



Running Water

Teacher's Guide



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Resource Authors:

Jason Toner	Inside Education
Tracy Chute	Inside Education
Patty Schultz	Inside Education

Resource Package Designer:

Christine Frost	Inside Education
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Technical Review by:

Al Borkent	Elk Island Public S.D.
Jeff Lee	Clearview S.D.

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David Hill	Alberta Irrigation
Roger Hohms	Alberta Agriculture, Food and Rural Development
Shelleen Lakusta	Alberta Environment
Dave Prescott	Alberta Sustainable Resource Development
Beverly Yee	Alberta Environment

Inside Education
www.insideeducation.ca
info@insideeducation.ca
P: 780-421-1497

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ALBERTA CURRICULUM CONNECTIONS

Social Studies

Grade 5

- 5.1.2 How do landforms, bodies of water and natural resources affect the quality of life in Canada?
- 5.1.3 In what ways do natural resources and the physical geography of a region determine the establishment of communities?

Science

Grade 5

Topic E: Wetland Ecosystems

Students will:

- Recognize and describe one or more examples of wetland ecosystems found in the local area; e.g., pond, slough, marsh, bog, fen.
- Understand that a wetland ecosystem involves interactions between living and nonliving things, both in and around water.
- Identify human actions that can threaten the abundance or survival of living things in wetland ecosystems; e.g., adding pollutants, changing the flow of water, trapping or hunting pond wildlife.

Grade 7

Unit A: Interactions and Ecosystems

- Identify examples of human impacts on ecosystems, and investigate and analyze the link between these impacts and the human wants and needs that give rise to them (e.g., identify impacts of the use of plants and animals as sources of food, fibre and other materials; identify potential impacts of waste products on environments).
- Analyze an ecosystem to identify biotic and abiotic components, and describe interactions among these components.
- Describe the process of cycling carbon and water through an ecosystem.
- Identify intended and unintended consequences of human activities within local and global environments (e.g., changes resulting from habitat loss, pest control or from introduction of new species; changes leading to species extinction).
- Analyze a local environmental issue or problem based on evidence from a variety of sources, and identify possible actions and consequences (e.g., analyze a local issue on the control of the beaver population in a nearby wetland, and identify possible consequences).

Grade 8

Unit E: Freshwater and Saltwater Systems

- Describe the distribution and characteristics of water in local and global environments, and identify the significance of water supply and quality to the needs of humans and other living things.
 - Describe in general terms, the distribution of water in Alberta, Canada, and the world; and interpret information about water characteristics (e.g., identify glaciers, snow, polar icecaps, ground water and oceans as components of Earth's water; interpret graphical information on the availability of potable water).
 - Recognize that fresh water and salt water contain varying amounts of dissolved materials, particulates and biological components; and interpret information on these component materials.
 - Identify major factors used in determining if water is potable, and describe and demonstrate tests of water quality (e.g., investigate and describe the physical characteristics of a sample of water, such as clarity, salinity and hardness; investigate biological tests).
- Investigate and interpret linkages among landforms, water and climate
 - Identify evidence of glacial action, and analyze factors affecting the growth and attrition of glaciers and polar icecaps (e.g., identify factors that affect the size of polar ice sheets and the Columbia Icefields).
- Analyze factors affecting productivity and species distribution in marine and freshwater environments.
 - Analyze relationships between water quality and living things, and infer the quality of water based on the diversity of life supported by it.
- Analyze human impacts on aquatic systems; and identify the roles of science and technology in addressing related questions, problems and issues.
 - Analyze human water uses, and identify the nature and scope of impacts resulting from different uses (e.g., identify pollutants in ground water and surface water systems resulting from domestic and industrial use; analyze the effects of agriculture and forestry practices on stream flow and water quality).
 - Identify current practices and technologies that affect water quality, evaluate environmental costs and benefits, and identify and evaluate alternatives (e.g., research and analyze alternatives for ensuring safe supplies of potable water; research, analyze and debate alternatives for a specific water quality issue, such as the location and design of a landfill, the protection of a natural waterway, the use of secondary and tertiary wastewater treatment, the salinization of soils due to irrigation, the eutrophication of ponds and streams due to excess use of phosphates in fertilizers and detergents, or a proposal to export water resources).
 - Provide examples of problems that cannot be solved using scientific and technological knowledge alone (e.g., the need to prevent pollutants from entering aquatic environments, the need to avoid damage from ice sheets and icebergs).

Grade 9

Unit C: Environmental Chemistry

- Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things.
 - Identify chemical factors in an environment that might affect the health and distribution of living things in that environment (e.g. available oxygen, pH, dissolved nutrients in soil).
 - Describe effects of acids and bases on living things (e.g., acid rain in lakes, antacids for upset stomachs, pH in shampoos and conditioners).
 - Investigate and evaluate potential risks resulting from consumer practices and industrial processes, and identify processes used in providing information and setting standards to manage these risks (e.g., interpret and explain the significance of manufacturer's information on how wood preservatives can be safely applied; recognize that some individuals may have greater sensitivity to particular chemical substances than do others in the general population).

Science 14

Unit D: Investigating Matter and Energy in the Environment

- Describe in general terms, how water, carbon, oxygen and nitrogen are cycled through the biosphere
- Describe the relationship between land use practices and altering ecosystems (e.g., swamp drainage, slash and burn forestry, agriculture).
- Trace the development of a technological application that has altered an ecosystem (e.g., power generation, fishing, logging, oil and gas exploration, agricultural practices).

Science 20

Unit B: Changes in Living Systems

- Analyze ecosystems and ecological succession in the local area, and describe the relationships and interactions among subsystems and components.
 - Analyze and investigate an aquatic or terrestrial local ecosystem, distinguish between biotic and abiotic factors, and describe how they affect population size.
 - Infer the abiotic effects on life (e.g., light, nutrients, water, temperature).
 - Describe the potential impact of habitat destruction on an ecosystem.
- Analyze and investigate the cycling of matter and energy flow through the biosphere and ecosystems, and the interdependence of society and the environment.
 - Outline the biogeochemical cycles of nitrogen, carbon, and water and, in general terms, describe their interconnectedness, building on knowledge of hydrologic cycle from Science 10, Unit D.
 - Describe artificial and natural interventions that affect the biogeochemical cycles: Water cycle (e.g., extraction of groundwater, dams for hydroelectricity and irrigation).
 - Assess whether the efforts to reduce human impact on biogeochemical cycles are viable, by taking into account a variety of considerations and perspectives (e.g., deep-well and deep ocean injection of wastes considerations include: properties of waste, concentration, uncertainty, environmental concerns, risks and benefits to human health and organisms, costs).

Biology 20

Unit A: Energy and Matter Exchange in the Biosphere

- Students will explain the cycling of matter through the biosphere.
 - 20–A2.1sts • explain that science and technology have both intended and unintended consequences for humans and the environment, e.g., (STS3)
 - discuss the use of water by society, the impact such use has on water quality and quantity in ecosystems, and the need for water purification and conservation (e.g., manufacturing and processing oil industry, agricultural systems, domestic daily water consumption).

Unit B: Ecosystems and Population Change

- Students will explain that the biosphere is composed of ecosystems, each with distinctive biotic and abiotic characteristics.
 - 20–B1.3k • identify biotic and abiotic characteristics and explain their influence in an aquatic and a terrestrial ecosystem in a local region, e.g., stream, lake, prairie, boreal forest, vacant lot, sports field
- 20–B1.1sts • explain that science and technology have both intended and unintended consequences for humans and the environment, e.g., (STS3)
 - evaluate the impact that human activity has had, or could have, on the biodiversity in an ecosystem and the influence of the needs and interests of society on this practice (e.g., draining of wetlands interbasin water transfer, land use, urbanization).

Environmental Outdoor Education (Grades 7-9)

- Demonstrate knowledge of the techniques required for maintaining hygiene in outdoor settings for water purification.
- Recognize that they as individuals are part of a complex global environment and that they both affect and are affected by their environment.
- Recognize changes that result from human use of environments, including: changes due to individual and group activity in the environment, changes that result from human construction (e.g., roads, buildings), changes that result from extraction or harvesting of natural resources, changes that result from addition of materials to environments.
- Demonstrate understanding of the air, water and soil cycles
- Environmental Investigations
- Commitment to Action

Career and Technology Studies

AGR 1100: Agriculture Technology
AGR 3110: Water Management

INTRODUCTION

Why an educational resource on water in Alberta's semi-arid south?

Water is essential for life. Not only is it important for physiological and biological reasons, water affects the physical landscape, economy, and culture of Alberta. With a high population and a large variety of water uses, it is important to have a greater understanding of water management in Alberta's semi-arid south.

This teaching resource was developed to support the Grade 8 Science unit *Freshwater and Saltwater Systems* as well as many other grade and subject levels. It will help students to appreciate the science and issues related to water by considering the following questions :

- What is a watershed?
- How does water affect the landscape?
- How is water being used in Alberta's semi-arid south?
- What needs are met by these activities?
- What are some of the concerns related to these uses of water?
- What is being done to conserve water and/or protect water quality in this region?
- Why is water management so important, and so complex?

About the Poster

The front of the *Running Water* poster provides a representation of the semi-arid environment of southern Alberta. Many users of water are represented including: rural and urban municipalities; wildlife; and industries such as petroleum and agriculture. The back of the poster explores many of the activities depicted on the front while making scientific, technological, societal and environmental connections. Graphs and schematic diagrams are included that expand on some of these topics.

RUNNING WATER KIT RESOURCE CD

In order to minimize our ecological footprint and to reduce the amount of paper being used, the *Running Water* kit includes a resource CD with supplementary materials. It is here that you will find the worksheets identified in the various activities; a PDF copy of the poster front and back; information pieces that you can use to project on a screen or duplicate for distribution to your students; and additional background information on water. Should you misplace this CD, PDF copies of all of the worksheets are available at www.insideeducation.ca.
(See handout included in the resource kit for a more detailed list of the CD contents)

RUNNING WATER ACTIVITIES FOR STUDENTS

In this guide we have attempted to incorporate as many activities as possible considering the dynamics that exist in a classroom. Activities are designed to appeal to different learning styles. The lessons can be easily adapted to various grade levels and subject areas.

WATER CONNECTIONS- ALBERTA CURRICULUM

The *Running Water* poster and accompanying teaching resource are designed to provide support for Alberta teachers as they address the curriculum requirements listed on page one. In addition, each activity also lists associated curriculum connections. While areas of the Grade 8 Science Unit E *Freshwater and Saltwater Systems* are the primary focus for *Running Water*, the poster and teaching resource can also be used to meet the outcomes of several other courses and grade levels.

SKIMMING THE SURFACE answer key

By going through the following series of math questions, students will have a chance to familiarize themselves with the *Running Water* poster. Find the items on the poster, fill in the appropriate number and solve the problem. Provide each student with a copy of the "Skimming the Surface" worksheet. It can be printed from the resource CD.

Find the items listed below on the front of the *Running Water* poster. Fill in the numbers and solve the mathematical equation.

- # of bison x # of dams
 $7 \times 3 = 21$
- # of logging trucks + # of golf courses
 $1 + 1 = 2$
- # of Volkswagens + # of vehicle bridges – # of forest fires
 $2 + 8 - 1 = 9$ (VW's = 1 blue VW truck and 1 purple VW Beetle)
- # of pump jacks + # of centre pivot irrigation systems
 $9 + 4 = 13$
- (# of hay bales - # of turkey vultures) ÷ # of grain elevators
 $(17-1) \div 2 = 8$
- # of wastewater treatment facilities + # of derrick rigs
 $2 + 1 = 3$
- # of dams x # of storm drain outfalls
 $3 \times 2 = 6$
- (# rail cars x # of storm drain outfalls) – (# of centre pivots + # of dams)
 $(8 \times 2) - (4 + 3) = 9$

Using the key below, correlate your answers (on the right) with the letters (on the left). Unscramble your answers to find the solution to the statement that follows.

A=3	G=25	M=2	S=13	Y=7
B=40	H=39	N=17	T=39	Z=99
C=15	I=9	O=74	U=48	
D=8	J=50	P=93	V=66	
E=6	K=4	Q=58	W=82	
F=22	L=1	R=21	X=20	

Answer: The *Running Water* poster depicts a **SEMI-ARID** environment.

QUICKEST EYES IN THE BUNCH

Divide the class into small groups and provide each group with a copy of the *Running Water* poster. Have each group come up with a sound or catchy word that relates to water, for example, “splash.” This will be their team name and buzzer. Read the questions aloud and award points to the team with the correct answer. Teams indicate that they have the answer by *buzzing in* with their water word or sound.

Using the poster front find: (1 point questions)

1. A wetland
(*bottom left, centre, upper right, etc.*)
2. An antelope
(*bottom centre*)
3. A big horn sheep
(*top left, on cliff edge*)
4. A wastewater treatment plant
(*top centre, near city: Weirville Sewage Treatment, upper right*)
5. Someone testing water quality
(*three found along rivers; look for a blue and white truck*)
6. Tree harvesting
(*cut-block, upper left corner*)
7. A place where electricity is generated
(*hydroelectric power occurring at the three large dams*)
8. Someone fishing
(*many examples of fishing are depicted*)
9. A grain elevator
(*e.g. green elevator in the centre, near train track; small red elevator, top right*)

Using the poster back: (2 point questions)

1. Name two functions of riparian areas.
(*Refer to the article “Beneficial Buffers”*) Filter pollutants, slow run-off, prevent flooding, strengthen banks and shorelines, decrease erosion, absorb and store water, provide habitat
2. Define “aquifer.”
(*Refer to the article “Running Beneath Our Feet”*) An underground layer of soil, gravel or porous rock that holds water and allows water to flow
3. Name Alberta’s seven major river basins.
(*Refer to the image “Alberta’s Seven Major River Basins”*) Hay River Basin, Peace/Slave River Basin, Athabasca River Basin, Beaver River Basin, North Saskatchewan River Basin, South Saskatchewan River Basin, Milk River Basin

QUICKEST EYES IN THE BUNCH cont'd

4. List one benefit and one concern of dams.

(Refer to the article "Hold the Flow")

Benefits – supply more water downstream in summer, storage reservoirs for irrigation, supply and maintain consistent water supply for user, used for hydroelectric power generation, recreational uses, reduce flooding

Concerns – sedimentation, natural fluctuations altered, land lost to reservoir, migration patterns of animals altered, require continued monitoring and maintenance

5. Identify the three major characteristics of water quality.

(Refer to the article "Questioning Quality") Chemical, physical, biological

6. What is a watershed?

(Refer to the article "What is a Watershed") An area of land that drains water into a body of water such as a stream, lake, river, wetland or ocean.

7. Identify Alberta's largest user of surface water.

(Refer to the pie chart "Alberta's Surface Water Consumptive Uses") Irrigation

8. What do we mean by a semi-arid environment?

(Refer to introduction article, top left.) Areas that receive low levels of annual precipitation (300 – 350 mm).

9. Identify the type of gas found in coal seams.

(Refer to the article "There's Gas in Coal") Methane/Natural gas

10. Name three ways we use water at home.

*(Refer to the article "Splashing Around Town") Drinking, washing, cooking, cleaning, watering lawns
Additional answers are encouraged*

Using the poster front and back find: (3 point questions)

1. An example of a ranching practice that would help to protect water quality.

Answers may include:

A ranch that has well maintained fences to keep cattle away from water bodies.

A ranch with off-site watering systems that bring water to the cattle, away from water bodies.

The confined feeding operation is properly collecting and handling waste, dispersing it away from water bodies.

2. The largest user of groundwater in Alberta (Commercial/ Industrial, e.g. pumpjack)

3. The most efficient form of irrigation on the poster (centre pivot, many found throughout bottom right)

4. The least expensive and oldest form of irrigation on the poster (flood irrigation, farm on poster centre)

5. A place where transpiration might occur (any plants on the poster)

6. The headwaters (the small streams, starting at the glaciers, top right)

FOLLOW THE FLOW

Time: 60 minutes

Curriculum Connections:

- Grade 7 Science *Interactions and Ecosystems*
- Grade 8 Science *Freshwater and Saltwater Systems*
- Grade 9 Science *Environmental Chemistry*
- Grade 7-9 *Environmental Outdoor Education*
- Science 14 *Investigating Matter and Energy in the Environment*
- Science 20 *Changes in Living Systems*

Objectives:

- Students will investigate the various uses of water in Alberta.
- Students will explore some of the technologies associated with water and look at the impact that these technologies have on water quality and quantity.
- Students will look at some of the impacts humans have on aquatic systems and how to reduce the impact.

Materials:

- *Running Water* posters
- Sticky notes (one pad per group)
- “Follow the Flow” handout - one copy per student (available on resource CD)

Background Information:

Refer to the sections on the back of the *Running Water* poster entitled:

- Running Water in Alberta's Semi-Arid South
- What is a Watershed?
- Questioning Quality
- Splashin' Around Town
- Hold the Flow

Procedure:

1. Divide students into groups and provide each group with a copy of the poster, a pad of sticky notes and copies of the “Follow the Flow” handout found on the resource CD. For individual work, a smaller copy of the poster can be printed off using the poster PDF on the resource CD.
2. Students will work through the “Follow the Flow” handout identifying the uses of water and the impacts that various activities have on a watershed.
3. Some answers will be written on the handout while others will be written on sticky paper and attached to the front of the poster. When using the sticky paper, have students write the corresponding question number and a brief description on the sticky paper.

Extension:

- Have students investigate the river that they rely on for their own water needs. What biotic and abiotic elements affect the flow and distribution of water? What are the various industrial, agricultural, domestic and recreational activities that affect this river?

FOLLOW THE FLOW answer key

The following answer key provides possible answers to the student worksheet. However, student answers may vary and discussion is encouraged.

1. Using sticky paper, label the bodies of water that you spot on your travels down the river. Identify each water body (e.g., wetland, stream, reservoir...) and state whether it is part of a natural or managed system.
Canal (Managed), Stream/Tributary (Natural), Reservoir (Managed), River (Natural), Dugout (Managed) Lake (Natural), Off-Stream Reservoir (Managed), Wetland/Marsh (Natural)
2. Using your sticky paper, label at least five structures that affect the natural flow of water in the watershed. In the space provided, identify the function of each structure.
 - *Dams- hold back water allowing for a continuous supply*
 - *Weirs- divert water and control flow*
 - *Canal system- provides a supply of water to areas that would otherwise not have it*
 - *Hydroelectric facility- provide a renewable source of electricity*
 - *Bridges- help to provide efficient transportation routes*
 - *Stormwater drains- help to drain communities to prevent flooding and water damage*
3. How would the landscape differ without a managed system of water? Without this managed system, how would the many activities on the poster be affected? (e.g. industrial, agricultural, domestic and recreational)
 - *Without the reservoirs and canals, many agricultural products could not be grown on the landscape.*
 - *Many rural communities rely on agriculture for their livelihood, without water this is not possible.*
 - *Many rural communities would be without a reliable water supply for domestic use.*
 - *Oil industry activities that rely heavily on water may not be possible.*
 - *Some recreational activities, such as swimming, boating and fishing would not be as prevalent without a managed system to maintain lake/reservoir levels.*
 - *Wastewater from homes would not be treated.*

4. Describe the effect of biotic and abiotic elements on the flow and distribution of water in the poster.

Element	Biotic or Abiotic	Effect
<i>Trees and Shrubs in riparian area</i>	<i>Biotic</i>	<i>Help prevent erosion that would change the course of the river and affect the quality of the water.</i>
<i>Human alteration</i>	<i>Biotic</i>	<i>Humans alter the flow and distribution of water to meet their needs.</i>
<i>Animals</i>	<i>Biotic</i>	<i>Cattle can damage riparian areas and potentially contaminate water supplies.</i>
<i>Structures</i>	<i>Abiotic</i>	<i>Bridges, dams etc. alter the natural flow of water.</i>
<i>Rocks and sediments</i>	<i>Abiotic</i>	<i>Can greatly influence the flow of water and affect water levels.</i>

5. Using your sticky paper, label any evidence of glacial action that you can find on the poster. Name as many of the landforms as possible.
Glacier, River, Stream, Moraine, Prairie Potholes- Wetlands
6. Using your sticky paper, label at least four natural resources that are being developed on the poster.
 - *Oil (pumpjacks found throughout, oil derrick on bottom right)*
 - *Natural gas from coal (silver sheds on bottom left portion of poster)*
 - *Forestry (near foothill region)*
 - *Agriculture (throughout) - Cattle (free range and confined feeding operation), Crops/Irrigation farming*
 - *Fishing (in off-stream reservoir, right)*

7. Label one activity occurring in the watershed where quantity may be a concern. Explain how it is a concern below.
- *Urban development*
Potential loss of wetlands- can affect water quantity
Can disrupt the flow of water
Creates an increased demand for water
 - *Agriculture*
Irrigation uses a relatively large amount of water
 - *Transportation*
Roads can affect the flow of surface and ground water system
Bridge crossings must be properly designed to allow proper flow
 - *Oil extraction*
Water is often used to increase oil reservoir pressure and is removed from the active hydrologic cycle
 - *Reduced water flow due to dams*
8. Label one activity occurring in the watershed where quality may be a concern. Explain how it is a concern below.
- *Urban development*
Potential loss of wetlands can affect water quality
Greater amounts of wastewater produced
 - *Agriculture*
Excessive fertilizing could negatively affect water quality
Ranching- cattle can damage riparian areas; care should be taken to ensure water supplies are not contaminated
Confined feeding operations must properly handle waste
Erosion from farmlands can be a concern
 - *Recreation*
Cleared riparian areas for water access can negatively affect water quality
Motorboats can release pollutants if not properly maintained
 - *Transportation*
Various fluids can leak from automobiles that can impact water quality
Bridge crossings must be properly designed to decrease risk of sedimentation
 - *Natural gas extraction from coal seams*
Any water produced from coal seams must be disposed of properly
Steps must be taken to ensure groundwater aquifers are protected
 - *Sedimentation of water bodies is a concern related to:*
Construction sites
Forestry activities- road building and stream crossings
 - *Stormwater can affect water quality*
9. Label three examples that show the water quality is being protected on the poster. Briefly describe how they protect the water quality below.
- *Water quality is being protected on some of the farms with large riparian areas around water bodies.*
 - *Riparian areas on ranches are fenced off to restrict cattle access.*
 - *There are solar powered water stations for cattle, away from water bodies.*
 - *Water is being treated at the treatment facility before being released back into the waterway.*
 - *There are images of individuals in the poster who are monitoring water quality.*

WANDERING THROUGH THE WATERSHED

Time: 1 class + presentation time (minimum)

Curriculum Connection:

- Grade 5 Science *Wetland Ecosystems*
- Grade 7 Science *Interactions and Ecosystems*
- Grade 8 Science *Freshwater and Saltwater Systems*

Objectives:

- Students will be creative in telling a story about the journey that one molecule of water takes as it travels through the watershed.
- Students will develop a further understanding of a watershed and the hydrologic cycle.
- Students will consider some of the influences that they have on water.

Materials:

- *Running Water* poster
- Craft materials may be required (paper, colouring pencils, scissors, etc.)

Background Information:

Students can refer to various sections on the back of the poster including:

- What is a Watershed?
- Questioning Quality

Procedure:

1. After introducing the concepts of a watershed and the hydrologic cycle, have students develop a story illustrating the travels of one molecule of water. Using the poster as a guide, students will brainstorm the variety of situations a water molecule could experience. Students will present this story to the class. Encourage students to be creative in this presentation, and in the adventures that the main character has.

2. Students, working alone or in small groups, can make use of their personal talents and present this story in a variety of creative ways. For example:
 - Art (e.g. a cartoon, or diagram)
 - Music (a song)
 - Multimedia (e.g. a slide show)
 - Drama (a play)
 - Writing (a poem, or a story)
3. The story of each molecule's adventure must include at least:
 - Three stages of the hydrologic cycle
 - Three instances where animals or humans use the water molecule
 - Three instances where the quality of that water is affected

WHO WANTS WATER?

Time: 60 minutes

Curriculum Connection:

- *Grade 8 Science* Freshwater and Saltwater Systems

Objectives:

- Students will develop an understanding of water allocation.
- Students will be introduced to the various water users in Alberta.
- Students will be challenged to develop strategies for water allocation.

Materials:

- *Running Water* posters
- Large beaker with half-full mark
- 5 smaller beakers

Background Information:

Refer to the introductory article “Running Water in Alberta’s Semi-Arid South” and “Alberta’s Consumptive Uses” pie charts on the back of the poster (also available on the resource CD).

For more information on water allocation, visit the Alberta Environment website at:

http://www3.gov.ab.ca/env/water/GWSW/quantity/waterinalberta/allocation/AL3_purpose.html

Procedure:

Introductory Activity

1. Fill a large beaker with water and make a half-way water level mark. The water in the beaker is to represent a river.
2. Ask for five student volunteers to represent users of the river. Assign each of the five volunteers to be one of the following water users – Municipal, Agriculture, Petroleum, Environment and Recreation.
3. Have the five users stand in a row at the front of the class and provide a smaller beaker to each of them.

4. Explain to the students that they all rely on the river for water. You are going to walk down the user line and pour water into each of the small beakers. The users will have to tell you how much of the water they think they need. The one rule is that they will need to leave some water for the other users in the line.
5. Once the water has been allocated to each of the users, explain that the half-full line on the large beaker represents the amount of water that must remain in the river when it flows out of Alberta into Saskatchewan (i.e. apportionment, or trans-boundary, agreements).

Group Activity

1. Divide class into small groups. Using the *Running Water* poster, students should take 5 minutes to brainstorm all of the water users in the watershed.
2. With the users that students were able to identify, have each group develop a water allocation strategy to decide what allocation, or share, of the available surface water each user should be entitled to. Have groups determine a per cent value for each user. The values should add up to 100%.
3. Have students present their allocations to the class with justifications as to why they assigned the values they did.
4. Discuss the difficulties students had trying to decide where the water should go.
5. Show students Alberta Environment’s surface water allocations. Are there any similarities to their own allocations? Are there any statistics that seem surprising? What users are listed here that students did not have on their own lists?

WHO WANTS WATER? cont'd

Extension:

Have the students imagine that Alberta's south is experiencing drought-like conditions with very little spring snowmelt and low amounts of precipitation. Have the students develop a fair way to distribute the water. They should consider the social, environmental, and economic needs of the province.

Following this, discuss *Alberta's First in Time, First in Right* principal. In Alberta, the most senior licenses (i.e. earliest licenses) have right to the water, and in Alberta's south these licenses can belong to irrigation farmers. However, in times of drought Albertans have worked together to share water.

WATER WATCH

Time: 60 minutes in class / 1 week (at home)

Curriculum Connection:

- Grade 8 Science *Freshwater and Saltwater Systems*

Objectives:

- Students will record their personal water use for one week and compare it to the national average.
- Students will evaluate their water use and find ways to reduce this amount.
- Students will become aware of issues surrounding their personal water use.

Materials:

Running Water poster

“Personal Water Use” handout - one copy per student (available on resource CD)

“Personal Water Use – Low-Flow Values” - one copy per student (available on resource CD)

1 litre container filled with water

Background Information:

Refer to the section on the back of the *Running Water* poster entitled “Splashing Around Town.”

Procedure:

1. Hold up a one-litre container and ask students to guess how many containers of water they would use in one day. Have the students write their estimates down to refer to later.
2. Print off the worksheet entitled “Personal Water Use” from the resource CD. Distribute one copy per student. Have students calculate their daily and weekly water use by filling out this sheet over the period of one week. A value should be placed in each box indicating the number of times they do each activity and, when necessary, the length of time that the water runs. For example:
 - a toilet is flushed seven times per day.
 - water runs for 1 minute each of the 12 times that hands are washed. Suggest to students that they include the entire household in this activity to

increase the accuracy of household values.

Note: You may consider doing daily checks to ensure that students are participating in the activity.

3. Total up the all of the water used in one week and then calculate the average daily use. Compare this to the average use in a Canadian home—335 L.
4. Conduct a discussion on water use. Were students surprised with the amount of water they used in and around the home? Brainstorm a list of ways to conserve water while still meeting needs (i.e. cooking, proper cleaning, etc.)
5. Provide each student with a copy of the handout, “Personal Water Use – Low-Flow Values” from the resource CD. Have students recalculate their water use using the low-flow values. Compare these values with the original values.

Extension:

- Compare the average daily use with other countries. Refer to the following website for this information: www.ec.gc.ca/water/images/manage/use/a4f4e.htm Discuss reasons why Canadians use more water than most other countries.
- Most people in the world do not have the same access to water that we enjoy. Allot each student a certain amount of water (for example, 40 L/day) and have students determine how they would use that water.
- Ask students to bring in empty 4 L milk containers. Line these containers up along a wall, piling them one on top of another. Collect enough to equal the amount of water that an average household uses in a day (you will need 84 containers). This is a powerful way for students to conceptualize their water use. Be sure to recycle containers afterward.
- If you have access to a lot of snow, have students gather enough snow to melt the equivalent of one toilet flush (6 L). Students will be amazed with the amount of snow required.

TOWN HALL MEETING

Time: three class periods

Curriculum Connection:

- Grade 8 Science *Freshwater and Saltwater Systems*
- Grade 7-9 *Environmental Outdoor Education*
- Science 14 *Investigating Matter and Energy in the Environment*
- Biology 20 *Ecosystems and Population Change*

Objectives:

- Students will consider many environmental, social and economic factors surrounding a proposed dam building project.
- Students will determine stakeholder involvement in this decision and will take on the role of one of these stakeholders at a public consultation.
- Students will research, maintain and defend their position when challenged.
- Students will appreciate the complex nature of public consultation on issues related to the environment, economy and energy.

Materials:

- *Running Water* poster
- Poster paper, pens, etc.
- Internet access
- Weirville town hall meeting flyer (available on resource CD)

Background Information:

Refer to the section “Hold the Flow” on the back of the poster (also available on resource CD).

Procedure:

1. Introduce this activity by reviewing the article “Hold the Flow” from the back of the *Running Water* poster (copies can be made from the resource CD). Quickly brainstorm with students some benefits and drawbacks of the construction of a dam. Briefly explore some environmental, social, and economic impacts.

2. Show students the flyer on the upcoming Weirville town hall meeting (flyer can be also be found on the resource CD). Students can be assigned a stakeholder group, or select a group they would like to represent from the front of the *Running Water* poster. Major stakeholders should be represented and may include government, agricultural groups, environmental community, municipalities, urban and rural residents, recreational water users, and aboriginal groups among others.
3. Stakeholder groups should have approximately the same number of participants. Students do not necessarily have to be on the side that they personally support and should be able to discuss many sides of the issue.
4. In their groups, students should research and discuss their thoughts. Through this sharing process, students should also anticipate opposing views they will encounter and prepare to defend their position on the matter. Depending on the amount of time available, groups may prepare a brief presentation that will help support their position. This presentation may be enhanced through graphs, images, or other visual aids.
5. When students are organized, provide guidelines for the town hall meeting. These may vary depending on the grade level of the class. The desks may be arranged in a large circle in the classroom. Every group should have an opportunity to speak and order should be maintained. Often, a system to address speakers is helpful. For example, groups can place an object on their desk to indicate that they have the floor.
6. After every group has presented their ideas and there has been adequate debate, then take the time to highlight the complexities surrounding public consultations of this type. This may occur through discussion, or formally, through a written response by each student. Have students consider various aspects and questions about the activity. *See questions on next page.*

TOWN HALL MEETING cont'd

- Was there a clear outcome?
- What position stood out as the most memorable? Why?
- Was this process fair? Why or why not?
- What role did the research component of this activity play?
- If you were in this situation, what would your personal opinion be on the proposed development?
- As you learned more about the issues, was it easier or more difficult to determine your personal opinion? Do you think your position may have been swayed by any of the arguments presented by your classmates?

Extension:

- Students can compose mock “Letters to the Editor” explaining their position as it relates to the proposed dam construction.
- Have students design maps of location, both pre- and post-dam construction. Determine how much land would be covered by the reservoir.
- Beavers build dams regularly. How and why do beavers build dams? What similarities and differences are there between beaver dams and human-constructed dams? Should beaver dams be tampered with?

Suggested Evaluation Rubric

- 4 Position was very well stated and defended. Group demonstrated exceptional knowledge and understanding of the issue. Information had a high degree of clarity, accuracy, and thoroughness with clear evidence of research. The style of presentation/debate was highly engaging, effective and respectful. Position was very well supported with well-organized and relevant facts, statistics and/or visual aids.
- 3 Position was adequately stated and defended. Group demonstrated good knowledge and understanding of the issue. Information was clear, accurate and thorough with evidence of research. The presentation/debate was effective, engaging and respectful. Adequately supported with organized and relevant facts, statistics and/or visual aids.
- 2 Position was stated but lacked in clarity. When challenged, the position was weakly defended. Group demonstrated fair knowledge and understanding of the issue. Group was challenged by the clarity, accuracy or thoroughness of the information. There is evidence of some research. Presentation/debate could have been more engaging, effective and/or respectful. Position was somewhat supported with facts, statistics and visual aids, the relevance of which was somewhat questionable and/or poorly organized.
- 1 Position was unclear and/or undefended. Group demonstrated poor knowledge and understanding of the issue. Information was not clear, accurate or thorough with little evidence of research. Presentation/debate was not engaging, effective and/or respectful. Position was not supported with facts, statistics and/or visual aids. Group was disorganized.

WATER ON THE WEB

Time: 60-90 minutes

Curriculum Connection:

- Grade 8 Science *Freshwater and Saltwater Systems*

Objectives:

- Students will look at the most common uses of water comparing Alberta, Canada, and other countries around the world.
- Students will link the quantity and uses of water to the geography, climate and social situation of the area.

Materials:

- “Water on the Web” handout - one copy per student (available on resource CD)
- Access to the Internet

Procedure:

1. Have students quickly brainstorm the common uses of water in Alberta. The *Running Water* poster may be used to generate ideas. Have students rate what they think would be the top three uses of water on a local, national and international level.
2. Provide each student with a copy of the student worksheet entitled “Water on the Web” from the resource CD. Explain to students that they will be completing an online search to examine water resources and uses that will consist of two parts.
3. *Part 1* Using the websites and questions provided, students will research how water is used on local, national and international levels.
4. *Part 2* Case Study. Students will complete an independent case study on water use in a chosen country. A website is provided for gathering information, however, students may do an Internet search for further information.
5. Have students create a brief report (300 - 500 words) about the country they chose. Using the criteria given to them, they will describe the geographic and climatic features, the amount of available water resources, and how water supply and use in that country might differ from Alberta.

Extension:

- Students can present their report to the class. Make a bulletin board display representing water use around the world using a world map as the centre of the display. Post these reports around the world map.
- Have students create graphic representations of the information from Part 1 or Part 2 of their online search.

Answers For Part I (can also be found on resource CD)

a) Non-consumptive water use

Water is withdrawn and directly returned to its source

b) Consumptive water use

Water is withdrawn and used so that it is not directly returned to its source (e.g. agriculture, industry, domestic/municipal)

1. What is the primary consumptive use of surface water in Alberta?

Water for irrigation. (70.95% of surface water used in Alberta is used for irrigation)

2. What is the primary use of water in Canada?

Water for thermal power generation. (Water is used in creating steam that turns turbines to generate electricity)

3. Looking closer at the graph, determine what is the primary consumptive use of water in Canada.

Water for agriculture

4. What is the primary use of water in of the world?

Agriculture

5. How does the domestic water consumption in developed countries compare to that in developing countries?

*Domestic water consumption in developed countries is about six times greater than developing countries.
500-880 litres/person/day versus 60-150 litres/person/day*

6. Why do you think there is such a large difference in the domestic water use between developed and developing countries?

Reasons may vary but may include: greater availability of water due to geography and climate; more effective and established water supply systems typically exist in developed nations; appliances and activities that consume large amounts of water are more prevalent in developed countries (e.g. shower, bath tub, toilets, dish washer, clothes washer, car washing, watering lawns, etc.).

WOW – A WORKING WATERSHED

Time: 75-90 minutes (minimum)

Curriculum Connections:

- Grade 5 Science *Wetland Ecosystems*
- Grade 7 Science *Interactions and Ecosystems*
- Grade 8 Science *Freshwater and Saltwater Systems*

Objectives:

- Students will observe the connection between the geography of the land and the course that water flows. (i.e. watershed function)
- Students will consider the impact of human activities on a watershed.
- Students will describe the effect of a riparian area on water quality and quantity in a watershed.
- Students will observe water transforming from one state to another in a simulation of the hydrologic cycle.
- Students will determine the importance of temperature in driving the hydrologic cycle.
- Students will appreciate the connection between surface water and groundwater systems.

Materials:

- *Running Water* poster
- Large clear plastic tub or aquarium in which to construct watershed
- Gravel
- Piece of craft felt, slightly bigger than your container (available at fabric or craft stores)
- Sponge
- Wax paper, plastic wrap, aluminum foil or other impermeable surface
- Spray bottle
- Watering can (suggest small child's bathtub or beach watering can)
- Red, blue or purple juice crystals
- Soya sauce
- Small plastic container (e.g. sandwich container)
- Lamp
- Ice

Background Information:

Refer to the sections on the back of the *Running Water* poster entitled:

- What is a Watershed?
- Running Beneath our Feet
- Beneficial Buffers

Procedure for demonstration:

This activity is divided into four different sections. Section A and B are the foundation activities for understanding how a watershed works. Section C and D investigate riparian areas and wetlands; the effects of activities on the landscape; and the hydrologic cycle. Pictures of the demonstration can be found on the resource CD.

A. *Constructing the watershed:*

1. Ensure materials are clean.
2. Spread gravel along the bottom of the tub to create a slope so that one end of the tub is about 2 cm deep while the other end is at least 7 cm deep.
3. Make a few holes in the plastic container; this will allow water to flow out of the container, connecting it to the *groundwater system*. Draw a line at the half-full mark and then place the plastic container at the bottom of the aquarium, or large tub, near the bottom of the slope. Build in the gravel around the container. This container is representative of a large water body such as a lake.
4. Pour water in the small container repeatedly until there is a stable amount of water in the container at the half-full mark. Water will now line the bottom of the bin as well, filling the spaces in the gravel representing *groundwater*. Draw a line at the water level on the side of the bin to indicate the level of the *water table*.
5. Create a channel down the middle of the bin, representing the main river in the watershed. Shape the gravel as desired to represent a landscape with hills and valleys, tributaries and other bodies of water.
6. Place the felt on top of the gravel, being careful not to disturb the slope. Leave a section of gravel at the lower end of the bin exposed.

7. Flatten a small area next to the river and place a small rectangle of impermeable material (e.g. wax paper, plastic wrap, aluminum foil) over top to represent a developed area such as a parking lot. Rocks may be needed to hold the paper in place.
8. You may choose to use a variety of small toys to represent activities on the landscape (e.g. trucks, animals, houses, etc.)

B. Simulating rainfall:

The spray bottle is used to represent a light rain and the watering can will simulate a heavy rain.

1. Use the spray bottle to spray water over the surface. Observe what happens.
2. Use the watering can to pour water over the surface. Suggest that some students observe the sides of the container while others observe the surface. Draw attention to the *runoff, infiltration and percolation*.
3. Observe what happens at the impermeable surface where development has occurred.

C. Riparian areas and wetlands:

Riparian areas are the areas located along the edges of water bodies. A healthy riparian area consists of vegetation that will slow and filter water as it moves to the water bodies. Wetlands are low-lying areas of land that are saturated with water for all or part of the year. Wetlands also filter and store water. Here, damp sponges will be used to represent wetlands and riparian areas.

1. Construct riparian areas by placing sponges along the rivers edge. The sponges may have to be held in place with rocks, or pins.
2. Construct a wetland by making a depression in the landscape and inserting a sponge.
3. Add more water and now observe the surface water flow. It should be slower, and more water should be stored in the wetland and riparian areas.
4. Sprinkle juice crystals onto different areas of the watershed. This can represent pollution of some sort (e.g. excess fertilizer). Observe the movement of the materials when it rains. Compare the water in the aquifer to the water in other parts of the watershed. Is there any difference in the clarity of

the water in different parts of the watershed?

5. Sprinkle soya sauce on areas of the watershed, this can represent a chemical spill of some sort (e.g. oil from cars). Make the same observations.
6. Pretend development of the landscape has occurred by removing the wetlands and riparian areas. Repeat steps 2 through 4 and observe any differences that may occur. Students should observe that less water is stored, and more contaminants enter the lake and groundwater system.

D. Hydrologic Cycle

1. Cover the system with either a clear lid or plastic wrap and set up a lamp directly over the container of water. Leave the light shining directly on the body of water overnight.
2. During the next class period, examine the system. DO NOT REMOVE THE COVER. Have the students compare the water levels from the day before and look for evidence of evaporation and condensation. If no evaporation has occurred, leave the system for an extended period. Placing ice on top of the container should help create condensation.
3. If the temperature is cooled sufficiently, enough water may collect to simulate precipitation. Observe where the condensed water forms. What does this suggest?

Extension:

- Insert a turkey baster through the top of the landscape into the groundwater table and withdraw some groundwater. This represents a *water table well*. Here the groundwater aquifer is not under pressure (not confined) and a pump is necessary to bring water to the surface. Notice the effect on the water table and the lake levels. Discuss the importance of groundwater to rural communities in Alberta's semi-arid south.
- Leave the watershed model, with the lid off, for a couple of days. Notice how the water levels lower, and the model begins to dry up. Here, evaporation levels are greater than precipitation levels, much like that of a semi-arid environment. Discuss how seasons affect the quantity of water in a watershed. Discuss methods to help ensure a stable water supply year-long (e.g. dams, reservoirs, canals, etc.).

MAKE YOUR OWN WATER FILTER

Time: 60-90 minutes

Curriculum Connections:

- Grade 8 Science *Freshwater and Saltwater Systems*
- Grade 9 Science *Environmental Chemistry*
- Grade 7-9 *Environmental Outdoor Education*

Objectives:

- Students will test different products for their filtering abilities and decide which combination of materials will make the most effective filter.
- Students will draw conclusions on how the filter affects physical, chemical and biological water quality.
- Students will become aware that some filters do not necessarily remove all types of contaminants.

Materials:

Running Water poster

“Make Your Own Water Filter” handout - one copy per student (available on resource CD)

Empty 2 L pop bottle, cut in half (one per group)

Napkins

Paper towel

Course sand

Fine sand

Cotton balls

Activated charcoal

Coffee filter

Sponge

Peat

Cheese cloth

Florist foam

Sample of dirty water

Gravel (different sized pebbles)

NOTE: You do not need all of these materials but a good selection of items will make the activity more interesting for the students.

Background Information:

Refer to the section on the back of the *Running Water* poster entitled “Questioning Quality.”

You and your students can also refer to the background information located on the resource CD entitled: “Focus On Water Quality” (Alberta Environment)

Procedure:

1. After reading the section “Questioning Quality,” on the back of the *Running Water* poster, provide each student with the handout, “Make Your Own Water Filter,” from the resource CD.
2. Divide students into groups of three. Explain to students that, as a group, they will be building water filters. Their task is to create the most effective filter for dealing with physical, chemical and biological contaminants.
3. Provide each group with a list of items that they may use to build a filter. Groups will brainstorm and discuss the combination of four materials that would make the best filter. They may need time to research a bit further.
4. Each group will obtain a pop bottle that has already been cut in half by the teacher. Both halves are needed.
5. Groups then gather the four materials they have chosen, wash the items and build a filter. To build the filters, organize the materials in layers in the top of the pop bottle. Have them complete part A on the student handout.
6. With a brief presentation to the class, students should describe their filter explaining why they selected the materials they did and how it will address the *potential* biological, chemical, and physical contaminants. Have each group demonstrate their filter to the class by pouring visibly *dirty* water through the filter and collecting it in the bottom half of the bottle.
7. Once all students have demonstrated their filters, have them complete part B of the student handout. Here, they will consider the limitations of the filter.
NOTE: Do not allow the students to taste the water, as there may be bacteria or other micro-organisms present. Be sure students wash their hands thoroughly when finished with the activity.
8. Conduct a discussion on the effectiveness of this type of filter. Look at the physical, chemical and biological contaminants that could be removed and those that cannot be removed using this primitive filter.

MAKE YOUR OWN WATER FILTER cont'd

The more effective filters in the class would have used:

- Activated charcoal to improve taste and smell as well as remove some organic compounds, pesticides and benzene (chemical properties)
- Fine sand and gravel to remove sediment as well as some potentially dangerous biological components such as cysts, worms and some viruses.
- Other materials to remove particulates (physical contaminants)

Note for discussion: To make the water suitable for drinking and remove other dangerous micro-organisms, more treatment may have to occur (e.g. chlorine treatment, UV light treatment)

Extension:

- Have students compare the cost of this filter with its effectiveness. Further, students can research *BioSand Water Filters*, a Canadian-designed filter that allows communities in developing nations to filter drinking water using materials found in their local area at minimal costs.
- Have students research commercial water filters. What similarities did their filters have to commercial filters? How did they differ?

GLOSSARY

Allocation	In order to withdraw water from fresh surface and groundwater sources large water users, like agriculture, industry, and municipalities, must apply for an allocation—or water license—from Alberta Environment.
Aquifer	An underground layer of soil, gravel or porous rock that holds water and allows water to flow.
Climate change	Changes in climate related to the trapping of more heat in the atmosphere resulting from increased greenhouse gas concentrations.
Climate	Weather in a specific location averaged over long periods of time.
Condensation	A stage in the hydrologic cycle where water molecules in the atmosphere change from a gas to a liquid and collect to form clouds and fog.
Confined aquifer	Groundwater that is trapped under a layer of impermeable rock or dense clay. Water in a confined aquifer is typically under pressure.
Dam	A barrier across a body of water used to regulate flow, or help store water.
Dry coal bed	A coal bed that does not contain or produce water. The term is often used when referring to natural gas from coal development.
Enhanced oil recovery	Recovery of oil that uses methods beyond the natural oil reservoir pressure or pumping alone. These methods often involve water.
Evaporation	A process in the hydrologic cycle in which water molecules are changed from the liquid to the gas phase.
Greenhouse effect	The process of warming the Earth's surface through the trapping of heat by atmospheric gases. This is necessary and naturally occurring but may be intensified by human activities that increase the concentration of greenhouse gases.
Greenhouse gases	Gases that trap heat in the atmosphere thus contributing to the greenhouse effect. Gases include, but are not limited to, water vapour, carbon dioxide, methane and chlorofluorocarbons.
Groundwater recharge	The percolation of water deep into the soil and gravel until it reaches the water table, replenishing groundwater supplies.
Groundwater	Water that fills the small spaces between different soil, sand, and rock formations. These saturated formations are known as aquifers.
Hydrologic cycle	The circulation of water through the environment and the changes in state it goes through along the way.
Infiltration	The stage of the hydrologic cycle where water molecules enter the soil. The rate at which this occurs depends on many factors, including texture of the soil, density and content of organic matter.
Natural gas	A fossil fuel, mostly consisting of methane, commonly used as a source of energy and for plastic production.
Non-point source pollution	Pollution that occurs over a broad area as water picks up contaminants and deposits them into a water body or into the groundwater system. This pollution is not easily identified.
Overdrafting	When referring to groundwater, describes the removal of more water from an aquifer than can be replaced naturally.

GLOSSARY

Percolation	Part of the hydrologic cycle where water moves downward through the spaces between soil and rock layers.
Point source pollution	The contamination of a body of water, which is easily identified because it comes from one specific location or source. (e.g. pipe).
Potable water	Water that is suitable for human consumption.
Precipitation	Stage of the water cycle that releases water from the clouds as rain, snow, sleet, freezing rain or hail when the atmosphere is saturated with water.
Raw water	Water that has not been treated.
Reservoir	A stored body of water that is used to provide a stable supply of water.
Riparian zone	The lush green areas surrounding a body of water that include smaller plants and grasses as well as larger trees and shrubs. Riparian areas filter water; slow the flow of water; strengthen banks and decrease erosion; store water; and provide habitat.
Saturated zone	Areas of underground rock and sand that are saturated with water. This constitutes an aquifer.
Semi-arid	A region that experiences low average annual rainfall (between 300-350 mm) and is characterized by short, shrubby vegetation and grasses.
Surface runoff	When precipitation exceeds infiltration, the soil becomes saturated and water moves down slope. The runoff enters streams, rivers, etc. replenishing reservoirs.
Transpiration	A process in the hydrologic cycle where water is absorbed by the roots of plants and is transported out of the plant via stomata.
Unconfined aquifer	An aquifer that is connected to the water table, is at atmospheric pressure and is mainly dependent on precipitation to recharge.
Unsaturated zone	Where water and air share the underground space between sand and rocks.
Wetlands	Low lying areas of land that are saturated with water for all or part of the year. Wetlands filter and store water, and provide valuable wildlife habitat.
Water table	The upper surface of the saturated zone in the groundwater system.
Watershed	An area of land that is defined by topography and drains water into a common location such as a river, wetland, or ocean.
Weather	The state of the atmosphere in a specific place at a certain period of time. It includes things like temperature, precipitation, wind, etc.

RESOURCE LINKS

The following organizations have additional resources on water and water related issues available to teachers for use in the classroom as well as possible presentations and field outings.

General

www.cwra.org/Branches/ProjectWet/default.aspx - Project WET is a water education resource providing supplementary materials for teachers of all grade levels.

www.ducks.ca/resource/teachers/index.html - The Ducks Unlimited website offers plenty of options for lesson plans, background information and field trip opportunities.

www.watercan.com/h2oh - The site provides background information and lesson plans on water issues in Canada and the developing world.

www.ec.gc.ca/water/index.htm - The Environment Canada Freshwater website contains information on physical, chemical, social and governmental issues in Canada. Lesson plans are included for many subject areas and grade levels.

www.waterforlife.gov.ab.ca - The Alberta government's plan to address current and emerging water issues in the province, Water For Life, is available for download. This website also provides ample facts and information on water related topics including groundwater, watersheds, water use and water quality in the province.

www.calgary.ca/waterservices - The City of Calgary waterworks website provides information on water treatment, and water conservation tips. The Youth Education section contains downloads for students as well.

www.lethbridge.ca/home/City+Hall/Departments/Helen+Schuler+Coulee+Centre/default.htm -The Helen Schuler Coulee Centre offers field trip opportunities to schools in the Lethbridge area.

Water and the Petroleum Industry

www.capp.ca - The Canadian Association of Petroleum Producer's website has a wealth of industry facts and information, including a glossary and sections relating to water issues.

www.pembina.org - The Pembina Institute is a not-for-profit research and education organization that specializes in sustainable energy, climate change, and other environmental issues.

The following articles can be downloaded here to provide further information on issues related to enhanced oil recovery and natural gas from coal development.

- Oil and Troubled Waters (Mary Griffiths and Dan Woynillowicz, 2003)
- Unconventional Gas- The environmental challenges of Coal Bed Methane development in Alberta (Mary Griffiths and Chris Severson-Baker, 2003)

www.csug.ca - The Canadian Society for Unconventional gas website offers a helpful page for frequently asked questions on natural gas from coal development.

Watersheds

Links to three of Alberta's Watershed Planning and Advisory Councils (WPAC's)

www.brbc.ab.ca - Bow River Basin Council

www.oldmanbasin.org - Oldman Watershed Council

www.nswa.ab.ca - North Saskatchewan Watershed Alliance

RESOURCE LINKS

geoscape.nrcan.gc.ca/h2o/bow/poster_e.php - Orders can be placed on the Natural Resources Canada website for a Bow River Basin Waterscape Poster. The website also contains information on various aspects of the river system.

Elementary and Junior High School teachers' guides for this poster can be downloaded from the City of Calgary Website: www.calgary.ca/waterworks (Youth Education section)

Climate Change

www.climatechangecentral.com - Climate Change Central offers information on climate change issues in Alberta and gives suggestions on ways individuals can reduce their impact. Information on upcoming events is also provided.

www.ualberta.ca/ersc/water/index.htm - The U of A's Environmental Research and Study Centre provides links to some of the research being conducted at the university on climate change issues and how they are affecting water quality and quantity.

Riparian Areas and Wildlife

www.cowsandfish.org - The Cow and Fish website provides information on riparian areas in Alberta and provides contacts for possible field trips or presentations.

www.srd.gov.ab.ca/fishwildlife - This website for the Fish and Wildlife division of the Government of Alberta offers information on Alberta's wildlife including facts on species at risk and downloads on biodiversity.

Water and Agriculture

www.everydropcounts.com - The Alberta Irrigation Projects Association has produced a video series with teacher materials entitled "Every Drop Counts" and is linked to the Grade 8 Science unit, Freshwater and Saltwater Systems.

www.agric.gov.ab.ca/app21/rtw/index.jsp - Alberta Agriculture, Food and Rural Development's website is full of information on how water is used in the associated industries.

First Nations Schools

www.tsag.net - First Nations schools can contact the First Nations (Alberta) Technical Services and Advisor Group to receive a no-cost DVD that explores water related issues on Canadian reserves. Classroom presentations on a variety of topics may also be available.

www.insideeducation.ca

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