water
- › 71% Of the earth's surface is covered in water
- › The oceans hold about 96.5% Of all earth's water
- › There is very little water in comparison to the surface and mass of the earth itself
- › Water is an alien and weird substance: all the water in our biosphere arrived here from asteroids after earth formed, and it defies many laws of physics
- › Water can exist in all three forms of matter (liquid/gas/solid) at normal temperatures found on earth
- › The water cycle is continuous, traveling in watershed systems, which also include the human body and all living matter
- › Life forms, such as salmonids, are particularly dependent on the flow of watershed systems, and in turn the watershed system is dependent on them as nutrients for trees and soil life

Indigenous Knowledge Element

Learners will be introduced to the fact that Indigenous cultures have a long history of knowledge and understanding about local ecological systems such as the watershed. They will learn and practice the local Indigenous word for water. If possible, a guest Elder or Knowledge/Culture-Keeper will visit the class during this session.

Preparation

For this session you will want to have your multimedia system set up with the link to the *Water is Weird* video ready to go.

- › *Water is Weird* BBC video (3 min): <https://www.bbc.com/ideas/videos/why-water-is-one-of-the-weirdest-things-in-the-uni/p06y2c9k>

For Activity 1, you will also need:

- › Chart paper and markers
- › As many resources you can find that are grade-appropriate level for your learning group (e.g., dictionaries, encyclopedias, Geography and/or Earth Science textbooks)

Learners will benefit from online access to research their group's words and terms.

Learning the Content

Watch the short video about the weirdness of water to pique the learner's interest and curiosity about water.

Students will explore the content during the inquiry-based Activity 1, and reinforce their knowledge by sharing what they have learned with their peers.

Words and Terms

Aquatic Invertebrate	small animals, such as insects, crustaceans, mollusks, and worms that live in water. Most invertebrates are found living in the stream bottom among the rocks and gravel.
Aquifer	underground area that becomes saturated with water within the local watershed.
Ground water	watershed flow that has infiltrated the ground, has entered the area below the water table, or has been discharged into a stream channel, or springs and seepage water. Groundwater is stored in, and moves slowly through, the layers of soil, sand, and rocks in aquifers.
Indigenous	People, plants, and other biological species originating, occurring naturally, or for a long-time (beyond human memory or recorded history) in a specific place.
Indigenous knowledge	refers to the local understandings and philosophies developed by societies with long histories of interaction with their natural surroundings.
Indigenous territory	historically different Indigenous groups lived in certain large areas that we now consider their territory. Different Indigenous groups can have overlapping traditional territory.
Salmonid	a family of ray-finned fish which includes salmon, trout, chars, freshwater whitefishes, and graylings, which collectively are known as the salmonids. All salmonids spawn in freshwater, but in many cases, the fish spend most of their lives at sea, returning to the rivers only to reproduce. This lifecycle is described as anadromous. They are predators, feeding on small crustaceans, aquatic insects, and smaller fish.
Surface water	any water that collects on the surface of the earth. This includes oceans, seas, lakes, rivers, or wetlands.
Traditional local language	the language of the Indigenous culture of the local area.
Tributary	a river or stream flowing into a larger river, lake, or water body.
Water table	the upper-most level of an underground area (aquifer) that is saturated (filled) with water.
Watershed	an area of land that catches and collects rain and snow, draining and seeping it through a network of marshes, creeks, streams, and groundwater into a common body of water (such as a river, lake, or ocean).

Evaluating the Learning

Watershed Wiz Quiz Game

This is an optional activity. For instructions, see the Session 2 Activity Plan (page AP2-3)

Watershed Reflection

The “Watershed Reflection” activity gives learners the opportunity to process what they have learned and make connections to their own life and experience. Reviewing this component of their Learner’s Guide is a valuable way to help you assess the level of learning and comprehension in your group, and provide some guidance towards ideas you may want to revisit through the rest of the projects and beyond.

There are several key learning outcomes to look for within the reflection component of this session. Students will be able to:

- › Define the term ‘watershed’
- › Explain the role of slope, shape, and physiography in a watershed
- › Identify three features of a riparian ecosystem
- › Learn and practice the local Indigenous word for ‘water’

Sharing Circle

This valuable exercise involves taking a few moments to sit in a circle, and invite participants to share something from their “Watershed Reflection”.

Wading In: Grade Curriculum and Competency Connections

For detailed information visit <https://curriculum.gov.bc.ca/curriculum/science>

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 9 Science	<ul style="list-style-type: none">• Matter and energy cycles• Sustainability of systems• First Peoples knowledge of interconnectedness and sustainability	<ul style="list-style-type: none">• Questioning and predicting• Planning and conducting• Processing and analyzing data and information• Evaluating• Applying and innovating• Communicating
Grade 9 Social Studies	<ul style="list-style-type: none">• Physiographic features of Canada	<ul style="list-style-type: none">• Use Social Studies inquiry processes and skills to ask questions; gather, interpret, and analyze ideas; and communicate findings and decisions

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 11 Earth Science	<ul style="list-style-type: none"> • The distribution of water and its influence on weather and climate. • Water as a unique resource • First Peoples knowledge and perspectives of water resources and processes 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Environmental Science	<ul style="list-style-type: none"> • Energy of water flow through ecosystems • First Peoples ways of knowing and doing 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Science for Citizens	<ul style="list-style-type: none"> • Scientific processes and knowledge inform our decisions and impact our daily lives • Scientific understanding enables humans to respond and adapt to changes locally and globally 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Environmental Science	<ul style="list-style-type: none"> • Human actions affect the quality of water and its ability to sustain life • Human activities cause changes in the global climate system • Living sustainably supports the well-being of self, community, and Earth 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Specialized Science	<ul style="list-style-type: none"> • Biodiversity is dependent on the complex interactions and processes between biotic and abiotic factors • Climate change impacts biodiversity and ecosystem health 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Notes

[illegible]

Activity Plan

Session 2: Wading In



Big Idea/Inquiry
What is a watershed?



Time
Approximately 2.5 hours

Indigenous Knowledge Element: Local Indigenous word for water

Ideally, an Elder or Culture-keeper visits for this initial session to share a bit about local Indigenous watershed knowledge and language (See regional resources). If this is not possible, there are some key points to share in the “Introducing the Topic” section below.



Purpose

The purpose of the session is to:

- introduce the concept of watersheds so that students become familiar with the theme that underpins the learning projects
- understand and identify the important role of watersheds in our community
- consider the Indigenous knowledge of the local watershed



Handouts/Materials

- *Learner’s Guide—Session 2: Wading In*
- Chart paper for “Watershed Words” and quiz activities
- Encyclopedias and dictionaries
- Grade-level appropriate Geography and/or Earth Science reference books
- “Watershed Words” cards for this session (see Learner’s Guide page LG2-4)



Equipment Needed

- AV equipment or computer with audio
- Internet access (at least one per group)
- *Water is Weird* BBC video (3 min): <https://www.bbc.com/ideas/videos/why-water-is-one-of-the-weirdest-things-in-the-uni/p06y2c9k>



Learning Goals

To gain a basic understanding of watershed systems in our environment, both globally and locally.

Learning Outcomes

Students will be able to

- › Define the term watershed
- › Identify three features of a riparian ecosystem
- › Discuss the relationship between salmonids and a healthy watershed
- › Learn and practice the local Indigenous word for water

Key Learning Points

- › All biological life (humans and other mammals, fish, birds, insects, plants, and microbes) rely on clean, uncontaminated water
- › Water is an unusual substance because all the water in our biosphere arrived here from asteroids after Earth formed, and it is the only substance that can exist in all three states of matter at normal Earth temperatures
- › Watersheds are a key part of the global water cycle
- › Indigenous cultures living in a region for thousands of years have a wealth of local knowledge, language, and understanding of the watershed
- › Most fresh-water travels through watershed systems
- › Everyone lives within an interconnected network of watershed systems
- › The features such as tributaries (streams and creeks), ground surface and sub-surfaces, riparian ecosystems, marshes, bogs, fens, and estuaries of the Watershed work together to catch, collect, and transport precipitation (snow/rain/mist/dew). These also act as carbon sinks
- › A riparian ecosystem is an area where land meets/adjoins a waterway or water body. A functioning riparian zone provides food, energy, and habitat for waterfowl, amphibians, fish, migratory birds, insects, and more
- › Plants, creatures, soil, and physiographical aspects of a riparian zone affect the water
- › Salmonids are keystone species within our local watersheds. They need the watershed, and the watershed needs them (nutrients when they return to spawn and decompose).

Introducing the Topic

To introduce the topic, watch the [Water is Weird video](#) (link on page EG2-2 and above) together.

If an Indigenous Culture-Keeper is not available, explain that Indigenous cultures living in a region for thousands of years have a wealth of local knowledge, language, and understanding of the watershed. If you are able, share the local Indigenous language word for water. Then break into small groups and have learners read through the introduction section of the *Session 2: Wading In* Learner's Guide.



Activity 1: Wading In

Assign each group with two of the vocabulary words to research and share about, using the method in the *Session 2: Wading In* Learner's Guide (page LG2-4) (20 min)

Closing the Session

Summarizing and Reflecting Activities: Have learners complete the following activities.



Activity 2: Watershed Wiz Quiz (optional)

Play "Watershed Wiz Quiz" using the "Wading In" session cards.

Each group:

- Carefully takes their chart papers from Activity 1 and folds over the top part where the word/term is written.
- Tapes or pins each paper at the front of the room so everyone can see the image and bullet notes, but not the word/term itself.

Put notebooks away and let the quiz begin! Learners will draw a word/term from a container and match it to the correct chart paper. When they get it right (maybe with a little help from their friends), they will read out the bulleted notes about the word/term. And then they get to pick who goes next!



Activity 3: Watershed Reflection

Recommendations for transitioning to this activity:

- Share a bit about what you are reflecting on at this stage of the session.
- Direct learners to page LG2-8 of their Learner's Guide to work independently through this activity.

Review each student's entry to help in evaluative.



Activity 4: Sharing Circle

Take a few moments to sit in a circle and invite participants to share something from their "Watershed Reflection".

Watershed Wiz Quiz
"Wading In" Words and Term

Watershed	Indigenous
Indigenous Knowledge	Indigenous Territory
Traditional Indigenous Language	Aquifer
Water Table	Surface Water
Ground Water	Tributary
Salmonid	Aquatic Invertebrate

Session 3

Mapping Our Watersheds

Educator's Guide



Focus on learning and exploring the features of the watersheds in your area. You will be identifying well-known places, like mountain peaks and rivers, and directly connecting them to the concept of watershed systems and your local experiences.



The Big Question: What does our local watershed look like?

This session is highly inquiry-based. Learners will be diving into researching and mapping the features of the local watershed(s). In addition to watershed features, they will be locating their homes and their school, which will help draw even more connections between them and the watershed system.

Indigenous Knowledge Element

This is a great opportunity to explore the local Indigenous language further by investigating the traditional place names for local watershed features, such as mountains and rivers. If possible, a guest Elder or Knowledge/Culture-Keeper will visit the class during this session.

Indigenous language resources can be found on the *Best Water Ways* web page. If you are in a school district context, you should find assistance within your Indigenous Education department.

Preparation

Materials that you will need to facilitate this activity effectively include:

- › Grade-level appropriate Geography and Cartography textbooks and reference materials
- › Large black and white local maps. Often regional districts or municipal maps departments will print these out for you. If not, there are links to where you can source maps in the resources section
- › Local map template (see Activity 1, Part 2)
- › Watershed features labels (*Session 3: Mapping Our Watersheds* Learner's Guide, page LG3-6) can be cut out during the activity

This activity is contextual in nature, so you may need to do a bit of pre-learning about your region (unless you are already a local watershed expert!). Links to regional watershed information are listed in our web page resource section at cowichanlandtrust.ca/best-water-ways to help you with this piece. The following questions can help you to jot down some notes in preparation for this activity:

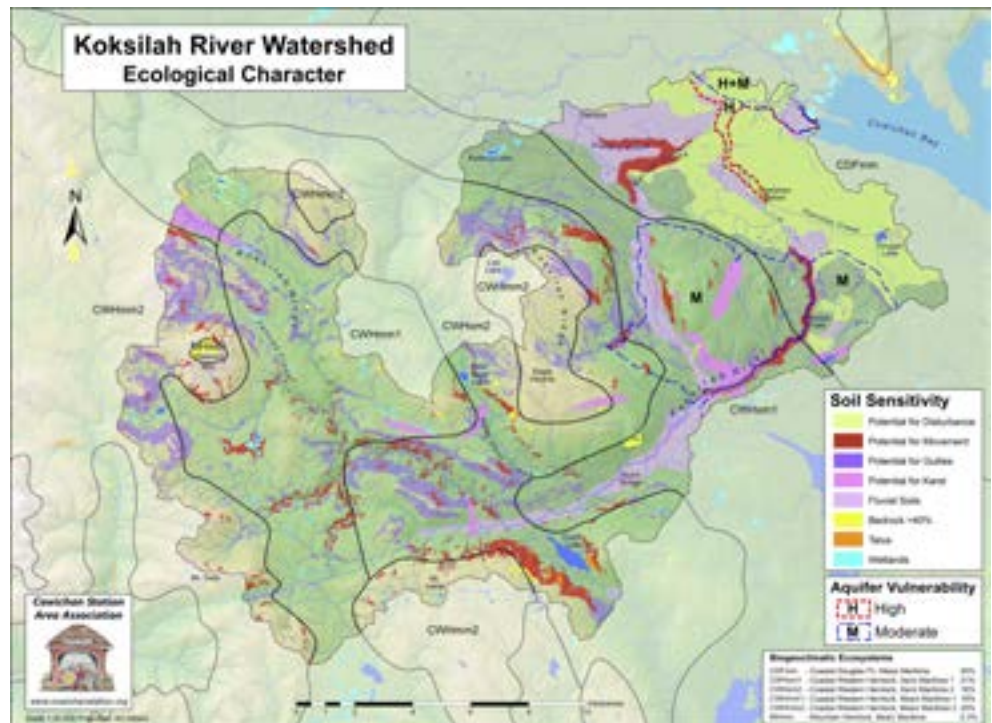
- › What is the largest watershed in your region?
- › How many watersheds are in your area?
- › Where are the watershed boundary lines?
- › What are the mountains, hills, or high spots in your area? Can you find Indigenous names for them?
- › What are the valleys, streams, rivers, marshes, estuaries? Can you find Indigenous names for them?

Introducing the Concept

Learners will be diving quickly into the learning activity, but you will probably want to lead an opening discussion around different kinds of maps (e.g., street maps, topographical maps) they will be using. It would be effective to have a few different maps available (e.g., road, topographic, climatic, political, ecosystem) to demonstrate the diversity of maps that exist.

An example of a type of Ecosystem Map from a Koksilah River Watershed assessment report (2019).

Courtesy of the Cowichan Station Area Association



Learning the Content

Break the learners into small, even-numbered groups. Follow the directions for Activity 1 in the Session Activity Plan (page AP3-3). Learners will map out the watershed features in their groups, and in the process, explore the “Words and Terms” below.

Words and Terms

Contour lines and intervals a contour line is a line drawn on a topographic map to indicate ground elevation or depression. Contour lines never cross. A contour interval is the vertical distance or difference in elevation between contour lines.

Ecosystem map a map that represents ecosystem characteristics and relationships of a given area.

Elevation distance in height above sea level.

Gully a deep narrow water-worn ravine, often with water flowing through as a stream or river.

Indigenous place names of mountains or other features, according to location.

Physiography collective physical features such as slope, shape, and elevation of an area.

Slope how steep the land is, how much vertical rise in elevation there is for a certain horizontal distance. Rise over run.

Topographic map a type of map showing natural and/or physical features of a landscape, including contours and elevation.

Valley a stretched-out groove in the land that has higher ground on three sides and usually has water flowing through the center. Usually V- or U-shaped.

Watershed boundary line the line that divides the watershed and where water will flow. A raindrop that lands on one side of the boundary will flow into one body of water; a drop that lands on the other side will flow into a different body of water.

Evaluating the Learning

Watershed Wiz Quiz Game

This is an optional activity. For instructions, see the Session 3 Activity Plan (page AP3-4).

Watershed Reflection

The “Watershed Reflection” activity encourages learners to process what they have learned, and make connections to their own life and experience. Reviewing this component of their Learner’s Guide is a valuable way to help you assess the level of learning and comprehension in your group, and provide some guidance towards ideas you may want to revisit through the rest of the projects and beyond.

There are several key learning outcomes to look for within the reflection component of this session. Students should be able to:

- › Identify the largest watershed system in the area
- › Name two smaller watershed systems in the area
- › Name two mountains in the area and which watershed they belong to
- › Practice local Indigenous language place names for watershed features
- › Identify a stream in the area and which system it belongs to
- › Identify two rivers in the area
- › Identify a marsh in the area
- › Name an estuary in the region

Sharing Circle

Take a few moments to sit in a circle and invite participants to share something from their “Watershed Reflection”.

Mapping Our Watersheds: Grade Curriculum and Competency Connections

For detailed information visit <https://curriculum.gov.bc.ca/curriculum/science>

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 9 Science	<ul style="list-style-type: none"> • Matter and energy cycles • Sustainability of systems • First Peoples knowledge of interconnectedness and sustainability 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 9 Social Studies	<ul style="list-style-type: none"> • Physiographic features of Canada 	<ul style="list-style-type: none"> • Use Social Studies inquiry processes and skills to ask questions; gather, interpret, and analyze ideas; and communicate findings and decisions
Grade 11 Earth Science	<ul style="list-style-type: none"> • The distribution of water and its influence on weather and climate. • Water as a unique resource • First Peoples knowledge and perspectives of water resources and processes 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Environmental Science	<ul style="list-style-type: none"> • Energy of water flow through ecosystems • First Peoples ways of knowing and doing 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Science for Citizens	<ul style="list-style-type: none"> • Scientific processes and knowledge inform our decisions and impact our daily lives • Scientific understanding enables humans to respond and adapt to changes locally and globally 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Activity Plan

Session 3: Mapping Our Watersheds



Big Idea/Inquiry

What does our local watershed look like?



Time

Approximately 2.5 hours

Indigenous Knowledge Element:

Indigenous names of the Traditional Territory/local mountains/high ground

See online regional resources at cowichanlandtrust.ca/best-water-ways. Alternative: if you are in an area without distinct mountains or high ground, what other features have Indigenous names (lakes, rivers, etc.)?



Purpose

The purpose of the session is for students to name, and become familiar with, the features of the watershed(s) they live within.



Handouts/Materials

- *Learner's Guide—Session 3: Mapping Our Watersheds*
- Grade-level appropriate textbooks and reference materials (Geography/Cartography)
- Local topographical hard copy and digital maps
- Large map template
- Labels for watershed features (Learner's Guide, page LG3-6)
- Magazines with watershed images
- "Watershed Wiz Quiz" game cards (this guide, page AP3-5)



Equipment Needed

- Computers with internet access



Learning Goals

To gain a basic understanding of the watershed systems in your region.

Learning Outcomes

Students should be able to:

- › Identify the largest watershed system in the area
- › Name two smaller watershed systems in the area
- › Name two mountains in the area and which watershed they belong to
- › Practice local Indigenous language place names for watershed features
- › Identify a stream in the area and which system it belongs to
- › Identify two rivers in the area
- › Identify a marsh in the area
- › Name an estuary in the region

Key Learning Points

From your preliminary research, identify these key learning points for your context:

- › What is the largest Watershed in your region?
- › How many watersheds are in your area?
- › Where are the watershed boundary lines?
- › What are the Indigenous and common names of mountains, hills, or high spots in your area?
- › What are the valleys, streams, rivers, marshes, estuaries?

Introducing the Topic

To introduce this topic:

- › Discuss the fact that there are many, different kinds of maps used to organize and locate information. For example, standard road maps help you navigate an area, whereas political maps show information about how people have voted in different areas. Ecosystem maps are becoming more commonly used to help inventory ecological characteristics of an area.
- › Cultural maps focus on information such where different languages are spoken, and Indigenous communities are located. Use this time to share Indigenous names for the traditional territory and watershed features in your area.
- › Direct learners to read through the introductory section of their *Session 3: Mapping Our Watersheds* Learner's Guide, either independently or in small groups.



Activity 1: Research and Map Our Watershed

Part 1	<ol style="list-style-type: none">1. Divide into four groups (or more, depending on your class size).2. Using local topographic maps (hard copy and digital), have each group explore, find, and answer the inquiry questions found on page LG3-3 of their Learner's Guide
Part 2	<ul style="list-style-type: none">• Provide a large map template that has basic topographical features of your area.• Using the same groups as in Activity 1, have learners label the names of mountains and high ground features, and details like rivers and lakes. They can shade in the contour lines according to the slope, and could also collage on the map with magazine images such as forests, mountains, towns.• Have each student draw in or label (generally) where they live on the map.



A visit to your local salmon hatchery is a great way to connect watershed health with the wellbeing of salmon species.

Photo: Stephanie Cottell

Closing the Session

Summarizing and Reflecting: Have learners complete the following activities.



Activity 2: Watershed Wiz Quiz (optional)

Each group carefully takes their maps from Activity 1, and tapes or pins each map at the front of the room so everyone can see.

Put notebooks away and let the quiz begin! Learners will draw a word or term from a container and match it with a corresponding example on one of the maps, explaining what it is using the example.

When they get it right (maybe with a little help from their friends), they get to pick who goes next!



Activity 3: Watershed Reflection

Recommendations for transitioning to this activity:

- Share a bit about what you are reflecting on at this stage of the session.
- Direct learners to page LG3-5 of their Learner's Guide to work independently through this activity.

There are several key learning outcomes to look for within the reflection component of this session. Refer to page EG3-4 of the *Mapping Our Watersheds* Educator's Guide for details.

Review each student's entry to help in evaluative.



Activity 4: Sharing Circle

Take a few moments to sit in a circle and invite participants to share something from their "Watershed Reflection".

Watershed Wiz Quiz

"Mapping Our Watersheds" Words and Terms

Topographic Map	Elevation
Ecosystem Map	Contour Lines and Intervals
Valley	Gully
Watershed Boundary Line (Or Divide)	Slope
Indigenous Place Names of Mountains	Indigenous Place Names of Rivers or Other Features

Notes

[illegible]

Session 4

Watersheds In Distress

Educator's Guide



Learn more about practices that are causing serious damage to our watersheds, and threatening the health of our fish populations and drinking water.



The Big Question: How is our watershed being harmed?

In this session, your group will learn more about practices that are causing serious damage to our watersheds, and threatening the health of our fish populations and drinking water.

Indigenous Knowledge Element

Reciprocity: the idea of balanced and mutual exchange within natural, economic, and social systems that humans are one part of with all other life.

Share or, ideally, have an Elder or Knowledge/Culture-Keeper share, a story from the local tradition that reflects this concept (see *Best Water Ways* website for resource links).

Preparation

Look at the regional resources on the *Best Water Ways* site at cowichanlandtrust.ca/best-water-ways. Check if there is a watershed education group in your area that can provide a presentation on this topic. Grade-level appropriate Ecology textbooks, articles, and research papers can add depth to topics that interest your group.

Introducing the Concept

To introduce this session, take a few minutes to review your group's previous learning regarding features, flow, and dynamics of the local watershed, both in the rural and urban areas. Share with them that, in this session, they will begin to explore how different human actions and practices impact the water flow, and water quality, within the watershed. For example, deforestation and development involve removing key elements (trees and other vegetation) that help slow down and filter water flow.

Ask the group what they may have already noticed about impacts to the water flow and quality when they were detectives in the local watershed. This conversation will help your students draw connections between what they have already discovered and the new information they are about to learn.

Learning the Content

Activity 1: Identifying Impacts on the Watershed

Break the learners into small, even-numbered groups. Follow the directions for Activity 1 in the Session Activity Plan (page AP4-2). Learners will work in groups to research the words and terms and share the information with each other.

Words and Terms

Contaminants a polluting or poisonous substance that makes something impure or alters it from its healthy, natural state.

Deforestation the action of clearing a wide area of trees.

- Invasive species** a plant, animal, or insect species that is not native to a specific location (an introduced species), spreads to a degree believed to cause damage to the environment, human economy, and/or human health.
- Nitrates (NO₃)** a chemical compound of Nitrogen and Oxygen. These are essential chemical elements for life. However, in excess, and when in this form, they are harmful. When nitrogen fertilizers are used to enrich soils, excess nitrates are carried by rain, irrigation, and other surface waters through the soil into groundwater. Human and animal wastes can also contribute to nitrate contamination of water.
- Phosphorus** a very reactive chemical element required in small amounts by both plants and animals. Excess phosphorus from fertilizer and other human use (soaps) is carried through the watershed and is very disruptive of balance in aquatic and riparian ecosystems.
- Reciprocity** the concept of mutual exchange and shared benefit within relationships between people and between people and nature. One way of putting it is the fair balance of giving and taking in a relationship.
- Surface run-off (also known as overland flow)** the flow of water that occurs when excess stormwater, meltwater, or other sources flows exceed the capacity of the natural waterways and flow over the lands surface. Repeated surface run-off impacts vegetation, causes flooding and soil and land erosion.

Evaluating the Learning

Watershed Wiz Quiz Game

This is an optional activity. For instructions, see Session Activity Plan (page AP4-3)

Watershed Reflection

The “Watershed Reflection” activity gives learners the opportunity to process what they have learned and make connections to their own life and experience. It is also a valuable way to help you assess the level of learning and comprehension in your group, and to provide some guidance towards ideas you may want to revisit through the rest of the projects and beyond.

Learning outcomes embodied in this session include the learner’s ability to:

- › Name two threats to our watersheds
- › Explain how threats to the watershed impact our drinking water
- › Describe how a damaged watershed harms fish species such as salmon

Sharing Circle

Take a few moments to sit in a circle and invite participants to share something from their “Watershed Reflection”.

Watersheds In Distress: Grade Curriculum and Competency Connections

For detailed information visit <https://curriculum.gov.bc.ca/curriculum/science>

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 9 Science	<ul style="list-style-type: none"> • Sustainability of systems • First Peoples knowledge of interconnectedness and sustainability 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Earth Science	<ul style="list-style-type: none"> • Evidence of climate change • First Peoples knowledge of climate change and interconnectedness as related to environmental systems • Effects of climate change on water sources • First Peoples knowledge and perspectives of water resources and processes 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Environmental Science	<ul style="list-style-type: none"> • First Peoples ways of knowing and doing • First Peoples knowledge and other traditional ecological knowledge in sustaining biodiversity • Ecosystem complexity • Human actions and their impact on ecosystem integrity 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Science for Citizens	<ul style="list-style-type: none"> • Impact of technologies • Actions and decisions affecting the local and global environment, including those of First Peoples • Human impact on Earth's systems • Actions and decisions affecting the local and global environment, including those of First Peoples 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 12 Environmental Science	<ul style="list-style-type: none"> • Water quality parameters and bioindicators • Availability and water use impacts • Changes to climate systems • Global water security: conservation of water • Impacts of global warming • Land use and degradation 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Specialized Science	<ul style="list-style-type: none"> • Biodiversity is dependent on the complex interactions and processes between biotic and abiotic factors • Climate change impacts biodiversity and ecosystem health 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Notes

[illegible]

Activity Plan

Session 4: Watersheds In Distress



Big Idea/Inquiry

How is our watershed being harmed?



Time

Approximately 2.5 hours

Indigenous Knowledge Element: Reciprocity

Reciprocity: the idea of balanced and mutual exchange within natural, economic, and social systems that humans are one part of with all other life.

Share (or ideally have an elder/culture keeper share) a story from the local tradition that reflects this concept (see *Best Water Ways* website at cowichanlandtrust.ca/best-water-ways for links).



Purpose

The purpose of the session is for students to learn about practices that are causing serious damage to our watersheds, and threatening the health of our drinking water and fish stocks



Handouts/Materials

- *Learner's Guide—Session 4: Watersheds In Distress*
- Grade-level appropriate articles and research papers about impacts on watershed ecosystems
- Earth Science/Ecology reference books



Equipment Needed

- Internet access



Learning Goals

To become aware of threats to the watersheds, water health, and fish health.

Learning Outcomes

Students will be able to:

- › Name two threats to our watersheds
- › Explain how threats to the watershed impact our drinking water and quality of life. Removal of wetlands is one of the root causes of major flooding all around the world
- › Describe how a damaged watershed harms fish species such as salmon

Key Learning Points

- › Industrial deforestation and clearing of riparian areas during development removes primary filtration and/or slows water flow into the watershed.
- › Exposed soils runoff into the watershed, causing sediment damage in fish habitat, and potential contaminants to our drinking water
- › Other contaminants, such as nitrates, phosphorus, and chemical pesticides, enter the watershed from agriculture and other industry
- › Residential areas impact the watershed through phosphorus and other chemical runoff into storm drains and house drains
- › Invasive plant and animal species gain a foothold in damaged ecosystems both in riparian (e.g., blackberry/ivy) and aquatic zones (e.g., parrots feather/reed canary grass), impacting the natural flow of the system
- › Reciprocity: when harm is done to natural systems, eventually harm comes to all beings living in those systems, including humans. Taking good care of Earth's ecosystems with active reciprocity helps maintain balance and reduce harm

Introducing the Topic

To introduce this session, engage in conversation by asking learners what watershed impacts they are already aware of.



Activity 1: Identifying Impacts on the Watershed

Divide into six groups. Using the inquiry questions in their Learner's Guides, each group will research one watershed threat in the vocabulary list and share what they learn. Assign each group one of the vocabulary words to research and share about. Follow the method in their Learner's Guides (20 min).

*There is a table in the Learner's Guide (page LG4-3) where learners can draw and record what they learned about other groups' "Words and Terms" as they share. One side is for the image, and one side for the bullet notes.

Closing the Session

Summarizing and Reflecting: Have learners complete the following activities.



Activity 2: Watershed Wiz Quiz (optional)

Put notebooks away and let the quiz begin! Learners will draw a word or term from a container and match it with a corresponding example on one of the maps, explaining what it is using the example.

When they get it right (maybe with a little help from their friends), they get to pick who goes next!



Activity 3: Watershed Reflection

To transition into this reflective activity, share a bit about what has stood out for you in this session. Direct learners to work on their “Watershed Reflection” independently in their Learner’s Guide.



Activity 4: Sharing Circle

Take a few moments to sit in a circle and invite participants to share something from their “Watershed Reflection”.

Watershed Wiz Quiz

"Watersheds In Distress" Words and Terms

Reciprocity	Eutrophication
Deforestation	Runoff
Phosphorus	Contaminants
Invasive Species	Nitrates

Session 5
Watershed SOS
Educator's Guide



*Jump into some action-oriented, solution-based learning
focused on the protection and restoration of our watersheds.*



The Big Question: How can we protect and restore our watershed?

This session is very exciting because learners will be jumping into more action-oriented and solution-based learning, discovering:

- › How we can learn from Indigenous knowledge of local plants
- › Practices that can be changed to prevent further damage to our watersheds
- › How we can actively work to restore the areas that have been damaged already
- › How we can help mitigate flooding and other impacts to our communities that result from altered watersheds

Indigenous Knowledge Element

In this session, the Indigenous knowledge element is focused on the local Indigenous language names and uses of riparian plants. It would be ideal for you to have an Elder or Knowledge/Culture-Keeper, knowledgeable about plants, to visit your class during this session. Ask them in advance to bring in plant samples and/or products that have been made using native plant material, such as hats, baskets, or medicines.

Often, local Indigenous communities will have stories or legends that help impart the value of different plants for ecological value, food, or medicine. If you can't have a special visitor come to this session, check out the resource section of the *Best Water Ways* website for stories or information you can share about Indigenous plants from an Indigenous perspective.

Preparation

For Activity 1, you will need:

- › Grade-level appropriate Ecology textbooks, articles, and research papers
- › Large paper
- › Pens/felts, etc.

If you do not have an Indigenous guest visit during this session, decide how you want to integrate the Indigenous element and bring whatever materials you require for this piece.

Introducing the Concept

In this session, it is important for students to understand that there are threats to our watersheds, including degradation of fish habitat and ecological diversity, but that there are many actions that can be taken to help protect our watersheds to prevent further damage, and to restore damaged areas back into health. It's all about active hope and human participation to get this important work underway!

Learning the Content

Hope and Action

After introducing that this session is about *hope* and *action*, break the students into small groups, and follow the instructions for Activity 1 in your Session 5 Activity Plan (page AP5-3).

There are several options for additional activities that will take you and your students out of the classroom and into the community. These activities are focused on stewardship. A local conservation or Streamkeeper group will be able to help you with these activities.

Words and Terms

Decontamination the process of removing or neutralizing contaminants that have accumulated somewhere.

Ecological restoration the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Local Indigenous Plants local Indigenous language words for willow and/or red-osier dogwood (these native plants are widespread in B.C.).

Mitigation action taken to make something less harmful.

Rain gardens a garden of native shrubs, perennials, and flowers that are planted in a small depression. Usually planted on a natural slope, it is designed to temporarily hold and soak in rainwater run-off that flows from roofs, driveways, patios, or lawns.

Selective forestry logging selected trees in a forest, ensuring the growth of other trees, and that the dynamics of the surrounding natural ecosystems are not affected.

Stewardship activities such as water quality monitoring, habitat assessment, and storm drain marking that help us assess and protect the health of our watersheds.

Get Involved!

Fisheries and Oceans

Canada have some great learning activities that you can get involved in with your learners. These integrate fun, hands-on learning with stewardship contributions in your community. These include activities such as storm drain marking.

Learn more at <https://www.pac.dfo-mpo.gc.ca/education/stormdrain-collecteur-eng.html>

The **Great Shoreline Clean Up** program is also a great community activity that your group can participate in.

Visit <https://www.shorelinecleanup.ca/>

“Shout Out and Share!” Preparation

The “Watershed Reflection” portion of this session is used as a time for learners to start planning an independent communication component about their watershed learning. Consider it to be an independent mini-project nested with the *Best Water Ways* learning experience as a whole.

This element of the learning project effectively hones in on the curriculum competency of ‘Communication’.

“Communicate scientific ideas and information, and perhaps a suggested course of action for a specific purpose and audience; constructing evidence-based arguments and using appropriate scientific language, conventions, and representations; and express and reflect on a variety of experiences, perspectives, and worldviews through place.”

Prepare for this part of the session by looking over the “Shout Out and Share!” planning process shown on page AP5-4 of this guide. This series of questions has been developed to help learners consider and decide what they want to do for the “Shout Out and Share!” component. Jot down notes about ideas that stand out for you, and add any emerging concepts and questions that you feel will enrich the process.

Sharing Circle

Take a few moments to sit in a circle and invite participants to share something from their “Shout Out and Share!” planning. It is an excellent opportunity for learners to provide feedback for one another.

Place-based
learning at
the Cowichan
River.

Photo: Stephanie
Cottell



Watershed SOS: Grade Curriculum and Competency Connections

For detailed information visit <https://curriculum.gov.bc.ca/curriculum/science>

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 9 Science	<ul style="list-style-type: none"> • Matter cycles within biotic and abiotic components of ecosystems • Sustainability of systems • First Peoples knowledge of interconnectedness and sustainability 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Earth Science	<ul style="list-style-type: none"> • The hydrologic cycle • Water as a unique resource • Influences of large bodies of water on local and global climates • Evidence of climate change • First Peoples knowledge of climate change and interconnectedness as related to environmental systems • First Peoples knowledge and perspectives of water resources and processes 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Environmental Science	<ul style="list-style-type: none"> • Succession • Matter cycles through and between living systems • First Peoples ways of knowing and doing • Benefits of ecosystem services • First Peoples knowledge and other traditional ecological knowledge in sustaining biodiversity • Ecosystem complexity • Resource stewardship • Restoration practices 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 11 Science for Citizens	<ul style="list-style-type: none"> • Evidence-based decision making through science • Beneficial scientific innovations • Human impact on Earth’s systems • Actions and decisions affecting the local and global environment, including those of First Peoples 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Environmental Science	<ul style="list-style-type: none"> • Mitigation and adaptations • Soil characteristics and ecosystem services • Land management • Personal choices and sustainable living • Global environmental ethics, policy, and law 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Specialized Science	<ul style="list-style-type: none"> • Biodiversity is dependent on the complex interactions and processes between biotic and abiotic factors • Climate change impacts biodiversity and ecosystem health 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Activity Plan

Session 5: Watershed SOS



Big Idea/Inquiry

How can we protect and restore our watershed?



Time

Approximately 2.5 hours

Indigenous Knowledge Element

Local Indigenous language names of riparian plants.



Purpose

The purpose of the session is for students to learn:

- How we can change practices and prevent further damage to our watersheds
- How we can actively work to restore the areas that have been damaged already
- How we can help mitigate flooding and other impacts to our communities that result from altered watersheds
- How we can learn from Indigenous knowledge of local plants



Equipment Needed

- Internet access



Handouts/Materials

- *Session 5: Watershed SOS Learner's Guides*
- Map from Session 4
- Chart paper
- Grade-level appropriate ecology textbooks, articles, and research papers
- "Shout Out and Share!" planning guide (this guide, page AP5-4)



Learning Goals

- To understand that practices can be changed to prevent damage to our watersheds.
- To learn ways people can restore the health of local watersheds.

Learning Outcomes

Students will be able to:

- › Name two important stewardship activities that help us assess the health of streams, creeks, lakes, and rivers
- › Name two practices that could be changed to help prevent damage to watersheds. For example, small fish-bearing streams in parks and public areas are often subjected to degradation from off-leash animals, kids playing, etc. v
- › Talk about how they can help protect the streams
- › Describe one approach to restoring riparian ecosystems
- › Explain how rain gardens help mitigate flooding in urban areas
- › Practice saying a riparian plant name in the local Indigenous language

Key Learning Points

- › Stewardship activities such as storm drain marking, water quality, and habitat monitoring help us know how healthy our watershed is, and help us determine when restoration action is needed
- › Selective logging rather than clear-cutting, and not logging on steep slopes and in riparian areas, would help prevent on-going damage to our watersheds
- › Ecological agricultural practices, such as ensuring there is sufficient native vegetation to filter farm runoff, removing invasive plants, capturing fertilizer runoff with zeolite stone before it enters the watershed, helps to reduce contamination
- › Ecological restoration techniques, such as stabilizing slopes with willow cuttings and stimulating/accelerating natural succession process, can re-establish the health of riparian ecosystems
- › Reducing the residential use of phosphorus soaps and products will help prevent contamination
- › Creating rain gardens in residential and commercial areas will help filter contaminants from the water and reduce its flow, which can help mitigate flooding
- › Local Indigenous communities have traditional language names and ways of classifying riparian plants

Introducing the Topic

Begin the session by reflecting on what was learned about threats to our watersheds in the previous session. Emphasize the fact that many of these threats are consequences of human practices that can be changed. Share your excitement and hope about learning some of the alternatives and solutions that can help bring our watersheds back into good health.



Activity 1: Helping Our Watersheds

Divide into small groups (different groups from Session 4, if possible). Using the inquiry questions in their Learner's Guides, each group will research one or more watershed health solution in the vocabulary list, come up with a simple image and bulleted key information, and share what they have learned using the method in the Learner's Guide (20 min).

*There is a table in the Learner's Guide for learners to draw and record what they learned about other groups' words and terms as they share. One side is for the image, and one is for the bullet notes.

Learners can complete the table in their guides while listening to the other groups (total 30 mins.).

Closing the Session

Summarizing, Reflecting and Communicating: Have learners complete the following activities.



Activity 2: Shout Out and Share!

The "Watershed Reflection" portion of this session is being used as a time for learners to consider, through a series of guided questions, what and how they want to communicate about the riparian restoration activities.



Activity 3: Sharing Circle

Take a few moments to sit in a circle and invite participants to share something about their "Shout Out and Share!" planning.

Shout Out and Share! Planning Guide

Note: This content is in the Learner's Guide of this session. It is included here for your reference but there is no need to print multiple copies for your learners.

So here you are learning about your watershed while doing some incredibly valuable ecological stewardship and restoration while you are at it!

One important element of this place-based learning project involves creating your unique way to share what you are learning and doing. Communicating about your learning helps you to gain a better understanding of the ideas and information, and your sharing is a powerful way to spread awareness about the health of our Watersheds.

This planning guide has been developed to help you consider, decide on, and plan your communication element.

Step 1: What

Answer the following exploratory questions. Answering these questions will help you decide what you want to communicate about the Riparian Restoration activities.

1. What specific parts of the learning projects are you finding most interesting?
2. What has surprised you about what you have been learning in this project?
3. What do you think is the most important information or concept that you've learned?
4. What do you think it would be like to communicate on one or two specific aspects of the Riparian Restoration activities?
5. What would it be like to communicate about the activities as a whole?

Looking back over your answers above, does something jump out at you about what you would like to communicate about this project? Chat with your teacher or classmates if you think it would be helpful to you.

I would like to communicate about:

Step 2: How

Answer the following exploratory questions. Answering these questions will help you decide how you want to communicate about this project.

1. How do you like to communicate - verbally, or through writing? If it's writing, is it creative writing or more technical writing? Do you like to interview experts? Do you like to do visual/graphic communication or a mix of methods?
2. What do you think would be some effective ways to communicate about this project?
3. What kinds of resources and tools do you have available to use for this communication? Can you access a camera or video-recorder? Art supplies?
4. What way of communicating would you most enjoy?

Looking back over your answers above, what jumps out at you about how you would like to communicate about this project? Chat with your teacher or classmates if you think it would be helpful to you.

I would like to communicate through:

Step 3: Who

Answer the following exploratory questions. Answering these questions will help you decide who to connect with to help with your communication element. Please note you might decide you don't need to connect specifically for this element.

1. How could my communication element benefit from connecting with a mentor?
2. Who would be helpful to connect with regarding my communication element?

Looking back over your answers above, does something jump out at you about who you would like to connect with about this project? Chat with your teacher or classmates if you think it would be helpful to you.

I would like to connect with:

Step 4: Plan

Now that you have a clear idea of what you want to share, how you want to share it, and who to connect with for input and mentorship (if anyone), it's time to plan your process.

Planning Questions:

1. How is timing related to what and how I want to share about the riparian restoration activities?
2. What kinds of additional equipment or material will I require and when? (Examples: camera, poster paper, materials)
3. What else do I need to do to prepare ahead for my Shout out and Share element?

Step 5: Do

As you are participating in the riparian restoration session activities, you are also going to be working on your "Shout out and Share!" element. Depending on what you've chosen and how you're going to share, this may mean taking some special notes/writing down questions, making some sketches, or taking some targeted photos.

You will have time after the Riparian Restoration activities to finalize your "Shout Out and Share!" element.

Notes

[illegible]

Session 6

Riparian Restoration Workshop

Educator's Guide



Take action! Learners will have an opportunity to learn, and practice, restoration techniques that will help restore a riparian area in your area



The Big Question: How do you DO riparian restoration?

This exciting session of *Best Water Ways* is all about action-action-action!

Learners will have an opportunity to learn, and practice, restoration techniques that will help restore a riparian area in your area.

For this session, learners are asked to plan how they will communicate about this restoration project with their peers and family. There is a “Shout Out and Share!” planning resource in the Session 6 Learner’s Guide that will help participants make decisions and plan how they want to let people know about what they learned and achieved by participating in this project.

The “Shout Out and Share!” component can be done visually, through art or a video. It can be expressed in a literary way, through poetry or a report, or it can be a blend of mediums. Students are invited to get creative about how they “Shout Out and Share!” about their experience in the riparian restoration.

Indigenous Knowledge Element

The local Indigenous language place name for the creek, stream, lake, marsh, etc. where you are doing your restoration project

Consult your Aboriginal Education department or Indigenous mentor to help find this information. If possible, have them come in at the beginning to offer a land acknowledgement, and throughout the restoration project activities to share stories and knowledge from the local Indigenous perspective.

Preparation

As mentioned in the Educator’s Guide Introduction, this session of the *Best Water Ways* place-based learning projects should involve planning and preparation before and during the delivery of the other sessions. As early as possible, you will need to explore potential restoration sites with support from conservation groups like the Cowichan Land Trust and an ecological restoration specialist to help you prepare and schedule these activities. You will want the groups and professionals to have reviewed the *Best Water Ways* resources so that you are all on the same page about the aim of your learning activities.

For this session have the ecological restoration professional review the riparian restoration project session materials, so that they know the terms and techniques you expect to be covered.

If you are looking to connect with a restoration specialist, check out the Western Canadian chapter of the Society for Ecological Restoration at chapter.ser.org/westerncanada. In the Cowichan Valley, a great local resource is biologist David Polster’s website: polsterenvironmental.com.

Introducing the Concept

You have been working up to this concept of hands-on ecological restoration throughout the previous sessions of this place-based learning project. At this stage, be ready to welcome your restoration specialist, and invite them to provide a bit of background as to how and why they ended up in this important specialized field.

Learning the Content

In this part of the learning project, you can relax and participate in the learning activities with your group! Keep in mind that each ecological restoration specialist will have a different style or approach to sharing the learning content with you and your students. They may want to teach concepts using slides in a classroom session and go into the field afterwards. Or, they may want to offer the whole learning experience in the field through hands-on activities. Just make sure to communicate in advance regarding their approach, so that you can be prepared to support them as needed.

Words and Terms

Bioengineering	the use of living plant materials to perform an engineering function, such as erosion control, drain-ways, or slope stabilization.
Hand-pruners	hand-held cutting tool used for pruning and taking cuttings.
Live staking	staking a long (2m) cutting of plant material into the soil where it will root and grow.
Loppers	long-handled cutting tool used for pruning and taking cuttings.
Natural succession species	indigenous species and communities of plants, animals, and insects that occur and evolve over time in an ecosystem.
Plant cuttings	cuttings of plant material taken from well-established sources.
Planting bar	a long heavy metal bar used to make deep, narrow holes for planting.
Pruning saw	a small hand-held saw used for pruning trees or taking cuttings.

Evaluating the Learning

The “Shout Out and Share!” component of the restoration project provides an effective way for you to evaluate the learning level of your group. Your learners will have taken some time to decide how they want to share their learning in earlier sessions. Learners will take notes and think about their “Shout Out and Share!” component throughout the last two sessions. However, the final work and presentation of this element will need to happen after the final sessions.

Riparian Restoration Workshop: Grade Curriculum and Competency Connections

For detailed information visit <https://curriculum.gov.bc.ca/curriculum/science>

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 9 Science	<ul style="list-style-type: none"> • Sustainability of systems • First Peoples knowledge of interconnectedness and sustainability 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Earth Science	<ul style="list-style-type: none"> • The hydrologic cycle • Water as a unique resource • Influences of large bodies of water on local and global climates • Evidence of climate change • First Peoples knowledge of climate change and interconnectedness as related to environmental systems • First Peoples knowledge and perspectives of water resources and processes 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 11 Environmental Science	<ul style="list-style-type: none"> • Succession • Matter cycles through and between living systems • First Peoples ways of knowing and doing • Benefits of ecosystem services • First Peoples knowledge and other traditional ecological knowledge in sustaining biodiversity • Ecosystem complexity • Resource stewardship • Restoration practices 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Grade Level and Subject	Content Connections	Curricular Competencies
Grade 11 Science for Citizens	<ul style="list-style-type: none"> • Evidence-based decision making through science • Beneficial scientific innovations • Human impact on Earth's systems • Actions and decisions affecting the local and global environment, including those of First Peoples 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Environmental Science	<ul style="list-style-type: none"> • Mitigation and adaptations • Soil characteristics and ecosystem services • Land management • Personal choices and sustainable living • Global environmental ethics, policy, and law 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating
Grade 12 Specialized Science	<ul style="list-style-type: none"> • Biodiversity is dependent on the complex interactions and processes between biotic and abiotic factors • Climate change impacts biodiversity and ecosystem health 	<ul style="list-style-type: none"> • Questioning and predicting • Planning and conducting • Processing and analyzing data and information • Evaluating • Applying and innovating • Communicating

Notes

[illegible]

Activity Plan

Session 6: Riparian Restoration Workshop



Big Idea/Inquiry

How can we protect and restore our watershed?



Time

Full-day or half-day field session (or more, depending on your context)

Indigenous Knowledge Element

The local Indigenous language place name for the creek, stream, lake, marsh, or estuary where you are learning.



Purpose

The purpose of the session is for students to learn bioengineering skills and techniques that help restore damaged riparian ecosystems along the watershed.



Handouts/Materials

- *Session 6: Riparian Restoration Workshop Learner's Guides*
- Map from Session 4
- Chart paper
- "Shout Out and Share!" planning guide (Session 5 activity plan, page AP5-4)



Equipment Needed

You will need:

- Gloves
- Pruning saws and loppers
- Trowels
- Planting bars
- Shovels
- Rakes



Learning Goals

- To learn and understand more about how restoring riparian areas help protect our watersheds, drinking water, quality of life, fish populations
- To learn a specific riparian restoration approach called *bioengineering*

Learning Outcomes

Students will be able to:

- › Name two practices that could be changed to help prevent damage to watersheds
- › Describe one approach to restoring riparian ecosystems
- › Explain how rain gardens help mitigate flooding in urban areas

Key Learning Points

- › Degraded areas within a watershed can be restored using a variety of techniques
- › Riparian areas can be restored with an approach called bioengineering
- › The overall aim is to stabilize slopes and soil enough to allow natural ecological succession to take hold and re-establish the natural ecological system

Techniques include:

- › Making the soil surface rough and loose to promote drainage
- › Taking with live cuttings from indigenous riparian shrubs such as willow and red-osier dogwood
- › Making 'live wattle-fences' with cuttings when necessary
- › Pocketing plantings of riparian vegetation
- › Adding plant propagation material of site-appropriate species such as alder seeds



Planting native species in a riparian area is a great restoration activity for learning groups.

Photo: Stephanie Cottell

Introducing the Learning

Before introducing the restoration professional that will be facilitating this session, direct learners to the *Session 6: Riparian Restoration Workshop* Learner's Guide to review their learning responsibility for the day. For example, taking notes about vocabulary and their "Shout Out and Share!" element.



Activity 1: Bioengineering in the Watershed I

Bioengineering workshop classroom session with ecological restoration specialist (or they may want to present the whole day in the field).



Activity 2: Bioengineering in the Watershed II

Bioengineering workshop field session with ecological restoration specialist (ensure that field safety orientation is completed at the outset).

Closing the Session

Summarizing/Reflecting/Evaluating/Wrap-up: Have learners complete the following activities.



Activity 3: Wrap-up Activities

Your learners will have taken some time to decide how they want to share their learning in earlier sessions (see *Session 5: Watershed SOS* Learner's Guide). Though learners will be taking notes and thinking about their "Shout Out and Share!" component throughout the last two sessions, the final work and presentation of this element will probably need to happen after the "Riparian Restoration Workshop" session has been completed.

Notes

[illegible]

Educator's Guide

Glossary

Aquatic Invertebrates	small animals, such as insects, crustaceans, mollusks, and worms that live in water. Most invertebrates are found living in the stream bottom among the rocks and gravel.
Aquifer	underground area that becomes saturated with water within the local watershed.
Contaminants	a polluting or poisonous substance that makes something impure, or alters it from its healthy, natural state.
Contour lines and intervals	a contour line is a line drawn on a topographic map to indicate ground elevation or depression. Contour lines never cross. A contour interval is the vertical distance or difference in elevation between contour lines.
Culverts	a tunnel (with or without a pipe) carrying a waterway (stream or ditch) under a road or railroad.
Decontamination	the process of removing or neutralizing contaminants that have accumulated somewhere.
Deforestation	the action of clearing a wide area of trees.
Dikes	a long wall or embankment built to prevent flooding from the sea or another body of water.
Ditches	a narrow channel dug in the ground, typically used for water drainage alongside a road or the edge of a field.
Ecological restoration	the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.
Ecosystem map	a map that represents ecosystem characteristics and relationships of a given area.
Elevation	distance in height above sea level of a specific location.

Ground water	a watershed flow that has infiltrated the ground, has entered the area below the water table or has been discharged into a stream channel, or springs and seepage water. Groundwater is stored in, and moves slowly through, the layers of soil, sand, and rocks in aquifers.
Gully	a deep and narrow water-worn ravine often with water flowing through as a stream or river.
Hand-pruners	hand-held cutting tool used for pruning and taking cuttings.
Impervious or Impermeable	a surface or substrate that does not allow fluid to pass through.
Indigenous	People, plants, and other biological species originating, occurring naturally, or for a long time (beyond human memory or recorded history) in a specific place.
Indigenous knowledge	refers to the local understandings and philosophies developed by societies with long histories of interaction with their natural surroundings.
Indigenous technology	living-skills, tools, devices, and methods that were developed by local Indigenous cultures based on their Indigenous knowledge systems.
Interconnectedness	the idea that all living and non-living things in the world are connected and affect each other.
Invasive species	a plant, animal, or insect species that is not native to a specific location (an introduced species), and that tends to spread to a degree believed to cause damage to the environment, human economy or human health.
Live-staking	staking a long (2m) cutting of plant material into the soil where it will root and grow.
Loppers	a long-handled cutting tool used for pruning and taking cuttings.
Mitigate	taking action to make something less harmful.
Natural succession species	Indigenous species and communities of plants, animals, and insects that occur and evolve over time in an ecosystem.
Nitrates (NO₃)	a source of Nitrogen (an essential chemical element) for plants. When nitrogen fertilizers are used to enrich soils, excess nitrates are carried by rain, irrigation, and other surface waters through the soil into groundwater. Human and animal wastes can also contribute to nitrate contamination of water.

- Perimeter drain** drainage system designed to collect the water that accumulates next to the foundation wall of a home. The drain is installed around the exterior or interior of a home to divert water away from the foundation and into the surrounding environment.
- Pervious or Permeable** a surface or substrate that does allow fluid to pass through.
- Phosphorus (P)** a very reactive chemical element required in small amounts by both plants and animals. Excess phosphorus from fertilizer and other human use (soaps) is carried through the watershed and is very disruptive to the chemical balance of aquatic and riparian ecosystems.
- Physiography** collective physical features such as slope, shape, and elevation of an area.
- Plant cuttings** cuttings of plant material taken from well-established sources.
- Planting bar** a long heavy metal bar used to make deep, narrow holes for planting.
- Pruning saw** a small hand-held saw used for pruning trees, or taking cuttings.
- Rain garden** a garden of native shrubs, perennials, and flowers planted in a small depression, which is generally formed on a natural slope. It is designed to temporarily hold and soak in rainwater run-off that flows from roofs, driveways, patios, or lawns.
- Reciprocity** the concept of mutual exchange and shared benefit within relationships between people, and between people and nature. One way of putting it is “the fair balance of giving and taking in any relationship”.
- Riparian** the land, habitats, and ecosystems that are associated with, adjacent to, and interdependent on bodies of water (streams, rivers, ponds, lakes, and shorelines).
- Salmonids** a family of ray-finned fish which includes salmon, trout, chars, freshwater whitefishes, and graylings, which collectively are known as the salmonids. All salmonids spawn in freshwater, but in many cases, the fish spend most of their lives at sea, returning to the rivers only to reproduce. This lifecycle is described as anadromous. They are predators, feeding on small crustaceans, aquatic insects, and smaller fish.
- Selective forestry** the logging of selected trees in a forest so that growth of other trees and the dynamics of the surrounding natural ecosystems are not affected.

Slope	how steep the land is; how much vertical rise in elevation there is for a certain horizontal distance. Rise over run.
Soil Bioengineering	the use of living plant materials to perform an engineering function such as erosion control, drain-ways, or slope stabilization.
Solubility	the ability for a given substance, the solute, to dissolve in a solvent (water or other fluid).
Storm drains	infrastructure designed to drain excess rain and groundwater from impervious surfaces such as paved streets, car parks, parking lots, footpaths, sidewalks, and roofs.
Surface Run-off (also known as overland flow)	the flow of water that occurs when excess stormwater, meltwater, or other sources flows exceed the capacity of the natural waterways and flow over the land surface. Repeated surface run-off impacts vegetation, and causes flooding and soil and land erosion.
Surface water	any water that collects on the surface of the Earth. This includes oceans, seas, lakes, rivers, or wetlands.
Topographic map	a type of map showing natural and/or physical features of a landscape, including contours and elevation.
Traditional Indigenous language	the language of the Indigenous nation within the local area.
Tributary	a river or stream flowing into a larger river, lake, or water body.
Valley	a stretched-out groove in the land. It has higher ground on three sides and usually has water flowing through the center. Usually V- or U-shaped.
Water table	the upper-most level of an underground area (aquifer) that is saturated (filled) with water.
Watershed	an area of land that catches and collects rain and snow, draining and seeping it through a network of marshes, creeks, streams, and groundwater into a common body of water (such as a river, lake, or ocean).
Watershed boundary	the line that divides the watershed and where water will flow. A raindrop that lands on one side of the boundary will flow into one body of water, and a drop that lands on the other side will flow into a different body of water.