

STAVE FALLS: POWER AND PLACE

TEACHER RESOURCE GUIDE



BChydro 

FOR GENERATIONS

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BC HYDRO BACKGROUND

BC Hydro, a commercial Crown corporation owned by the Province of British Columbia, generates, transmits, distributes and sells electrical power. As one of North America's leading providers of clean, renewable energy, we service 94 per cent of B.C.'s population. Clean, reliable electricity has been a hallmark of British Columbia for generations.

We are proud of our work in helping students understand electricity and how they can play a part in reducing the amount of energy we use in B.C. Energy conservation and efficiency are key to achieving the province's goals of meeting 66 per cent of provincial electricity needs through conservation by 2020 and fostering the development of innovative technologies that support energy conservation and efficiency. Education is critical to achieving these goals. Our belief in the importance of education drives our mandate to produce engaging educational materials that provide valuable information on electricity generation and use, safety, energy efficiency, energy alternatives, sustainability and the environment.

We appreciate your participation in Stave Falls: Power and Place and are available to support you. Please contact our office with any questions or requests.

Power House at Stave Falls

31338 Dewdney Trunk Road,

Mission, BC V4S 1C4

604 462 1222

bchydro.com/community/recreation_areas/stave_falls_visitor_centre.html

For more information about BC Hydro's education programs, visit www.bchydro.com/education.

BC HYDRO SCHOOL PROGRAMS

STATEMENT OF PURPOSE

We believe that creating energy conservation awareness among the next generation is one of the keys to achieving energy sustainability for our province. The primary objective of our school programs is to empower students to take action on energy use within their schools and to carry these messages to their families and to their communities.

Our resources, developed by B.C. teachers, for B.C. teachers, encourage school communities to develop and foster an energy conservation culture, explore electricity and understand electrical safety concepts.

BC Hydro's energy education programs include:

ENERGY EXPLORERS – PRE-SCHOOL TO KINDERGARTEN

Energy Explorers is an engaging program that introduces young children to energy and Power Smart behaviour through four sequential themes and a variety of hands-on materials. Children are introduced to the concept of energy and then progress towards discovering simple energy-saving actions they can do to help care for the Earth.

ENERGY DETECTIVES – GRADES 1 TO 3

This hands-on, engaging program teaches students about energy use and conservation. Students become energy detectives as they read the story of "Smarty and the Energy Detectives: The Mysterious Equation" and take an active role in developing energy-action plans for their schools, communities and homes.

ENERGY CAMPAIGNS – GRADES 4 TO 7

In this program, teacher and student teams attend a workshop to explore sustainability, energy conservation and climate change. The teams then share their learning with their classes. Students work together to develop a campaign to reduce energy use in their school community.

ENERGY CONNECTIONS – GRADE 6

This classroom resource directly supports the BC Science Curriculum – Grade 6 Electricity Unit, while teaching students to recognize potential hazards related to high-voltage electricity. Participating schools are provided free circuitry kits (one per school).

ENERGY AMBASSADORS – GRADES 8 TO 12

Students are empowered to lead real change by engaging with teacher sponsors and district facilities mentors to investigate and identify areas for conservation and sustainable action within the school and districts.

For more information about our school programs, please contact us at:

BC Hydro School Programs

333 Dunsmuir Street, 15th Floor

Vancouver, B.C. V6B 5R3

Telephone: 604 736 7424 Fax: 604 736 7415

Website: www.bchydro.com/education

Email: denise.browne@bchydro.com

STAVE FALLS: POWER AND PLACE - OVERVIEW

BC Hydro's Power House at Stave Falls is a Canadian National Heritage site located 65 kilometres east of Vancouver. This historic location and adjacent Hayward Lake Recreation Area provide an opportunity for learners of all ages to discover and explore a rich human and natural history.

Stave Falls: Power and Place is a new resource designed to support the Grades 4 to 7 Social Studies and Science curricula, while connecting learners to an outstanding national heritage site and the natural environment that surrounds it. Students are encouraged to think about B.C.'s renewable and non-renewable resources, hydroelectric generation, human and natural heritage, and conservation.

The Power House at Stave Falls provides a unique opportunity to bring the curriculum to life and engage students with real world experiences. Students' curiosity and wonder will be awakened once they see the inner workings of a 100-year-old power generating facility, interactive displays, archival photos and artifacts, and the original mechanical and electrical components installed over a century ago.

This resource provides teachers with background information, lessons, activities and resources to support the achievement of BC Ministry of Education Prescribed Learning Outcomes in several curriculum areas. (See the Curriculum Connections chart for details.) The extension activities provide further support for the achievement of learning outcomes and enhance the delivery of multiple subject areas.

The resource comprises five distinct components:

Teacher background information and curriculum links

This section contains useful information about BC Hydro, BC Hydro School Programs and ways to connect this resource to grades 4 to 7 curriculum.

Section One: Pre-trip (page 16)

These lessons introduce students to dams and the hydroelectric generation process and prepare them for the field trip to the Power House at Stave Falls. A comparison of beaver-created and human-created dams also provides strong connections to a study of habitats.

Section Two: Field Trip (page 34)

The activities in this section will enhance the visit to Stave Falls, both inside the power house and at the nearby Hayward Lake recreation area. The activities include a question sheet to complement the guided tour, a timeline activity situating students within a historical context and a scavenger hunt highlighting local flora and fauna.

Section Three: Post-trip (page 44)

The lessons in this section provide students with the opportunity to solidify their understanding of key concepts explored in the resource and to creatively express their ideas and opinions around conservation.

Additional resources and field trip planning tools (page 59)

Helpful references, checklists, and field trip preparation information

We invite you and your class to enjoy and experience first-hand the history, power and place that is Stave Falls.

CURRICULUM CONNECTIONS

In the chart, • denotes outcomes that are fully achieved by the activity, while * denotes outcomes that are moderately achieved by the activity or are supported by extension activities.

| Subject | Prescribed Learning Outcomes | Pre-trip | Field Trip | Post-trip |
|--------------------------------|--|------------|------------|------------|
| Grade 4 | | | | |
| Social Studies | | | | |
| Skills and Processes | <ul style="list-style-type: none"> • apply critical thinking skills – including comparing, imagining, inferring, identifying patterns, and summarizing – to selected problems and issues • (use maps) and timelines to locate, interpret, and represent major physical, political, and economic features of BC | * | | • • |
| Identity, Society, and Culture | <ul style="list-style-type: none"> • describe the significance of key events and factors in the development of BC and Canada, including the fur trade • identify effects of early contact between Aboriginal societies and European explorers and settlers | * * | • * | |
| Science | | | | |
| Life Science | <ul style="list-style-type: none"> • determine how personal choices and actions have environmental consequences | | | * |
| Earth Science | <ul style="list-style-type: none"> • analyze the impacts of weather on living and non-living things | • | | |
| Drama | | | | |
| | <ul style="list-style-type: none"> • express a variety of ideas and perspectives through drama • demonstrate collaboration skills during drama | | | • • |

| Subject | Prescribed Learning Outcomes | Pre-trip | Field Trip | Post-trip |
|--------------------------|--|----------|------------|---------------------|
| Grade 4 | | | | |
| English | | | | |
| Writing and Representing | <ul style="list-style-type: none"> • write clear, focussed personal writing for a range of purposes and audiences that demonstrates connections to personal experiences, ideas, and opinions • select and use strategies after writing and representing to improve their work • create meaningful visual representations that communicate personal response, information, and ideas relevant to the topic, featuring an organization in which key ideas are evident | • | | • • • |
| Speaking and Listening | <ul style="list-style-type: none"> • use speaking and listening to interact with others for the purposes of sharing and explaining ideas, viewpoints, and opinions | • | • | • |
| Reading and Viewing | <ul style="list-style-type: none"> • select and use strategies after reading and viewing to confirm and extend meaning, including using graphic organizers to record information | • | | • |

| Subject | Prescribed Learning Outcomes | Pre-trip | Field Trip | Post-trip |
|--------------------------------|--|----------|------------|-----------|
| Grade 5 | | | | |
| Social Studies | | | | |
| Skills and Processes | <ul style="list-style-type: none"> • apply critical thinking skills – including hypothesizing, comparing, imagining, inferring • (use maps) and timelines to locate, interpret, and represent major physical, political, and economic features of BC | * | • | • |
| Identity, Society, and Culture | <ul style="list-style-type: none"> • describe the significance of key events and factors in the development of BC and Canada, including the fur trade | | • | |
| Human and Physical Environment | <ul style="list-style-type: none"> • describe the location of natural resources within BC, including energy resources • analyse environmental effects of settlement in early BC and Canada | * | * * | * |
| Science | | | | |
| Earth and Space Science | <ul style="list-style-type: none"> • analyse how BC's living and non-living resources are used • identify methods of extracting or harvesting and processing BC's resources | • • | • • | • • |
| Drama | | | | |
| | <ul style="list-style-type: none"> • express a variety of ideas and perspectives through drama • demonstrate collaboration skills during drama | | | • • |

| Subject | Prescribed Learning Outcomes | Pre-trip | Field Trip | Post-trip |
|--------------------------|--|----------|------------|---------------------|
| Grade 5 | | | | |
| English | | | | |
| Writing and Representing | <ul style="list-style-type: none"> • write clear, focussed personal writing for a range of purposes and audiences that demonstrates connections to personal experiences, ideas, and opinions • select and use strategies after writing and representing to improve their work • create meaningful visual representations that communicate personal response, information, and ideas relevant to the topic, featuring an organization in which key ideas are evident | • | | • • • |
| Speaking and Listening | <ul style="list-style-type: none"> • use speaking and listening to interact with others for the purposes of sharing and explaining ideas, viewpoints, and opinions | • | • | • |
| Reading and Viewing | <ul style="list-style-type: none"> • select and use strategies after reading and viewing to confirm and extend meaning, including using graphic organizers to record information | • | | • |

| Subject | Prescribed Learning Outcomes | Pre-trip | Field Trip | Post-trip |
|---------------------------------|---|----------|------------|------------|
| Grade 6 | | | | |
| Social Studies | | | | |
| Skills and Processes | <ul style="list-style-type: none"> • apply critical thinking skills – including comparing, classifying, inferring, imagining, verifying, identifying relationships, summarizing, and drawing conclusions – to a range of problems and issues • interpret graphs, tables, aerial photos, and types of maps | • | • • | • |
| Science | | | | |
| Life Science: Diversity of Life | <ul style="list-style-type: none"> • analyse how different organisms adapt to their environments | • | | * |
| Physical Science: Electricity | <ul style="list-style-type: none"> • differentiate between renewable and non-renewable methods of producing electrical energy | | | • |
| Drama | | | | |
| | <ul style="list-style-type: none"> • use the creative process to explore a range of issues and responses • demonstrate collaboration skills during drama | | | • • |

| Subject | Prescribed Learning Outcomes | Pre-trip | Field Trip | Post-trip |
|--------------------------|--|----------|------------|---------------------|
| Grade 6 | | | | |
| English | | | | |
| Writing and Representing | <ul style="list-style-type: none"> • write clear, focussed personal writing for a range of purposes and audiences that demonstrates connections to personal experiences, ideas, and opinions • select and use strategies after writing and representing to improve their work • create meaningful visual representations that communicate personal response, information, and ideas relevant to the topic, featuring an organization in which key ideas are evident | • | | • • • |
| Speaking and Listening | <ul style="list-style-type: none"> • use speaking and listening to interact with others for the purposes of discussing and comparing ideas and opinions | • | • | • |
| Reading and Viewing | <ul style="list-style-type: none"> • select and use strategies after reading and viewing to confirm and extend meaning, including using graphic organizers to record information | • | | • |

| Subject | Prescribed Learning Outcomes | Pre-trip | Field Trip | Post-trip |
|--------------------------|---|----------|------------|-----------|
| Grade 7 | | | | |
| Social Studies | | | | |
| Skills and Processes | <ul style="list-style-type: none"> • use various types of graphs, tables, timelines, and maps to obtain or communicate information • defend a position on a contemporary or historical issue | | • | • |
| Science | | | | |
| Skills and Processes | <ul style="list-style-type: none"> • create models that help to explain scientific concepts and hypotheses | | | • |
| Life Science: Ecosystems | <ul style="list-style-type: none"> • analyse the roles of organisms as part of interconnected food webs, populations, communities, and ecosystems assess survival needs and interactions between organisms and the environment | | • | |
| Drama | | | | |
| | <ul style="list-style-type: none"> • perform drama for specific purposes and audiences | | | • |
| English | | | | |
| Writing and Representing | <ul style="list-style-type: none"> • write clear, focussed personal writing for a range of purposes and audiences that demonstrates connections to personal experiences, ideas, and opinions • select and use strategies after writing and representing to improve their work • create meaningful visual representations for a variety of purposes and audiences that communicate a personal response, information, and ideas relevant to the topic, featuring development of ideas by making connections to personal feelings, experiences, opinions, and information | • | | • |
| Speaking and Listening | <ul style="list-style-type: none"> • use speaking and listening to interact with others for the purposes of discussing and analysing ideas and opinions | • | • | • |
| Reading and Viewing | <ul style="list-style-type: none"> • select and use strategies after reading and viewing to confirm and extend meaning, including using graphic organizers to record information | | | • |

SECTION ONE: PRE-TRIP

LESSON 1: THE NATURE OF DAMS

DURATION

60 minutes

OBJECTIVES

Students will be able to:

- use a KWL chart to recognize their prior knowledge and identify additional information they want to learn
- demonstrate their prior knowledge about beavers
- generate questions about hydroelectric generation and Stave Falls

MATERIALS

- KWL chart template (see page 20)
- chart paper and markers
- *Beavers* PDF (page 21, for projection or making copies)
- *Creature Features* PDF (page 23, for projection or making copies)
- *Sample Mind Map* PDF (page 24, for projection or making copies)
- *Mind Map Rubric* PDF (page 25, for projection or making copies)

PREPARATION

- Create a classroom KWL chart that can be expanded; consider using one sheet of flip chart paper for each column. Refer to the sample provided on page 20 that includes all of the topics to be considered in this resource.
- Make one copy per group of four or five students of *Beavers* and *Creature Features*.
- Copy a class set of the *Mind Map Rubric* if you choose to review it with the class before they complete their own mind maps.
- Have digital projector available or prepare necessary overheads.

TEACHER BACKGROUND

- KWL is a learner-centred teaching strategy that provides a structure for students to organize ideas during a course of study. It allows students to recall what they think they know about a topic (**K**), identify what they want to know (**W**), and state what they have learned (**L**).
- The class starts a KWL chart in this lesson and adds to it throughout the activities, and later lessons, to provide a complete summary of learning at the end of the resource.
- An additional column may be added to note resources (**R**) that can be used to support what the students have identified they want to know.
- Mind-mapping is a type of brainstorming that shows how themes or ideas are connected
- Consider providing students with a copy of the Mind Map Rubric and reviewing the assessment criteria with them before they start completing their own mind maps.

FRAMING THE CONTENT

- This lesson is introduced by an activity that focuses on beavers and beaver dams. This allows students to expand their understanding of dams, since most will have some knowledge of beavers as a starting point. The lesson uses two learning strategies: KWL and mind-mapping.
- Finding similarities and differences between beaver dams and human-made dams provides a link that naturally introduces the topic of hydroelectric generation.
- By learning about beavers, which depend on the same resources as humans, students can develop a greater appreciation and care for our environment.

LESSON DEVELOPMENT

Activity 1

- Explain to students that they'll be looking at two different ways to use new information: completing the KWL chart and mind-mapping. Mind-mapping is a type of brainstorming that shows how themes or ideas are connected.
- As a class, have students identify what they **know** and what they **want to know** about beavers and their dams on the class KWL chart.
- Organize students into groups of four or five, and hand out Beavers and Creature Features to each group. Allow time for the groups to review the material.
- Prompt a class discussion with questions like these:
 - What was the most interesting fact you learned?
 - What topic areas do you think we could sort this information into? (Consider physical features, habitat, eating habits, etc.)
- Complete **learned** on KWL chart.

Activity 2

- Show the Sample Mind Map with a projector and draw attention to the key features:
 - a central image or word that clearly represents the topic
 - main themes or ideas radiating from the centre on lines
 - details are shown branching out from the main ideas
 - key images and words are connected with new lines
 - use of colour throughout (optional but recommended)
- Review the Mind Map Rubric with students.
- Have students begin their own mind maps on blank paper, reminding them to sort the information into main ideas and details.
- Help students identify their most important ideas (on the main branches) or group their ideas into common categories such as physical features, habitat and dams, food, adaptations, etc.
- Have students notice how the text structures (headings and labels) help them find the main ideas
- Remind students that mind maps are individual expressions and that each student will create his or her own unique product.

Activity 3

- Introduce the field trip to Stave Falls with the following prompts:
 - Why do you think we are focusing on beavers and their dams?
 - A hint: we're going to be learning about electricity.
 - Where do you think we could go to learn about how electricity gets made?
 - Why do you think it is important to learn about dams?
 - Ask if any students have seen a human-made dam before. What did they see and do there? Has anyone been to Stave Lake or Stave Falls?
- Have students create a KWL chart in their notebooks and have them complete what they know and want to know about human-made dams and the Power House at Stave Falls.
- Have students share their ideas with the class and continue to build the class chart.

ASSESSMENT

- Use the Mind Map Rubric to assess students' mind maps for key elements.

EXTENSIONS

- Use the internet to find out more information about beavers or Stave Falls to add to the KWL chart.

SAMPLE KWL CHART

| | What I think I KNOW | What I WANT to know | What I have LEARNED |
|--|---------------------|---------------------|---------------------|
| Beavers and their dams | | | |
| Human-made dams and hydroelectric generation | | | |
| Stave Falls | | | |
| Hydrologic Cycle | | | |

BEAVERS

Common Name

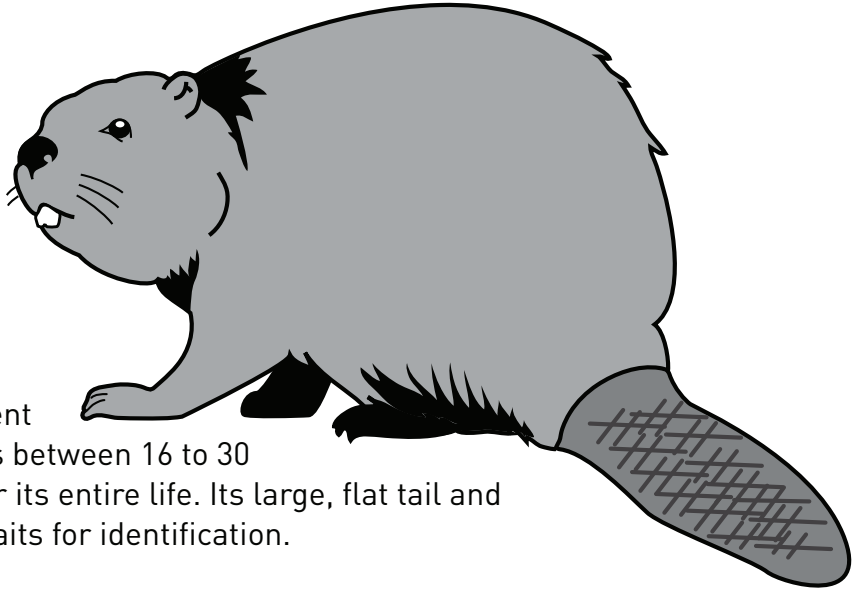
American Beaver

Scientific or Latin name

castor canadensis

Description

The largest of North America's rodent family, this aquatic mammal weighs between 16 to 30 kilograms and continues to grow for its entire life. Its large, flat tail and enormous front teeth are helpful traits for identification.



Lifespan

15 to 20 years

Population in British Columbia

400,000 to 600,000

Food

Beavers are herbivores and eat only plants. The plants they eat include bark and inner bark (cambium) of several tree species (aspen, willow, alder, birch, and others) and aquatic pond plants. Occasionally beavers eat grains or grasses they find on land.

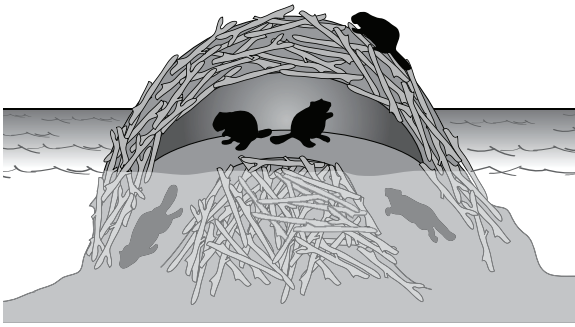
Habitat

Freshwater environments wherever enough tree supplies for building and food can be found, especially near running water.

Range

Found throughout North America north of Mexico and south of arctic regions. Not found in deserts or large areas without trees.





Den

Usually found in still water, beaver lodges are dome-shaped piles of sticks and mud. After building the lodge, beavers hollow out an underwater entrance and living area in the centre. In moving water, dens may be dug out of stream or river banks.

Predators

Bear, lynx, cougar, river otter, coyote, wolf and fox.

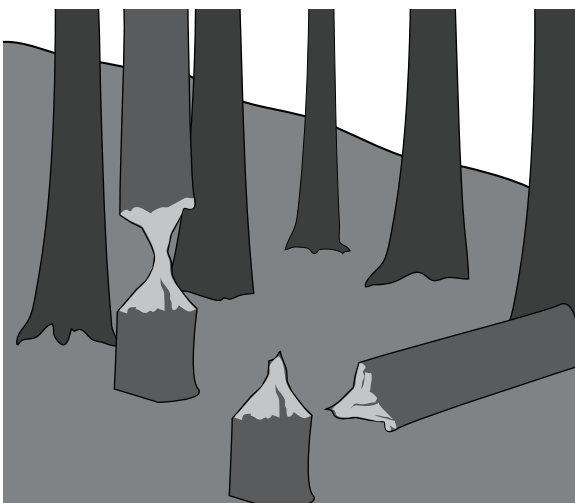


Behaviours

As they are mostly nocturnal (active at night) animals, beavers' activities are often unseen to us. They are certainly busy creatures, cutting down hundreds of trees per year for food, dams and lodges. They also make canals to transport branches from beyond the pond area. They slap their tails to alert one another to predators and intruders who enter their territory. The tail slapping can be heard 100 metres away.

Beaver Dam

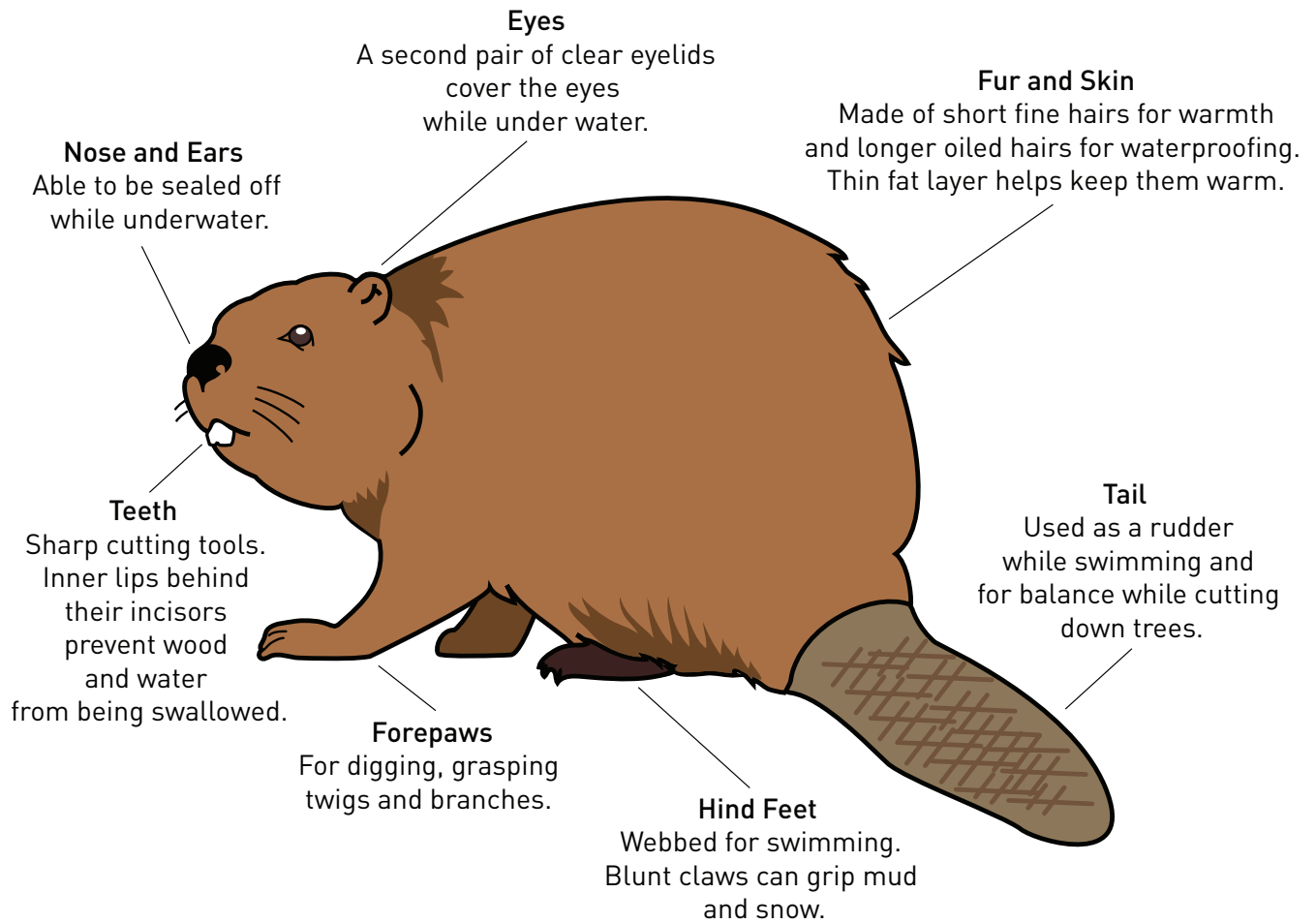
Constructed to allow travel and safety from predators, beaver dams are made of sticks, mud and stones. The largest known, found in Montana, can be seen from space!



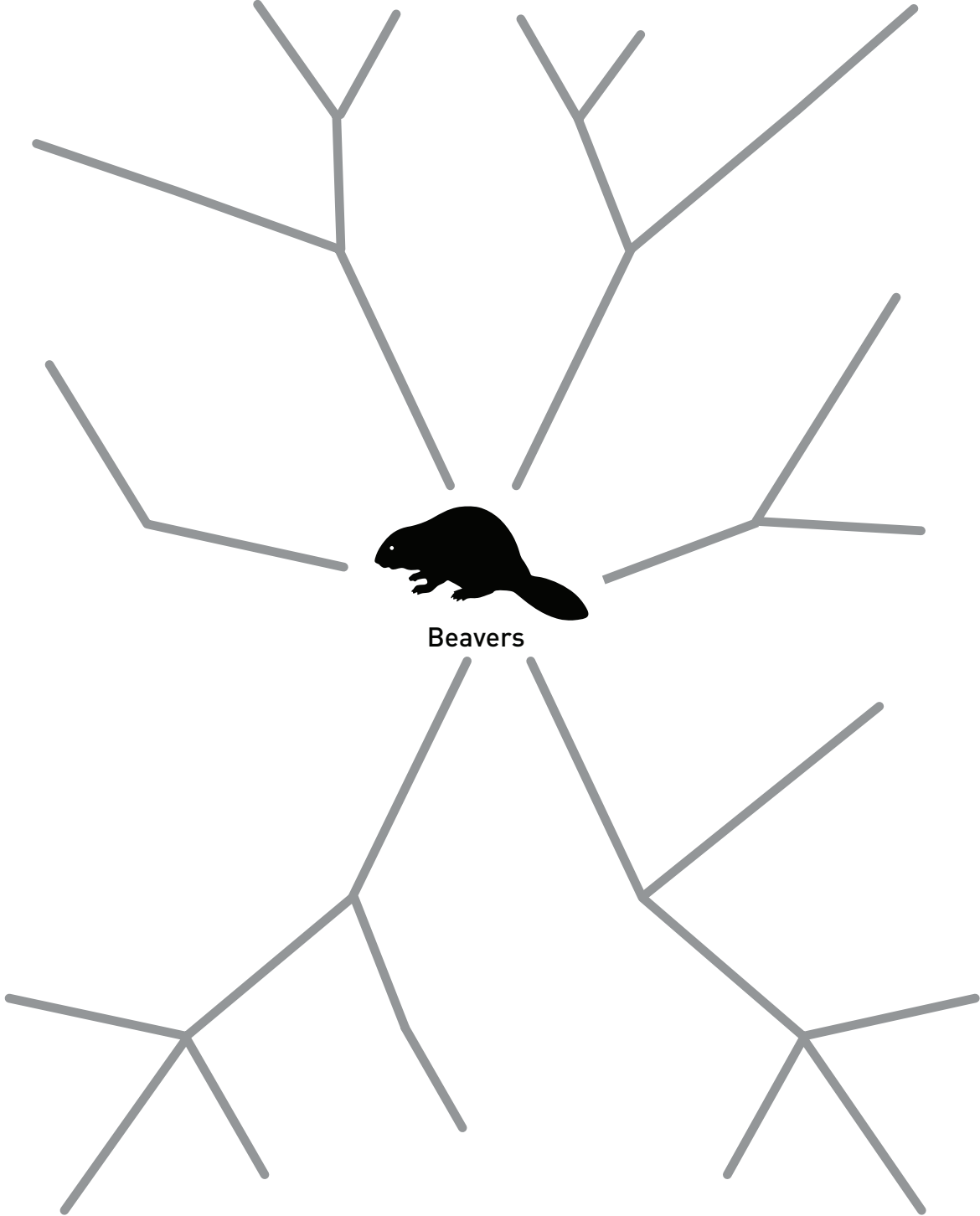
Beaver Dam Impact on environment

Beavers' tree-cutting and dam-building alter forests, and humans can find their activities a nuisance if property is flooded or damaged. The ponds created by beaver dams also create important habitat for insects, fish, birds, and amphibians such as frogs. Also, beaver dams can control sudden floods and improve water quality.

CREATURE FEATURES



SAMPLE MIND MAP



MIND MAP RUBRIC

Name: _____ Date: _____

The rubric below can help you develop your mind map by showing you what is expected. After you have created it, use the criteria to assess how you did and note where improvements can be made.

| Criteria | Level of Achievement | | | |
|---|----------------------|------------|---------|----------|
| | Beginning | Developing | Capable | Powerful |
| A central image that clearly represents the topic <ul style="list-style-type: none"> - image is clearly connected to entire topic | | | | |
| Main themes or ideas radiate from centre <ul style="list-style-type: none"> - organization is evident - each theme has supporting details | | | | |
| There is a connected structure <ul style="list-style-type: none"> - connections are made between themes where appropriate - details connect to more than one theme where appropriate | | | | |
| Use of colour <ul style="list-style-type: none"> - colour improves the appearance of the map - colour adds to the organization of the map | | | | |
| Care taken to do a good job <ul style="list-style-type: none"> - map is neat and clear - words are easy to read - pictures / images are appropriate | | | | |

LESSON 2: AQUA DROPS BY STAVE FALLS

DURATION

45 minutes

OBJECTIVES

Students will be able to:

- summarize an oral story, identifying the main events using a graphic flow chart
- identify the key stages in the process of hydroelectric generation
- identify the key stages in the process of the hydrologic cycle

MATERIALS

- one blank sheet of paper per student
- pencil and colouring markers
- projector
- *Hydroelectric Generation* image PDF (page 29, for projection or making copies)
- *Aqua Drops by Stave Falls* PDF (page 30, for projection or making copies)
- *Flow Chart Sample* PDF (page 31, for projection or making copies)
- *Stave Falls – A Special Place* PDF (page 32)
- *Hydrologic Cycle* image PDF (page 33, for projection or making copies)

PREPARATION

- Photocopy a class set of *Stave Falls – A Special Place*.
- Set up a laptop and projector to show support PDFs (or make sufficient copies for students).

TEACHER BACKGROUND

- **Think/Pair/Share** – This instructional strategy encourages accountability, dialogue, active listening and collaborative learning in group work. The think-pair-share structure gives all students the opportunity to discuss their ideas. This is important because students start to construct their knowledge in these discussions and find out what they do know. This level of self-awareness does not occur when they are just listening to one person explaining a concept.

- **Procedure**

- Place the students in pairs or small groups and pose a question.
- Have students first think for themselves and then give their partner a response.
- Next, the partner paraphrases what was heard.
- Then the partner gives his or her response, and the other person paraphrases.
- Once this process is complete, have the pairs report back to the whole group.

FRAMING THE CONTENT

- *Aqua Drops by Stave Falls* explains the process of hydroelectric generation, which is a direct link to the information learned on the Stave Falls field trip.
- The hydrologic cycle or water cycle is also explained in Aqua's story. You can focus on this aspect to support the Grade 4 Earth Science learning outcomes related to weather and precipitation.

LESSON DEVELOPMENT

Activity 1

- Review the hydrologic cycle:
 - Add the topic to the classroom KWL chart and ask students to identify what they already **know** about the hydrologic or water cycle.
 - Brainstorm questions to focus their reading and identify what they **want to know** about the hydrologic cycle.
- Show students the *Hydroelectric Generation* image with a projector or as a handout, and review the process of how electricity is made from falling water.
- Emphasize the fact that water used to create electricity passes through the dam, then continues, clean and unaffected, down the river.
- Project *Aqua Drops by Stave Falls* for the class to see, or provide copies for students, either individually or in pairs.
- Read *Aqua Drops by Stave Falls* aloud to the class. Share with students that *aqua* is Latin for *water*.
- Have students summarize the main events of the story using Think/Pair/Share (see description in Teacher Backgrounder page 26). Have students individually write down the events in their own words and return to their desks.
- Have students create a flowchart to summarize *Aqua Drops by Stave Falls* (see sample on page 31).
 - draw a circle large enough that their fist can just fit inside (palm side down) on a blank sheet of paper.
 - use a pencil to draw each stage of Aqua's journey outside the circle and place a border around the picture.

- write a description in one or two points of what is happening and use arrows to indicate the order of events (see flow chart sample).
- colour and add a title to their flow charts.

Activity 2

- Have students return their attention to the classroom KWL chart, and add any new learnings or questions to the hydroelectricity generation, hydrologic cycle or Stave Falls sections of the chart.
- Project or provide students with the hydrologic cycle graphic to reinforce Aqua’s journey.
- Identify with the class which topic on the chart is missing the most information (Stave Falls).
- Present students with the *Stave Falls – A Special Place* handout and read it either independently or as a class.
- Add to the KWL chart, as a class, including the new information.

Activity 3

- Discuss the class field trip with the following prompts:
 - Why do you think we are going to Stave Falls?
 - What do you expect to see there?
 - What are some expectations for how we will act while we are there?
- Direct students’ attention to the KWL chart and identify all of the questions that still haven’t been answered. Discuss which ones they expect to be answered at Stave Falls.
- Generate some more questions about Stave Falls and hydroelectric generation so that students are better prepared to learn more on the field trip.

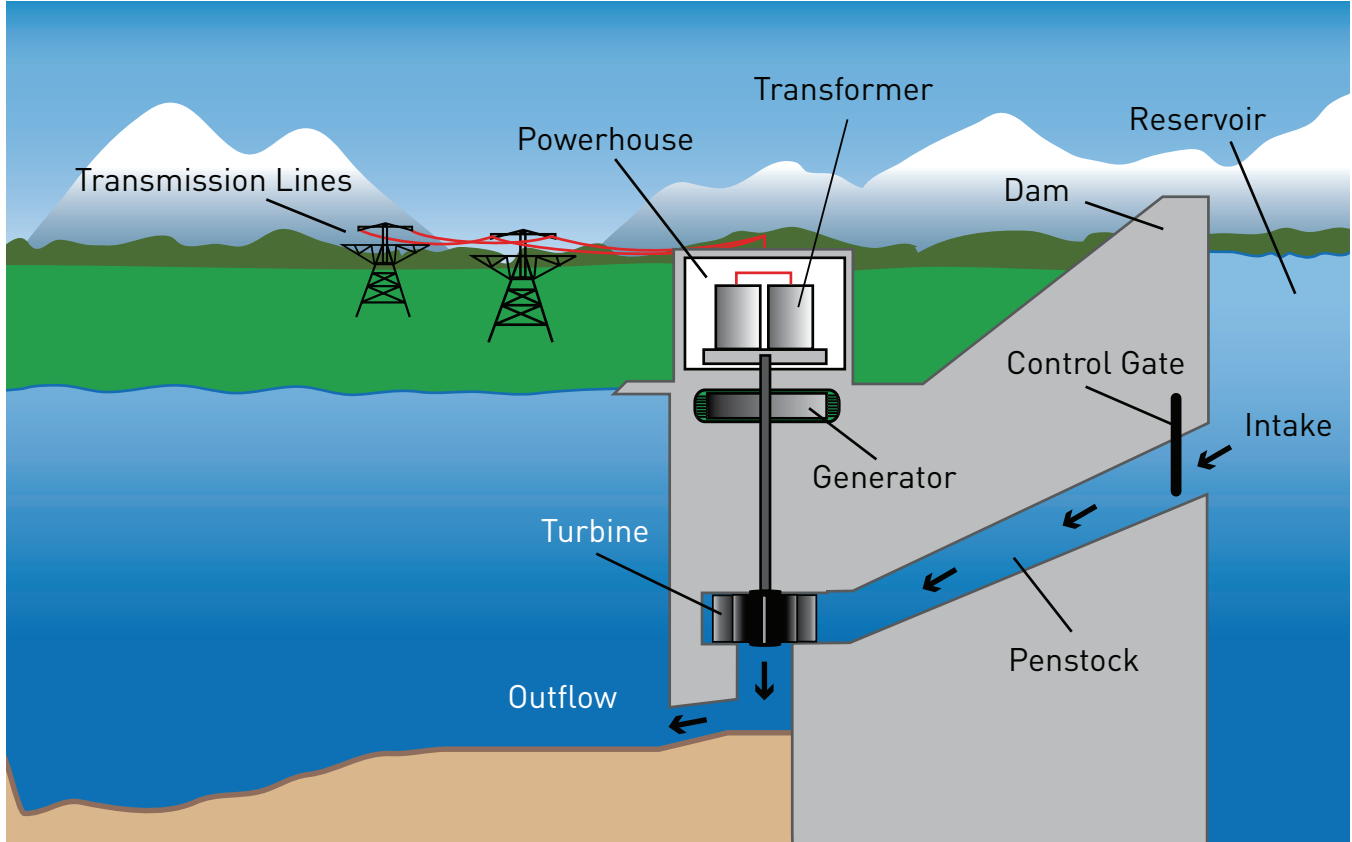
ASSESSMENT

- Collect student flow charts and evaluate them for grade-appropriate effort and accuracy.

EXTENSIONS

- Brainstorm and research other natural cycles (seasons, carbon cycle, nutrient cycle, salmon cycle, etc.) and consider creating a story to help explain the process.

HYDROELECTRIC GENERATION



How does a hydroelectric dam work?

1. Water falls on mountains as rain or snow.
2. A dam stops/slow the flow of a river to create a reservoir.
3. Reservoirs are filled.
4. Water enters intake and flows downhill in penstock.
5. Turbines inside the powerhouse are turned by force of falling water.
6. Electrical charge is created.
7. Transformer changes electricity from low to high voltage.
8. Electricity travels along transmission lines to substations and distribution lines so that it can be used.

Note: the moving water makes the turbine spin; then the water continues to flow through the dam and down the river. Hydroelectricity is renewable, because the energy from the water is used, but no water is ever removed from the natural hydrologic cycle (water cycle). The water is never “used up.” Hydroelectricity is clean, because the water is not polluted as it moves through the turbines.

AQUA DROPS BY STAVE FALLS

Hello, my name is Aqua, and I am a drop of water. I have been here since the beginning, and there are few places on planet Earth that I have not travelled. In fact, I'm almost always on the move. I could tell you stories of being frozen in a glacier that would make you shiver, or tell you about the time I went over a gigantic waterfall — and survived! Being a drop of water can take you to some very interesting places. I have been inside trees and seaweed, bugs and animals, soil and swamps. I can take several forms: solid, liquid, or gas. I've been thrown as a snowball, flowed through rivers to the ocean, streamed down human cheeks as a tear and even helped to form a rainbow once.

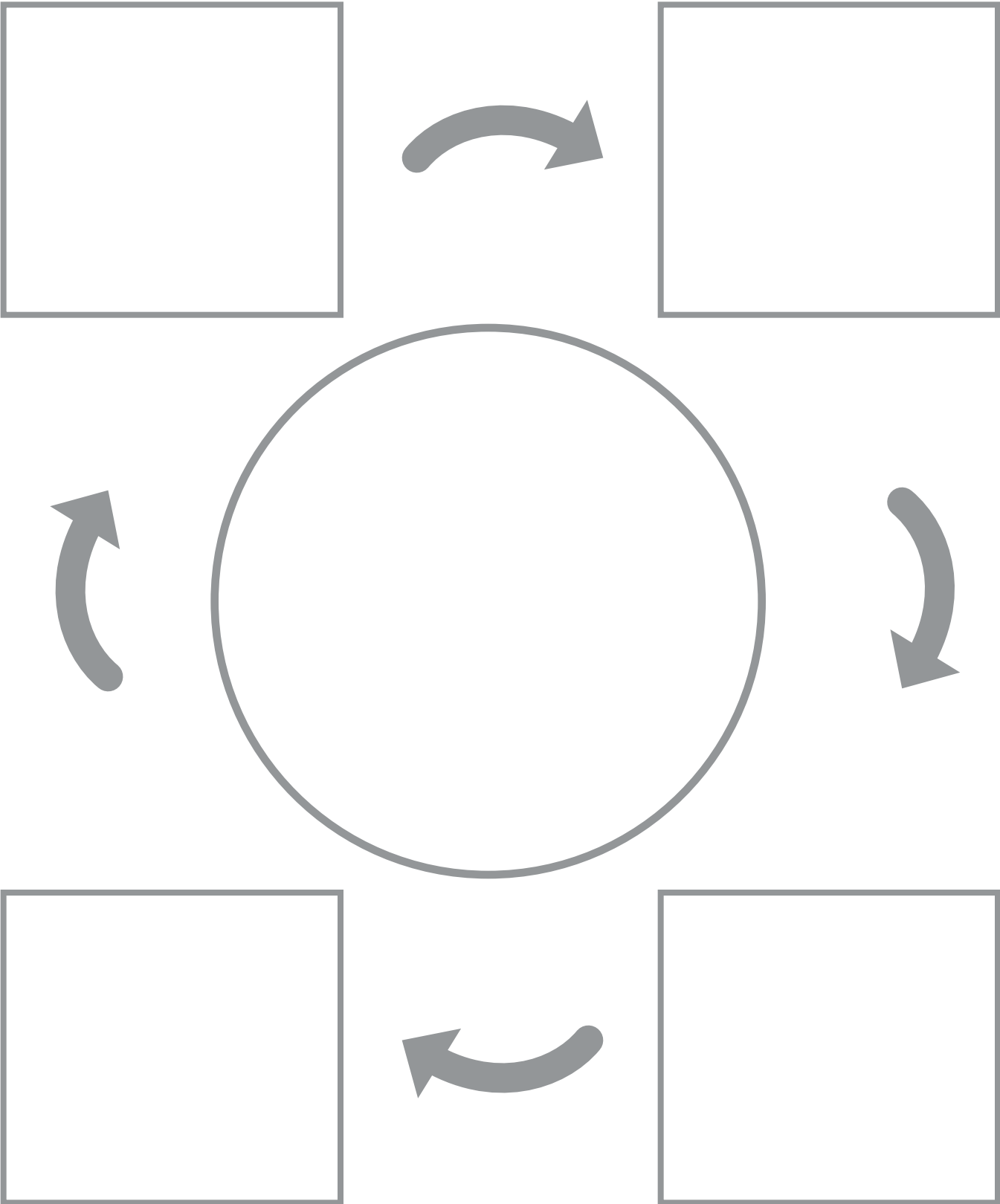
But today I want to tell you a story that happened not too far from here and is still happening every moment of every day. It's also a story that has a lot to do with you. It all started one warm summer day in the Pacific Ocean. I was just about to become part of a huge wave when I was heated up and turned into water vapour — that's a gas. I was lifted thousands of feet up into the sky until I cooled and became part of a fast-moving cloud.

My cloud, and many others, was blown towards a snow-capped mountain range when we all got squished together; and that's when things got stormy. Before I could say "H₂O," I was zooming down to Earth with the other drops raining down next to me. Some of us landed on trees and plants, others on the ground, and I made a splash in a beautiful lake; a reservoir actually. And that's when things got interesting.

Now, being a water drop I'm used to being pulled downhill by gravity, so when I started moving that way I wasn't surprised. I approached a huge concrete wall that I later learned was a dam. Suddenly I was sucked into an opening in the dam — the intake — and shot down a giant tube called a penstock. Just when I thought things couldn't go any faster, they did. I was soon spinning around the wheel of a large machine — a turbine. The energy of all the water drops forced the turbine to whirl around, and that energy was transformed into electricity.

The electricity travelled down transmission lines to a substation and then on to many places like your house. Maybe it was used to heat up water for your shower or dry your clothes for school. Meanwhile, I was flung out of the turbine, and before I knew it, the wild ride was over. I was shot through the outflow and into a lazy flowing river. By the time you hear this story, who knows where I could be? Can you imagine?

FLOW CHART SAMPLE



STAVE FALLS – A SPECIAL PLACE

heritage site:

a physical structure or landscape that is of great historical importance

Stave Falls is a special place for many reasons. As you learn about the changes that have happened there over time, try to imagine what the environment and life of the people who have lived there might have been like. On your visit to the **heritage site**, you will become a part of the living history too and perhaps make a special discovery of your own.

The history of the Stave Valley began long before people ever explored its wilderness. About 10,000 years ago, much of B.C. was covered in ice sheets. They were over a kilometre thick in places! As temperatures warmed, the ice sheets melted, leaving behind deep valleys, lakes, and small **glaciers**.

glacier:

a large mountain feature made of ancient ice and snow

First Nations people known as the Kwantlen, members of the Sto:lo Nation, were the first to settle here, with village sites at Stave Falls and Ruskin and at the place where the Stave and Fraser rivers meet. They knew the Stave River as “the source.” The Kwantlen were hunters, fishers and traders who found uses for nearly all that nature offered here, including food, shelter, tools, clothing and medicine. Like many First Nations groups throughout B.C., many were killed by **smallpox**, reducing their community from several thousand to less than 200 members today.

smallpox:

a contagious and possibly fatal disease for humans

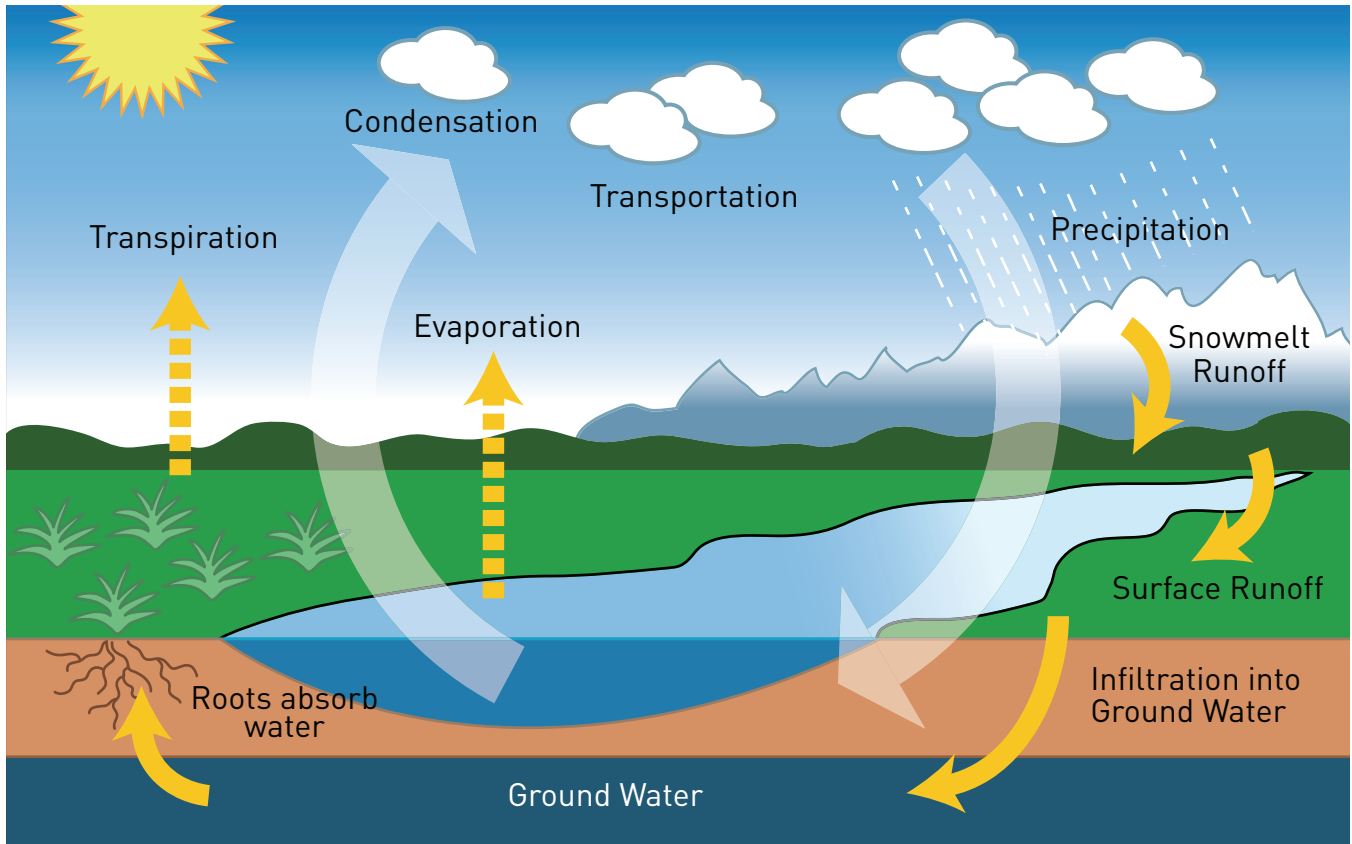
Later, European settlers arrived in search of natural resources to use and trade such as animal furs, lumber and fish. In fact, white pine trees cut down in the area were made into staves. The barrels were filled with goods to be shipped to other parts of the world. The most recent name of the valley, river and falls comes from the **staves** that formed the barrels.

staves:

wooden strips used to make barrels

In the early 1900s, people began to think about transforming the energy of the rushing river into electricity. After several failed attempts, construction on a dam at Stave Falls began in 1909, and electricity began flowing from the site to nearby New Westminster and Vancouver in 1912. A small but vibrant town was built to house workers and their families. It included a schoolhouse, dining and dance hall, bakery, bunkhouse and several homes. In the 1950s, the town was dismantled and buildings were demolished as workers moved to nearby towns. Finally, after supplying reliable and clean energy for over 80 years, the 1912 Power House at Stave Falls closed in 2000. It soon re-opened as the new visitor centre that you will be exploring with your class. A new, more efficient power house was created in 1999 and can be seen across from the visitor centre.

HYDROLOGIC CYCLE



Hydrologic Cycle

1. Precipitation (water falling to the earth as rain or snow)
2. Ground water or run-off (water that has been absorbed by the soil or funnelled into rivers or creeks)
3. Evaporation (water changing from liquid to gas form due to heat from the sun)
Transpiration (water changing directly to vapor (gas) from plants)
4. Condensation (cooling of water vapour into cloud)
5. Transportation (water vapour moving from one place to another)

SECTION TWO: FIELD TRIP

ACTIVITY: TOUR QUESTIONS

DURATION

Length of tour

MATERIALS

- *Stave Falls Powerhouse: Tour Questions* handouts for students, or pairs of students (provided by Visitor Centre staff)

PREPARATION

- Decide what is best for your students – to complete the tour questions after the tour, or use the handout as an interactive tour activity.
- If you wish, you may preview some or all of the questions with students before the trip or on the school bus.
- Visitor Centre staff will provide the handouts, if the tour questions are to be used during the tour.

ACTIVITY INSTRUCTIONS

Interactive Tour Questions:

1. Explain the purpose of the tour questions: to keep everyone focused, suggest questions to ask, provide a preview of what is coming ahead and highlight some of the important learnings.
2. Hand out question sheets to each student, or to pairs of students.
3. Provide time and reminders for students to answer the questions at appropriate times during the tour.
4. If students are working in pairs, consider a challenge to see who can complete their questions the quietest.

POWER HOUSE AT STAVE FALLS - TOUR QUESTIONS

Name: _____ Date: _____

Use this question sheet during, or following, your tour of the Power House at Stave Falls. You will find most of the answers to these questions by paying attention to your tour guide and to the information displays you see on the tour.

An answer key is available at the reception desk.

1. What natural process is explained in the short film *Rain*?

- a) nutrient cycle
- b) carbon cycle
- c) hydrologic cycle
- d) circle of life

2. Describe one interactive exhibit you experienced in Electrica and explain what you learned.

3. Was electrical power generation considered an essential service during World War II?

- Circle one. Yes No

4. Choose the animal species that is NOT common to this area.

- a) marmot
- b) osprey
- c) banana slug
- d) salmon

5. What was the first mechanical device installed in the power house?

6. Write two words to describe your experience at the penstock and dam viewing deck.

7. What do the letters CFL stand for? (Hint: not related to football!)

POWER HOUSE AT STAVE FALLS – TOUR QUESTIONS

8. What invention do you think the turbine design was inspired by?

- a) mortar and pestle
- b) water wheel
- c) steam engine
- d) printing press

9. What aspect of electricity do transformers actually transform?

- a) amps
- b) wattage
- c) current
- d) voltage

10. Considering that the Detroit Electric Car was produced in 1912, why do you think there have been so few electric vehicles produced since then?

11. What was the name of the mascot used to encourage saving electricity?

- a) Vera Voltage
- b) Curly Current
- c) Hydro Harry
- d) Reddy Kilowatt

12. Currently, the largest BC Hydro generating station is _____

13. Unscramble the jumbled letters to find out how you can save electricity just as your ancestors may have. (Hint: Doing the laundry) **nagh yrd**

14. A _____ is the name for the area of land that has surface water from all sources draining into a single point.

15. What is the name of the boat anchored just down stream from the power house?

Bonus Question: How did Stave Falls get its name?

POWER HOUSE AT STAVE FALLS – TOUR ANSWERS

1. What natural process is explained in the short film *Rain*?

- a) nutrient cycle
- b) carbon cycle
- c) hydrologic cycle**
- d) circle of life

2. Describe one interactive exhibit you experienced in Electrica and explain what you learned.

3. Was electrical power generation considered an essential service during World War II?

Circle one. **Yes** No

4. Choose the animal species that is NOT common to this area.

- a) marmot**
- b) osprey
- c) banana slug
- d) salmon

5. What was the first mechanical device installed in the power house?

crane in 1910

6. Write two words to describe your experience at the penstock and dam viewing deck.

7. What do the letters CFL stand for? (Hint: not related to football!)

Compact Fluorescent Light (bulb)

8. What invention do you think the turbine design was inspired by?

- a) mortar and pestle
- b) water wheel**
- c) steam engine
- d) printing press

POWER HOUSE AT STAVE FALLS – TOUR ANSWERS

9. What aspect of electricity do transformers actually transform?

- a) amps
- b) wattage
- c) current
- d) voltage**

10. Considering that the Detroit Electric Car was produced in 1912, why do you think there have been so few electric vehicles produced since then?

11. What was the name of the mascot used to encourage saving electricity?

- a) Vera Voltage
- b) Curly Current
- c) Hydro Harry
- d) Reddy Kilowatt**

12. Currently, the largest BC Hydro generating station is G.M. Shrum/WAC Bennett Dam

13. Unscramble the jumbled letters to find out how you can save electricity just as your ancestors may have. (Hint: Doing the laundry) **nagh yrd**

hang dry

14. A watershed is the name for the area of land that has surface water from all sources draining into a single point.

15. What is the name of the boat anchored just down stream from the power house?

MV Shirley

Bonus Question: How did Stave Falls get its name?

White Pine trees were harvested in the area and made into staves to form shipping barrels. Goods were sent in these barrels as far away as Hawaii.

ACTIVITY: TIMELINE

DURATION

20 minutes

MATERIALS

- timeline cards (provided by Visitor Centre staff)
- timeline overview

PREPARATION

- Review the timeline to familiarize yourself with the items to be discussed.

ACTIVITY INSTRUCTIONS

1. Find an area (inside or outside) big enough for your class to form a circle, and ask students to form the circle as quickly and quietly as possible.
Tip: with hands on hips, elbows should be touching for a good size circle.
2. Hand out one timeline card for each pair of students. Retain extra cards, if any.
3. Find a place for yourself between two students.
4. Have students hold their card in front of their chest so all cards are visible to the class.
5. Go around the circle and have each student read aloud his or her historical event.
6. Tell students they will have a limited time (about five minutes) to arrange themselves in chronological order from the earliest event to the most recent. For younger grades, ask them to share strategies for success before starting, and guide them with suggestions as needed.
7. At the end of the five minutes, recognize their efforts and check for accuracy. Rearrange the order as needed.
8. Read aloud the correct order of events.
9. Ask students to consider any or all of the following questions:
 - What event has been the most significant to your life and the lives of British Columbians?
 - What event do you think has had the biggest impact on Stave Falls?
 - Is there a significant event or invention that should be included here but is not? Why?
10. Collect the timeline cards to return to the tour guide.

EXTENSION

- Back in the classroom, have students choose an invention or event and research details about the impact it has had on society.
- Back in the classroom, have students create their own timelines starting with their birthday and choosing what they believe are the most significant events or inventions in their lives to the present day.

STAVE FALLS TIMELINE

1. **45 million years ago:** Coast Mountains formed
2. **2 million years ago:** Last Ice Age begins
3. **10-20,000 years ago:** Glaciers retreat
4. **8-10,000 years ago:** Sto:lo inhabit the Fraser Valley
5. **300:** Waterwheel invented
6. **1792:** Captain George Vancouver enters Burrard Inlet
7. **1880:** Light bulb is patented by Thomas Edison
8. **1907:** Building of Power House at Stave Falls begins, washing machine invented
9. **1912:** Stave Falls generates electricity for public use
10. **1969:** NASA lands on the Moon
11. **1973:** Personal computer invented
12. **1977:** Cell phone invented
13. **2001:** New Stave Falls Visitor Centre opens
14. **2010:** Vancouver Winter Olympic Games

ACTIVITY: SCAVENGER HUNT

DURATION

20 minutes

MATERIALS

- scavenger hunt checklist (provided by Visitor Centre staff)

SPECIES SCAVENGER HUNT

The species scavenger hunt is a tool intended to provide students with an opportunity to increase their awareness of the living world found in the Stave Falls area. Teachers and students may spot many of the species listed, although some are most active between dusk and dawn or can be more frequently seen during certain times of the year. Encourage students to challenge their observation skills by finding as many species within the timeframe (or on later nature explorations) as they can.

ACTIVITY SUGGESTIONS

- Remind students to **Leave no trace: leave only footprints and take only memories** while exploring the outdoor spaces. Tell them not to collect any natural objects.
- Suggest to students that sightings are only “official” once they have shared it with another student.
- Many animals are most active at dawn and dusk and may be harder to locate outside those periods. Students can continue to look for species back at school or in their neighbourhoods also.
- In some cases, the signs of local species are more evident than the species themselves (e.g., woodpecker holes, bird nests, animal scat or tracks, etc.).
- This list is a small sample considering that “B.C. is Canada’s most biologically diverse province containing significant numbers and variety of plants, animals, and ecosystem types including: 488 species of birds, 480 species of fish, 136 species of mammals, 20 species of amphibians, and 16 species of reptiles.” (BC Ministry of Environment, 2011)
- See the Green Schools link in the resources section of the Stave Falls: Power and Place resource to learn more about integrating environmental education across the curriculum.

SCAVENGER HUNT

The Stave Falls area is home to a variety of living things and historical treasures. Use your observation skills and senses to discover them.

Name _____

- Beaver (or signs)
- Bald Eagle
- Duck
- Raven
- Loon
- Canada Goose
- Woodpecker (or signs)
- Bird's nest
- Garter snake
- Frog
- River Otter
- Squirrel
- Deer
- Spider
- Spider web
- Banana Slug
- Cedar
- Douglas Fir
- Salmonberry
- Waterfall
- MV Shirley
- Others _____
- _____
- _____

SCAVENGER HUNT

The Stave Falls area is home to a variety of living things and historical treasures. Use your observation skills and senses to discover them.

Name _____

- Beaver (or signs)
- Bald Eagle
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- River Otter
- Squirrel
- Deer
- Spider
- Spider web
- Banana Slug
- Cedar
- Douglas Fir
- Salmonberry
- Waterfall
- MV Shirley
- Others _____
- _____
- _____

SECTION THREE: POST-TRIP

LESSON 3: A DAY IN THE LIFE

DURATION

60 minutes

OBJECTIVES

Students will be able to:

- use their imagination and recollection to write a “day in the life” story
- create an inventory of their electricity use during a typical day
- critically evaluate their energy use and consider ways to reduce and conserve

MATERIALS

- *Stave Falls Timeline* PDF (page 48, for projection or making copies)

PREPARATION

- Have an electronic version, or paper copies, of the timeline available for students to refer to.

FRAMING THE CONTENT

- Visiting the Power House at Stave Falls can feel as if one has travelled back in time to the early part of the last century. Certainly, much has changed in the way children and adults live today due to dramatic shifts in our society’s knowledge, technology and values. Focusing on the history of Stave Falls and hydroelectric generation is an opportunity to examine the changes that have occurred and to see electricity in a new way.
- This new knowledge will add to students’ ability to look at the challenges facing energy decisions in the future.

LESSON DEVELOPMENT

Activity 1

- As an introduction, tell students they will be using their experiences at the Power House at Stave Falls to look at how energy use has changed over time and to examine their own electricity use.
- Have students think (individually, in small groups, or as a class) about all of the ways that they use electricity each day from the time they awake until they go to bed. Have each student make a list of the electronic devices and appliances that they use daily.
- As a class, discuss the devices and appliances that may have been available in 1910, and what people living in 1910 would have used instead of what we use today.

- After students have made their lists, write the following headings on the board: food preparation, heating, lighting, entertainment, communication, recreation, transportation and school.
- Ask students if there are additional areas related to daily energy use that should be added.
- Explain that these headings serve as prompts to help them shape a creative writing piece that they will be doing.

Activity 2

- Tell students they will be writing about a day in the life of a student. Assign half of the class to write about a present-day student's life, and the other half to write about what a day might have been like for a student living in Stave Falls in 1910.
- Provide enough time for students to prepare a rough draft, following the writing process they are already familiar with.

Activity 3

- Have each student partner with another student who has written about the alternate time period.
- Have each student read aloud or exchange his or her story with the other. If appropriate, suggest that students give feedback to each other using a procedure they are already familiar with, or suggest *Two Stars and a Wish*:
 - After reading a peer's work, students identify two things they liked (the stars) and one suggestion for the next draft (the wish).
- If time allows, ask volunteers to share their stories. Include at least one from each era.

Activity 4

- Have students return to their lists of electrical devices and appliances and ask students to rank the top three or five devices that they believe they could not live without or that they use most frequently.
- Invite students to suggest which devices they could reduce the use of and challenge them to commit to using less of those devices for a certain number of days.
- Check in with the class throughout and at end of the commitment period to learn about their experiences.

ASSESSMENT

- Assess students' writing based on a grade appropriate rubric.
- Assess students' partner work and feedback, focusing on effort, thoughtfulness and participation.

EXTENSIONS

- Have students create a Venn diagram after they have exchanged their stories to compare the time periods and identify similarities and differences related to electricity use.
- Have students revise their draft writings into polished pieces using a familiar writing process.
- Discuss with the class what they hope the future of electronics and appliance use might look like and how students of the future will conserve power.
- Using Google Earth software, explore the Earth at night and show students the range of energy use throughout the planet. Remind students that some developing nations have not advanced their use of electricity as significantly as developing countries since the early part of the last century. To view the Earth at night follow these steps:
 1. Download and run Google Earth (see www.earth.google.com)
 2. In the view tab, select **Side bar**
 3. Select **Layers**
 4. Select **Gallery**
 5. Select **Earth City Lights**
 6. Start exploring
- Visit FirstWave (www.bchydro.com/firstwave) to learn about additional education programs supporting school-based conservation.

STAVE FALLS TIMELINE

1. **1792:** Captain George Vancouver enters Burrard Inlet
2. **1808:** Simon Fraser navigates the river that later bears his name
3. **1821:** Electric motor invented
4. **1827:** Hudson's Bay Company builds Fort Langley on the Fraser River
5. **1867:** Canada enters Confederation with four provinces
6. **1871:** British Columbia becomes a province
7. **1880:** Light bulb is patented by Thomas Edison
8. **1885:** "The Last Spike" completes the Canadian Pacific Railway
9. **1886:** Gasoline engine invented
10. **1893:** Radio invented
11. **1897:** Klondike Gold Rush begins
12. **1907:** Building of Power House at Stave Falls begins, washing machine invented
13. **1912:** Stave Falls generates electricity for public use
14. **1914 – 1918:** World War I
15. **1916:** Canadian women given right to vote
16. **1930s:** The Great Depression
17. **1939-1945:** World War II
18. **1962:** BC Hydro created
19. **1969:** NASA lands on the Moon
20. **1973:** Personal computer invented
21. **1977:** Cell phone invented
22. **1983:** Hayward Lake Recreation Area opens. Internet invented
23. **1999:** New Stave Falls powerhouse comes into service
24. **2000:** Original Stave Falls plant shuts down
25. **2001:** New Stave Falls Visitor Centre opens
26. **2010:** Vancouver Winter Olympic Games

LESSON 4: AND... ACTION!

DURATION

30 minutes (or more, depending on prior knowledge)

OBJECTIVES

Students will be able to:

- demonstrate their understanding of the process of hydroelectricity generation and the hydrologic cycle through drama exercises

MATERIALS

- *Hydroelectric Generation* image PDF (page 52, for projection or making copies)
- *Hydrologic Cycle* image PDF (page 53, for projection or making copies)
- *Drama Assessment Rubric* PDF (page 54, for projection or making copies)

PREPARATION

- Decide whether or not students will be demonstrating both processes.
- Have copies of *Hydroelectric Generation* and *Hydrologic Cycle* available for groups of students, or, alternatively, have the images projected for the class to see with an overhead or LCD projector.
- The concepts of hydroelectric generation and the hydrologic cycle were explained in lesson 2.

LESSON DEVELOPMENT

Activity 1

- Explain to the class that there are many ways to learn and develop understanding of an idea. Ask for examples from their own experiences. (They may mention reading, drawing, teaching, listening to a teacher, doing, observing a demonstration, etc.)
- Explain that the class is going to reinforce the learning of two concepts through drama or acting out using their bodies.
- Review hydroelectric generation and the hydrologic cycle by discussing and looking at the diagrams of each.
- Use one or all of the warm-up activities listed on page 51 to allow students to feel comfortable representing a process with physical action.
- Arrange students into groups of four to six. (Ideally, reluctant or shy students as well as enthusiastic performers can be distributed throughout the groups.)
- Remind students to think about their trip to Stave Falls, and to incorporate what they remember seeing and hearing while on the field trip.

- Review the guidelines with the students:
 - Groups are to create a performance that will explain one of the processes (hydroelectric generation or hydrologic cycle).
 - Groups have five to seven minutes to develop their performance.
 - All students need to have an active role in the performance.
 - Motion and sound need to be part of each stage of the process/performance, but there is to be no speaking.
 - Performances should not exceed one minute.
 - Be respectful of others and yourself.
 - The end of the performance is signalled by an actor saying “The end, thank you very much” and the audience giving polite applause.

Activity 2

- Hand out copies of Drama Assessment Rubric to each group before the presentations so students know what is expected of them.
- Create a “stage area” and allow the performances to begin.
- Encourage feedback from the audience to identify parts that were well-executed, or to ask questions.
- After the performances, ask students to discuss the following questions and share their answers with the group, or alternatively, present the questions for students to answer individually, as a written reflection of the activity:
 - How are the two processes similar and different?
 - What stage of the process has the most action or requires the most energy?
 - Which part of the process might be the quietest? The loudest?
 - Was this a helpful way to learn for you? Why or why not?

Optional: Class may vote for the group that best explained the process, had most energy/ participation, or best followed the guidelines.

ASSESSMENT

- Use the *Drama Assessment Rubric* to assess the students’ participation in the performances.
- Provide the *Drama Assessment Rubric* for students to self-assess

EXTENSIONS

- Invite students to suggest (or brainstorm as a class) other methods (e.g., drawing a storyboard, creating an animation, writing a song) that explain one of the processes or a related process in a different way.

DRAMA WARM-UPS

Rainstorm

Description: The entire class follows the teacher's actions to make the sound of a passing thunderstorm.

- The class forms a circle with teacher in the centre.
- The teacher faces each student in the circle in turn, doing one of the actions below. Students copy the teacher's action until the teacher circles around again with a new action.
- Order of actions: fast hand rubbing, two finger clapping, finger snapping, thigh slapping, foot stomping. Then reverse and fade out.

Statue

Description: Small groups of three to five students improvise a scene following the lead of the first student.

- The first student enters the performance area and becomes a statue of any object, stating "I am a..." (e.g., tree).
- The next student joins the first and becomes a related object, stating his or her role (e.g., "I am a squirrel sitting at the base of the tree") and acts appropriately.
- Action continues until all players are a part of the scene.
- Students can take turns setting the scene as the first actor.

Mirror

Description: Students observe and mimic each other's actions in a short, silent activity.

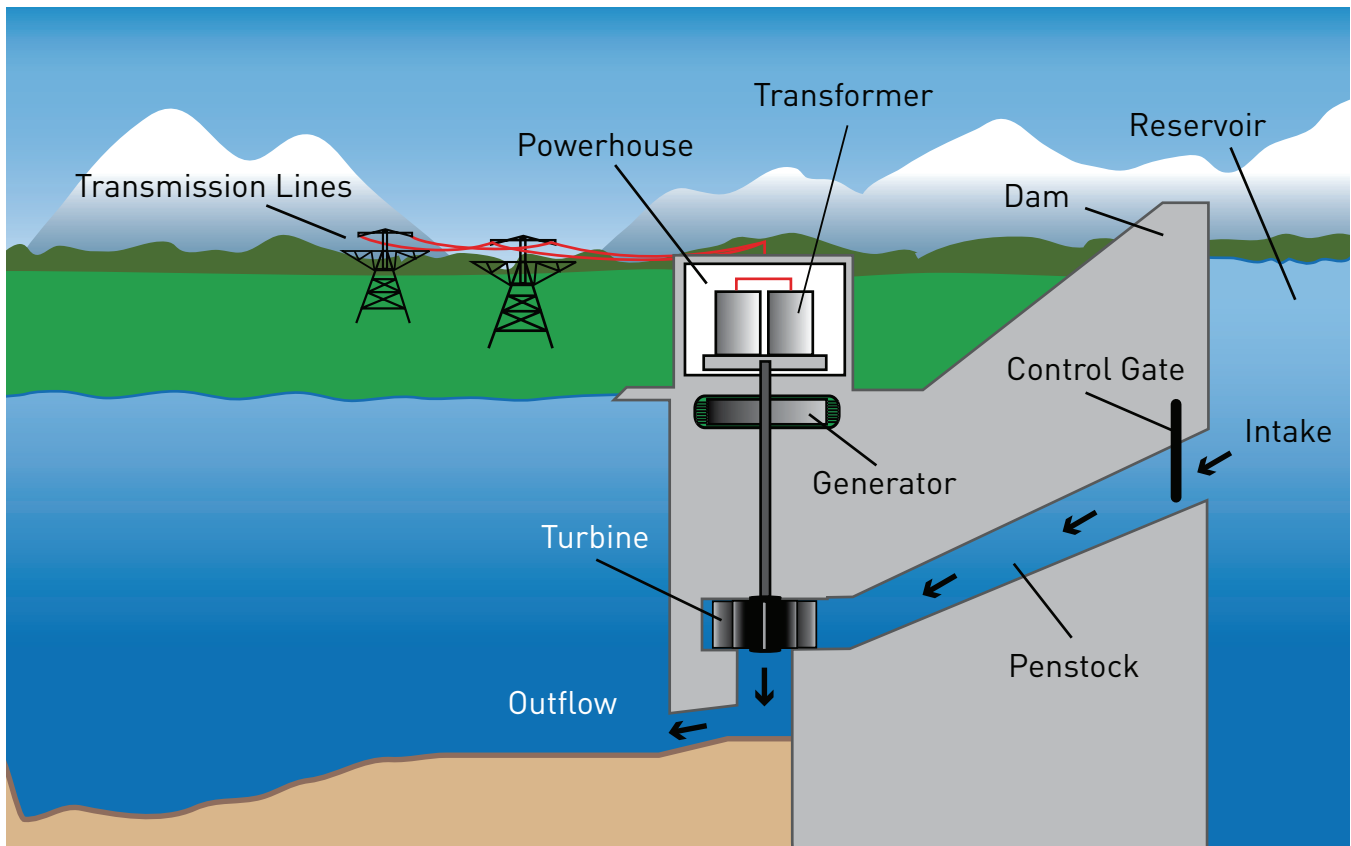
- Students form pairs.
- Students play rock/paper/scissors to decide who goes first.
- The first student stays in place and makes small, slow gestures using any body part including facial features.
- The second student "mirrors" the partner as closely as possible.
- Larger and faster movements may be encouraged if students are inclined.
- After two, students switch places.

Music Box

Description: The entire class creates a cacophony of sound by individually making their own and adding to the group's "music."

- The class forms a circle.
- The teacher chooses someone (or asks for a volunteer) to make the first sound and continue to repeat it for the duration.
- The next student makes a different sound, adding to the first. including facial features.
- Each student adds a sound to the others.

HYDROELECTRIC GENERATION

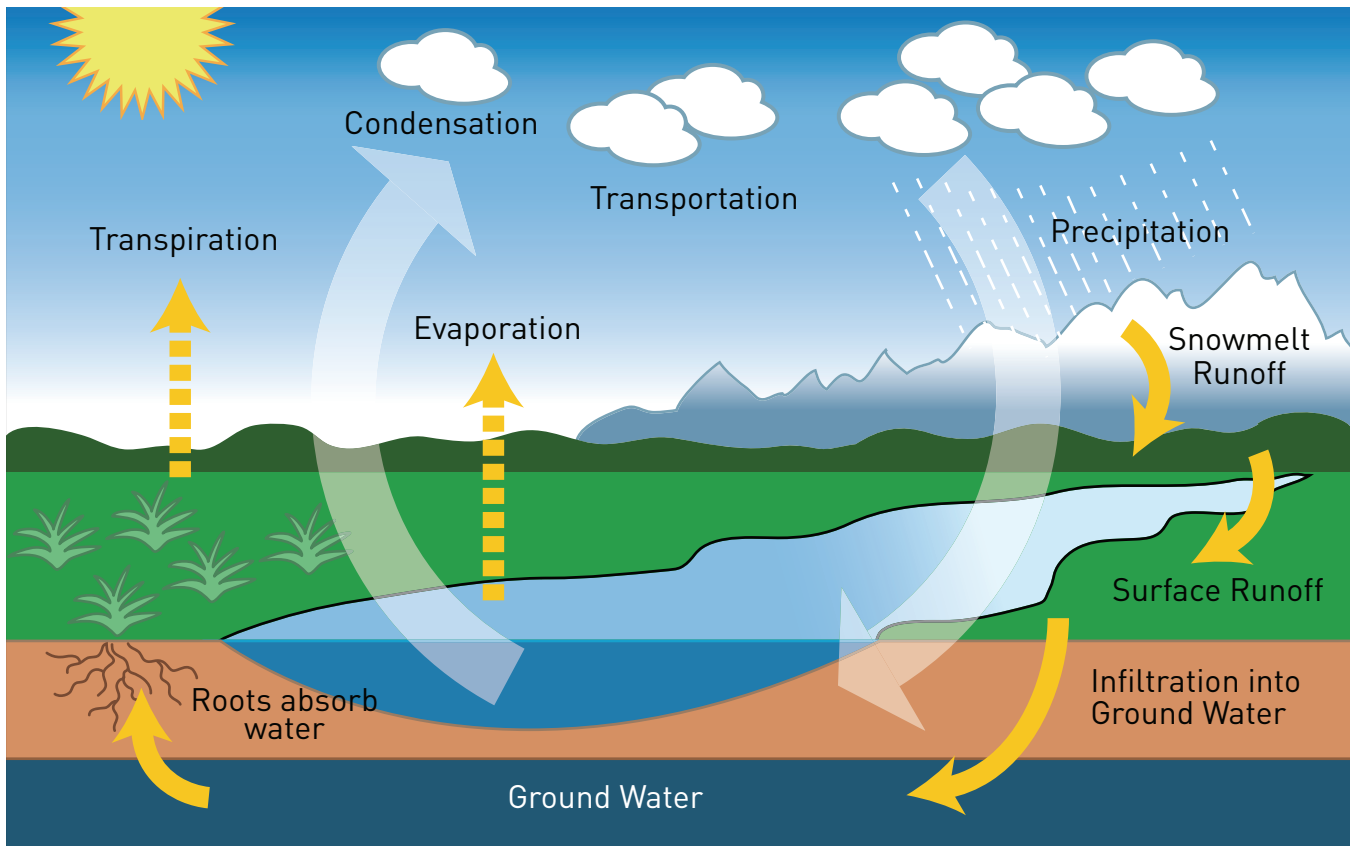


How does a hydroelectric dam work?

1. Water falls on mountains as rain or snow.
2. A dam stops/slows the flow of a river to create a reservoir.
3. Reservoirs are filled.
4. Water enters intake and flows downhill in penstock.
5. Turbines inside the powerhouse are turned by force of falling water.
6. Electrical charge is created.
7. Transformer changes electricity from low to high voltage.
8. Electricity travels along transmission lines to substations and distribution lines so that it can be used.

Note: the moving water makes the turbine spin; then the water continues to flow through the dam and down the river. Hydroelectricity is renewable, because the energy from the water is used, but no water is ever removed from the natural hydrologic cycle (water cycle). The water is never “used up.” Hydroelectricity is clean, because the water is not polluted as it moves through the turbines.

HYDROLOGIC CYCLE



Hydrologic Cycle

1. Precipitation (water falling to the earth as rain or snow)
2. Ground water or run-off (water that has been absorbed by the soil or funnelled into rivers or creeks)
3. Evaporation (water changing from liquid to gas form due to heat from the sun)
Transpiration (water changing directly to vapor (gas) from plants)
4. Condensation (cooling of water vapour into cloud)
5. Transportation (water vapour moving from one place to another)

DRAMA ASSESSMENT RUBRIC

| Criteria | Level of Achievement | | | |
|--|----------------------|------------|---------|----------|
| | Beginning | Developing | Capable | Powerful |
| Listening Listened to and followed teacher instructions Listened to other group members Allowed all ideas to be heard | | | | |
| Participation Got involved Gave best effort Encouraged others | | | | |
| Understanding Demonstrated the process clearly Asked questions for clarification if necessary Stayed within the time limit | | | | |
| Cooperation Offered ideas and listened to others Provided positive feedback Able to compromise when necessary | | | | |

LESSON 5: WHERE DO YOU STAND?

DURATION

30 minutes

OBJECTIVES

Students will be able to:

- define the terms natural resource, renewable resource and non-renewable resource
- classify resources and products in categories of renewable and non-renewable
- name daily actions that may help to conserve resources

MATERIALS

- projector
- *Hydro Power: Thinking of Our Future* PDF (page 57, for projection or making copies)
- *Where Do You Stand? Statements* PDF (page 58, for projection or making copies)

PREPARATION

- Set up computer and projector to display *Hydro Power: Thinking of Our Future* and the Activity 2 statements, or have copies ready to hand out to students.

TEACHER BACKGROUND

- Students may benefit from a review of effective listening behaviours and how to respectfully consider other's ideas and opinions.

FRAMING THE CONTENT

- This lesson presents conservation statements for students to respond to and reflect upon.

LESSON DEVELOPMENT

Activity 1

- Write the following words and definitions on the board: natural resource, renewable resource and non-renewable resource (see below for definitions). Option: Ask the class to consider their own definition of the terms and develop a class consensus through conversation.
- Use projector to display *Hydro Power: Thinking of Our Future* and read aloud. Alternatively, hand out the reading for students to read silently.

Activity 2

- See the list of statements on page 58. Consider using fewer statements and encouraging longer discussions, if appropriate for your group.
- Draw a line down the middle of the board and write “agree” and “disagree” on either side.
- Tell the class that you will read a number of statements related to resources and their use.
- Ask students to move to one side of the line or the other to show if they agree or disagree.
- Let students know that they will be expected to explain their decision if called upon and may change their position once new information is made available.
- Ask students to stand up and be ready to respond to the following statements.
- Tell students that it is important for them to think independently and not simply follow others. Also, they should refer to the definitions on the board to help guide their decisions.
- Use student responses to guide discussions about some of the statements, particularly if there is an even split between responses.
- Allow students who answer in the minority to have the opportunity to explain their thinking and hear from the other side.
- After discussing, allow students the option to change their mind.

Activity 3

- Show the list of statements to the students.
- Have students choose one statement and write a response that explains their opinions about the statement, and what is important about the statement.
- Use familiar writing processes or suggest students consider using who, what, when, where, why and how questions to guide their responses and add details to their writing.

ASSESSMENT

- Assess students’ participation in the activity.
- Assess students’ responses for grade-appropriate writing conventions and thoughtfulness

EXTENSIONS

- Follow up the *Where Do You Stand?* activity with a free-writing piece. Have students write everything they know about the word conservation.
- Discuss with the class, “What does it mean to stand up for what you believe”?
- Introduce and explore the concept of sustainability.

DEFINITIONS

Natural resource: a material or type of energy provided by the Earth

Renewable: replenished or replaced by natural processes or not diminished by use — for example, solar, wind, tide, geothermal, biofuel and hydro

Non-renewable: cannot be replaced once used

HYDRO POWER: THINKING OF OUR FUTURE

Hydroelectricity: A renewable source of energy made by the force of moving or falling water

Conservation: the protection and preservation of a valuable thing for future use

Following your trip to the Power House at Stave Falls, you now know how 95 percent of B.C.'s electricity is produced. However, you may be surprised to learn that the method for producing electricity varies around the world.

Everywhere on our planet, electricity is created by using the Earth's natural resources and converting them into electric power. Some of the resources used are renewable; that is, the Earth replenishes or replaces them even after they are used. Solar, wind, tidal, geothermal and bio-fuel are examples of renewable resources. Resources that we use that cannot be replaced are called non-renewable. Examples include fossil fuels such as coal, oil and natural gas, and uranium used for nuclear power.

As long as enough water continues to flow, hydroelectricity can be produced as a clean energy source. During the electricity generation process, water moves through a turbine to produce electricity, then continues to flow down the river, so it doesn't leave the water cycle (and doesn't get used up). In this province, BC Hydro produces the electricity that most people use. BC Hydro carefully looks at the impacts of generating electricity and plans for a future with more green energy in the electric system.

For all of us, being aware of our energy use, using only what we need and using our energy wisely will help to conserve all resources for future generations. It is the actions that we take today that matter most.

In the activity *Where Do You Stand?* you and your classmates have the opportunity to look at your thinking and actions about resource conservation. Hopefully you will be reminded of the ways you are already helping to save resources and making a difference with your daily choices.

WHERE DO YOU STAND? STATEMENTS

1. I use natural resources every day.
2. I need natural resources to survive.
3. Carpooling, walking or cycling to school saves natural resources.
4. Coal and fossil fuels are renewable resources.
5. Wearing a sweater and turning down the heat conserve energy.
6. I know why I should turn the tap off while I brush my teeth.
7. Of the 3 Rs, reducing is the hardest.
8. Most of the electricity in B.C. comes from hydroelectricity.
9. Wind, tidal and solar power are examples of renewable resources.
10. I took an action today to conserve a natural resource.
11. Everything I use comes from the Earth.
12. Gold is the most valuable resource.
13. Hydroelectricity is a clean source of electricity. (Clean means it doesn't create pollution when it is generated.)
14. Conserving resources is hard to do.
15. Hydroelectricity is a renewable energy source.
16. Fish are a non-renewable resource.
17. Technology can solve our environmental challenges.
18. My conservation actions can make a difference.
19. I will share what I know about conservation with others.
20. The present is better than the past and the future will be better than the present.

APPENDIX

RECOMMENDED RESOURCES

PRINT RESOURCES

Station Normal: The Power of Stave River. Hugh and Andrew Wilson. 2001

In 1911, electrical power from Stave Lake flowed to New Westminster and Vancouver. Published in association with B.C. Hydro, this is the story of life in a company town where everyone was family.

Gaslights to Gigawatts. Power Pioneers. 1998

A detailed human history of BC Hydro and its predecessors as told by the people who lived it, the Power Pioneers. The Power Pioneers are an organization of more than 5000 retired BC Hydro employees that contribute to communities across B.C. through fundraising and volunteer activities.

WEB RESOURCES

BC Hydro – Stave Falls Visitor Centre

http://www.bchydro.com/community/recreation_areas/stave_falls_visitor_centre.html

This site provides information about hours, admission fees, access, and directions.

BC Hydro – Power Smart

www.bchydro.com/powersmart

This site has information about how families can take action on climate change and energy conservation.

BC Hydro – First Wave

<http://www.bchydro.com/firstwave>

FirstWave is a unique and engaging website that supports BC Hydro's education programs with interactive actions and games for students, and on-line lesson support for teachers.

Green Schools, BC Ministry of Education

www.bced.gov.bc.ca/greenschools

The Ministry of Education is working in partnership to establish and coordinate Green School Initiatives and strategies. This site provides information and updates of projects that support B.C. students in becoming local leaders and improving their sustainable practices in everyday life.

EcoKids

<http://www.ecokids.ca>

This site provides environmentally educational games, stories, a picture gallery, calendar of events, contests, and facts about Earth's environment.

TEACHER CHECKLIST

- Read the Teacher Guide and resource components
- Contact the Stave Falls Visitor Centre to ensure there are bookings available (reserve space early, as spring and fall bookings fill up quickly)
- Review field trip details: date and time, cost, location, etc.
- Confirm your field trip with the Stave Falls Visitor Centre
- Complete any field trip forms required at your school
- Arrange for transportation to the meeting site
- Send Field Trip Information and Consent Forms home
- Invite parent or support staff participation
- Complete pre-visit components in class
- Review your field trip expectations and What to Bring list with students
- Visit Stave Falls Visitor Centre
- Complete post-trip lessons

FIELD TRIP TIPS

Perhaps you are accustomed to taking your classes on field trips, or you are just starting to explore the opportunities for learning beyond the classroom.... or you fall somewhere in between. Regardless of your experience, we hope you will find the following class management tips helpful during your Stave Falls field trip and beyond.

BEFORE YOU GO

- Be familiar with your destination and know what to expect.
- Be clear about student and teacher expectations. Consider answering the questions as a class: *What will a successful field trip look like for everyone? What are the common goals? What is the plan?*
- Review classroom rules and ask students how they can be translated to the field trip setting.
- Remind students that the field trip guides and staff are to be listened to respectfully, and their instructions are to be followed.
- Include students in the planning and fundraising (if needed).
- Invite a responsible parent or staff to support your class management.
- With student input, establish a signal that will tell students it is time to *stop, look, and listen*. Then practice at school. Example: Teacher says: *Power*, Students respond: *Smart!* (They are then expected to stop, direct eyes to speaker, and listen or gather together.)
- Review what participants will need to wear, bring and do to be prepared and enjoy the field trip. Consider packing extra snacks, water, and garbage bags (for emergency rain gear).

UPON ARRIVAL

- Account for all students and number off at intervals (especially arrival and departure). Ask students to call out their number in order to focus attention and ensure that everyone is present.
- Ask students to state pre-arranged behaviour expectations and the “attention signal.”
- Check in with the class’ needs: provide snack and bathroom breaks in keeping with your school’s routine if practical.
- Make sure students are aware of hazards and clearly define physical boundaries at each location.
- As much as is possible, let the location be the teacher: share your questions and curiosity with learners and invite sensory exploration.

WHAT TO BRING

STUDENTS

- Rain jacket
- Closed-toe shoes (runners) or boots
- Warm hat or sun hat
- Pen/pencil
- Note paper
- Lunch and snacks
- Full water bottle

TEACHERS

- Rain jacket
- Warm hat or sun hat
- Class list
- Contact info (bus or parent drivers, school, visitor's centre)
- Mobile phone
- Watch
- Map
- Pen/pencils
- Note paper
- Lunch and snacks
- Water bottle

OPTIONAL

- Camera
- Field guides
- Binoculars

SAMPLE PERMISSION LETTER

Your Elementary School
123 Street
Anywhere, BC
A1B 2C3

Re: Stave Falls Power House Field Trip

Dear Parent/Guardian,

On _____ our class will be going on a field trip to BC Hydro's National Historic site, the Power House at Stave Falls in Mission. The purpose of our visit is to explore the rich history of the site as well as to learn about hydroelectric power generation and energy conservation. The Visitor Centre features a short film, interactive displays, archival images and artifacts, and the original components of the facility constructed over a century ago. In addition, we may explore the adjacent Hayward Lake Recreation Area during a short nature walk. Information about the Visitor Centre can be found at www.bchydro.com/stavefalls.

The cost for the field trip is \$4.00 per student and we are asking each student to bring _____ to cover the cost of the field trip and school bus rental. Also, please ensure that your child is dressed for the day's weather and has a bag lunch for the day.

If you have any questions about the field trip or would like to assist in student supervision for the day, please contact the school.

Thank you,

Your Name

STUDENT REFLECTION

Name _____ Date _____

Please take some time to think about your experience at Stave Falls. What did you think and learn during your visit? Answer the questions below as best as you can and be prepared to share your answers.

1. The most interesting thing I learned during my trip to Stave Falls was...

2. A part of the field trip I would like to learn more about is...

3. I was able to get the most out of the field trip because I...

4. Something I am left wondering about is...

5. One area in which I think I could improve on my next trip is...

6. If I was in charge of planning this field trip next time I would...

7. One last thing I would like to mention is...
