Water Wise Teacher's Guide

A Project of the Cariboo Chilcotin Conservation Society

THE CARIBOO-CHILCOTIN CONSERVATION SOCIETY

AND THE CITY OF WILLIAMS LAKE

PROUDLY PRESENT

A Teacher's Guide to Water Chemistry and Water Conservation

Thank you to the following organizations for their contributions to the Williams Lake Water Wise Education Program:

City of Williams Lake

Gavin Lake Forest Education Society

Fisheries and Oceans Canada

ecoACTION

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VANCOUVER FOUNDATION

Community Futures Development Corporation of the Cariboo-Chilcotin

CFDC

Special Thanks to Jennifer Holtz for her development of this Teacher's Guide in 2006

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1. WELCOME TO WATER WISE

The Cariboo Chilcotin Conservation Society along with the City of Williams Lake are proud to present Water Wise. This education program is aimed at elementary grades 4 to 7.

The goals of Water Wise are to:

- ✓ teach students about water chemistry
- ✓ develop a respectful attitude in students towards water
- ✓ educate students about how their water use affects watersheds essential to fish, invertebrates, wildlife and plants
- ✓ make students feel they can take a proactive role in the conservation of water as well as other environmental issues
- ✓ further expose students to science in a fun & interactive way

This program meets the needs of the Integrated Resource Package for grades 4-7 by:

- ✓ using the water molecule to teach students basic chemistry principals
- ✓ educating students about hydrology
- ✓ explaining that the human body, wildlife and plants need water
- ✓ further developing the concept of renewable resources
- ✓ enhancing students' understanding of ecosystems with particular focus on the interconnectedness of the natural world

Requests to Teachers

In order to ensure your students have the best possible experience, we ask for your help with the following:

- ➢ Book all programs at least two weeks in advance, allowing ample time for preparation and scheduling.
- ➢ Provide the presenter with an open space in the front of the class; a table or two desks pushed together would be fine.
- ➢ Please contact the Cariboo Chilcotin Conservation Society (250-398-7929) if there is a change in time/date of a scheduled program as soon as possible.

We would also like to ask for your help in exciting your students about this very interesting topic. Thank you for all your assistance!

Program Outline

Water Wise consists of a choice of two 45-minute modules per school year. The first module, ***Water Chemistry,*** is to be presented during the fall/winter semesters. Its sister module, ***Waste Water***, is to be presented during the spring/summer semesters. The second year program works well as a follow-up. It consists of a ***Watershed*** - module, followed by a ***Water Quality*** module in the spring.

1. Water Chemistry (FALL)
    a. Introduction: Meet the presenter and reasons for concern about water.
    b. Water types: explain the different water types (salt or fresh).
    c. Water chemistry: describe water at the molecular level.
    d. Water cycling, geography & climate: describe the hydrologic cycle. Describe Williams Lakes' climate and geography as related to water abundance and availability.
    e. Water conservation: explain why students need to conserve water and teach them how to apply simple conservation practices *inside* their homes.

2. Waste & Groundwater
    a. Water management: describe how the City of Williams Lake manages our water and sewage.
    b. World water: discuss water abundance and use in other countries.
    c. Groundwater flow and use of mini-aquifer to demonstrate.
    d. Water conservation: explain why students need to conserve water and teach them how to apply simple conservation practices *outside* their homes.

3. Watershed – Learn how, and what impacts water as it travels.
    a. Introduction to concept of watersheds, tie into water cycle.
    b. Use of 3-D model to illustrate examples of activities in watersheds that may affect water quality.
    c. Game to encourage good water quality activities and reinforcement of the concepts.
    d. Reminder of water conservation.

4. Water Quality – Learn what affects the quality of water, and bottled water.
    a. Introduction of concept related to quality
    b. Water Testing overview
    c. Bottled Water facts and information
    d. Includes optional field trip to test the quality of water in the River Valley.

Introducing Mandy the Long-Toed Salamander

Mandy the Salamander was chosen as a Water Wise character because of its commonality in the area and importance to science and habitat monitoring. Long-toed salamanders (like Sal) are found throughout B.C. from wet coastal forests to cold mountain meadows to dry interior steppes. Amphibians, including frogs, toads, salamanders and newts, are recognized by scientists as an indicator species. Indicator species are extremely sensitive to changes in their habitat and as a result, amphibians are one of the first organisms in an ecosystem to be adversely affected by environmental pollution, climate change or other habitat altering factors. If scientists find that amphibian populations are declining, it is likely that there is some negative factor impacting the entire ecosystem. This is why amphibians are such important animals.

Let's help out by keeping our waters clean and abundant.

Meet Sal the Salmonid

Our second Water Wise character is Sal the Salmonid. Like salamanders, salmonids are found throughout the waterways of the Cariboo-Chilcotin region. Salmonids In our region are Sockeye, Chinook, Pink, Interior Fraser Coho, Kokanee and Rainbow Trout are frequently visible, especially during spawning time. These fish play an essential part in the ecosystems of our region. The primary role that salmonids play is the transference of nutrients from the ocean inland. From the land locked Kokanee and trout (including Whitefish, Rainbow Trout and blue listed Bull trout) to the anadromous salmonids (those that hatch in freshwater to lay their eggs) all are an important food source for wildlife and humans alike.

Salmonids can be identified by their adipose fin (located on their back between their dorsal and caudal fin). Their strong caudal or tailfin is what allows salmonids to jump waterfalls and swim in rough water. After spawning, the adult salmon will die and fill the water with nutrients used by other fish, birds, and numerous other wildlife species. Another distinguishing feature of salmonids is that they turn red during breeding.

If you would like to learn more about salmonids within our Cariboo-Chilcotin region visit www.ccconserv.org and press the **Salmonids** title on the left column of our home page! In our community, Fisheries and Oceans (DFO) provides an education program, ***Salmonids in the Classroom.*** The goals of this program are to educate students about how to be good aquatic stewards! For more information on this program, call the DFO staff at (250) 305-3015 (Tina Chestnut or Roy Argue).

2. WATER WISE TERMINOLOGY: CHEMISTRY

WATER MOLECULE

Adhesion –the binding of one substance to another. Water molecules are adhesive because they are easily attracted and attached to other molecules or substances such as glass, skin and plant tissue.

Boiling point –the temperature at which water becomes a gas. Water's boiling point is 100°C.

Capillary action –how water molecules move from one substance to another substance. Capillary action is possible because of tiny tubes present in most things. These tubes allow water molecules to be absorbed into many materials such as tree fibres, cotton fabric and living tissues.

Freezing point –the temperature at which water becomes a solid. Water's freezing point is 0°C.

Hydrogen bond –a chemical bond created when a positive hydrogen atom is attracted to a negative atom. This bond attaches water molecules to other water molecules, as well as non-water molecules.

Ice –the solid state of water molecules; frozen water.

Polar molecule –a molecule having opposite charges at each end. This property is why water molecules are easily attracted to other molecules.

Solute –the substance being dissolved in a solution.

Solution –two or more substances that have been mixed together.

Solvent –the substance that dissolves another substance in a solution. Water is referred to as the universal solvent because it can dissolve most other substances.

Specific heat –the amount of heat needing to be absorbed, or lost, for 1 gram of a substance to change its temperature 1°C. Due to water's relatively high specific heat it is able to stabilize air temperature.

Steam –the gaseous state of water molecules; boiled water.

Surface tension –the measure of stress needed to stretch or break the surface of a liquid. Water's surface tension is greater than most other liquids, giving water the appearance of having an elastic 'skin' on its surface. This 'skin' provides a 'floor' for very light weight objects such as water striders and leaves.

Water –the liquid state of water molecules, a clear liquid that makes up the streams, lakes and oceans.

pH SCALE

Acid –a solution that contains many hydrogen ions, ranging from 0-6 on the pH scale. Some common acids are coffee, vinegar, gastric (stomach) juice and lemon juice.

Base –a solution that contains few hydrogen ions, ranging from 8-14 on the pH scale. Some common bases are human blood, seawater, household bleach and oven cleaner.

Neutral –a solution that contains some hydrogen ions. Pure water is a neutral substance.

pH scale –a value ranging from 0 to 14 which measures how acidic or basic a solution is.

HYDROLOGIC CYCLE

Aquifer –where much groundwater can be stored. Aquifers are made up of sand that is heavily saturated (full of water). The City of Williams Lake gets its water from an aquifer that is over 70 metres underground.

Condensation –the process where water changes states from a gas (vapour) to liquid or from a liquid to a solid.

Evaporation –the process where water changes states from a liquid to a gas (vapour).

Groundwater –water that collects below the surface of the land.

Hydrologic cycle –the natural cycle of water continuously circulating around the world.

Permeable surface –a surface that allows water to be absorbed into it; for example, dirt absorbs rain water.

Precipitation –the process where condensed water vapour falls from the sky as snow, rain, sleet or hail.

Runoff –water that flows over and under land.

Transpiration –the process where water evaporates from plants.

3. WATER WISE TERMINOLOGY: CONSERVATION

Conservation –caring for or managing a natural resource such as water, trees and animals so that the supply never runs out and the quality is maintained.

Ecosystem –all living organisms and non-living factors that exist within a defined area. Examples of some common ecosystems in the Cariboo-Chilcotin are forest ecosystems, grassland ecosystems and wetland ecosystems.

Environmental pollution –the introduction of materials, into an ecosystem, that has a negative effect on that ecosystem. Some common pollutants are many cleaning products, exhaust from burning fossil fuels, heavy metals and untreated sewage.

Municipality –any group of people that have self-government to decide local affairs. Williams Lake is a municipality because it has an elected town council that creates local bylaws and maintains local services such as water systems, parks and schools.

Renewable resources –naturally occurring materials that either are potentially limitless, because of continuous flow or because of quick recharge time; for example water, trees and wild salmon.

Retrofit –replacing broken or old fixtures or appliances with new, more efficient ones. For example, replacing a leaky faucet with a low-flow faucet or installing a new, low-flow toilet.

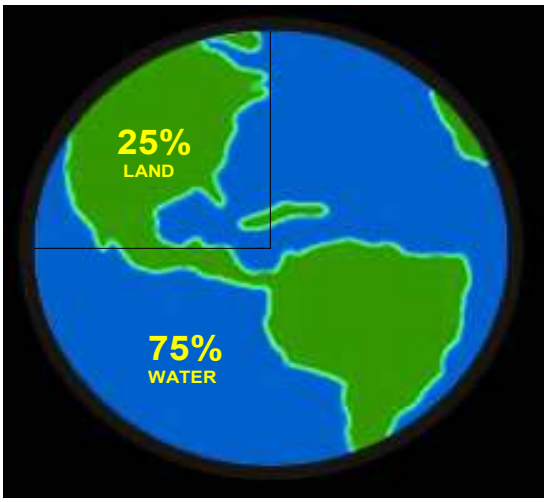
Watershed –an area of land that drains all water to a river system or body of water. For example, the City of Williams Lake accesses its water from the San Jose watershed.

Xerophyte –any plant that can live in extreme heat and drought conditions. These plant communities are called xerophytic communities.

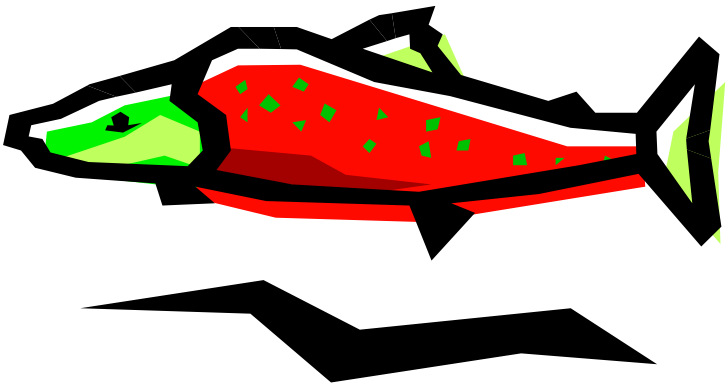
4. BACKGROUND –ALL YOU EVER WANTED TO KNOW ABOUT WATER BUT WERE AFRAID TO ASK!

Water is arguably the most important substance on Earth. Three quarters of the planet is covered with this wonderful resource. Water keeps our bodies hydrated, grows our food, generates our electricity and, may one day, power our cars. Water also helps maintain healthy ecosystems around the world, commonly being referred to as Earth's "circulation system".

Salt water makes up 97% of the water on Earth. But, don't fret, this is a good thing. Oceans and seas are responsible for many of the Earth's processes, such as nutrient cycling, stabilizing global climate, providing important food sources for countless species and transferring much needed nutrients from the ocean inland. Most importantly, salt water is where our freshwater comes from, by passing through the hydrologic cycle.

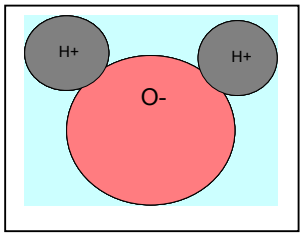


Only 3% of our planet's water is fresh. Of this, 2% is locked up in glaciers and polar ice, leaving only 1% of Earth's water supply accessible to humans. Of course, humans are not the only living beings on Earth that need fresh water; all those fishes, birds and trees need fresh water too! Due to this limited amount of fresh water, we must act responsibly with this precious resource to ensure it is around for future generations.



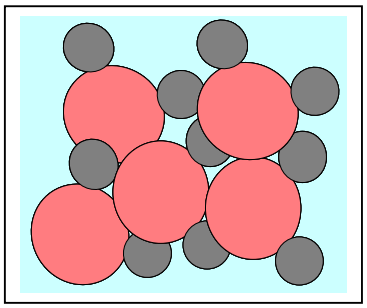
5. WATER CHEMISTRY –WELCOME TO THE AMAZING WORLD OF WATER

Meet the water molecule!

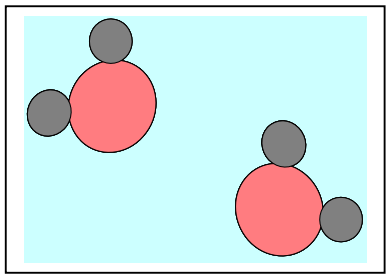


Have you ever wondered why water is referred to as H_2O? H_2O is the chemical formula that describes which atoms make up the water molecule. *WATER* is a molecule built out of three atoms: 2 hydrogen atoms and 1 oxygen atom. *HYDROGEN BONDS* are chemical bonds created when a slightly positive hydrogen atom is attracted to a slightly negative atom of another molecule. The water molecule is a *POLAR MOLECULE*, meaning one end has a positive charge and the opposite end has a negative charge. These properties make water a very unique molecule, allowing it to exist in the natural world in all 3 physical states: solid, liquid and gas. Can you guess what cartoon character the water molecule looks like?

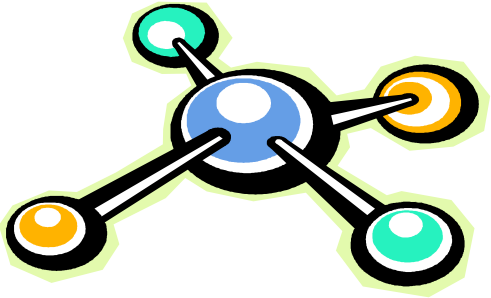
Why does ice float and steam rise?



ICE is created when water molecules are cooled down below their FREEZING POINT of 0°C. Imagine the molecules are huddling together to keep warm, just as you and your friends do on a cold day. Ice floats because air pockets get trapped between the frozen water molecules, making ice more buoyant than liquid water. This is why ice floats on top of water. Could you imagine what would happen to all the fish if ice sank to the bottom of lakes in the winter?

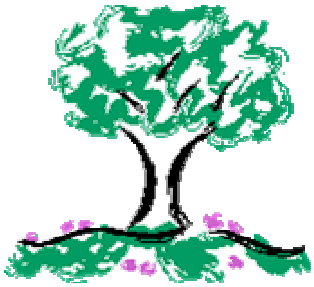


What happens when you heat up a pot of water? It creates steam. *STEAM* (gaseous water) is created when water molecules get heated up enough to reach their BOILING POINT of 100°C. Their hydrogen bonds break and individual water molecules are released. Since gases are lighted than liquids, steam rises. This allows individual water molecules to rise up into the atmosphere and eventually create clouds.



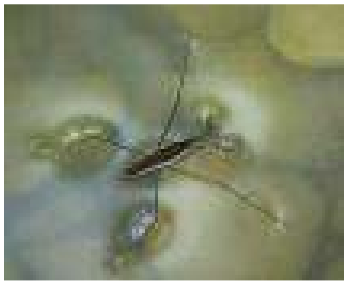
Water, stronger than you may think!

Water is a very clingy molecule. *ADHESION* is the term used to describe this clinginess of water molecules to other molecules (water and non-water). Due to water's polarity, it easily attracts other molecules. In addition to polarity, waters' strong hydrogen bonds attach these molecules together. These two factors, polarity and hydrogen bonds, make it almost impossible to keep water molecules away from other molecules, making water a very clingy molecule.



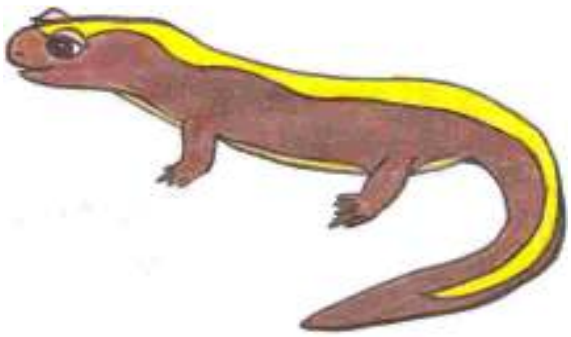
CAPILLARY ACTION is how water molecules move from one substance to another. Capillary action is possible because of tiny tubes that are present in most things. These tubes allow water molecules to be absorbed into many materials such as tree fibres, fabrics and living tissues. Capillary action along with water's adhesiveness explains how water moves from a tree's roots all the way up to its leaves, why a towel dries you off after a shower and how fabrics dipped in coloured water make fun designs.

In addition to adhesion and capillary action, surface tension plays an important role in the strength of water. *SURFACE TENSION* is the amount of energy needed to stretch or break the bonds of a liquid, in this case, water's hydrogen bonds. As stated earlier, hydrogen bonds are very strong; these strong bonds make water's surface tension strong. Due to this strong surface tension, water appears to have an elastic 'skin' covering its surface. This 'skin' creates a base to support lightweight objects such as water striders and leaves.



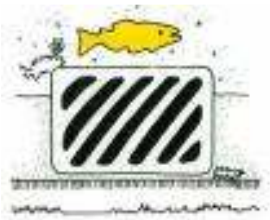
Is it hot in here?

Water helps regulate the Earth's temperature, ensuring we don't get too hot or too cold. This is because water has a high specific heat. *SPECIFIC HEAT* is the amount of heat needing to be absorbed, or lost, for 1 gram of a substance to change its temperature 1°C. Water needs more heat to boil or freeze than most other substances. Air has a lower specific heat than water, allowing air to heat up and cool down quicker than water. For example, on a hot sunny day a lake absorbs huge amounts of heat from the air, cooling the air by many degrees but only warming the lake one or two degrees.



Water loves to mix it up!

Water is the universal *SOLVENT*, meaning it will dissolve more substances than any other material on Earth. For example, making a jug iced tea from powder; this is possible because water dissolves the iced tea powder. When making iced tea, the ice tea powder is the *SOLUTE*, the water is the *SOLVENT* and the water-powder mix is a *SOLUTION*. But water does not dissolve every substance. Substances that water cannot dissolve are called insoluble.



Oil is insoluble; if grease or vehicle oil is poured down a storm drain it goes, untreated, into our streams, lakes and oceans. It has been found that releasing pollutants (like oil) into aquatic (water-based) ecosystems has negative effects on the plants, animals, fishes and invertebrates that need clean water to survive. Also many storm drains outflow into salmon rearing habitat; this can result in low birth rates in salmon and in some cases, premature death of young salmon. In Williams Lake, a new storm drain system is being planned that will treat water from storm drains before returning it to the river system.

pH what?!

Scientists use pH to describe the acidic, basic or neutral quality of water. This scale measures the amount of hydrogen ions in a solution. The *pH SCALE* assigns a number between 0 and 14 to an aqueous (liquid) solution. If a solution is between 0 and 6, it has a high amount of hydrogen ions making the solution acidic. Solutions between 8 and 14 have a lesser amount of hydrogen ions making them basic. Neutral solutions have a pH of 7.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

←---------- acidic ---------- neutral ---------- basic ----------→

Some common acids are lemon juice, gastric (stomach) juices and vinegar. Pure water and our blood is neutral. Seawater, ammonia and bleach are common bases.

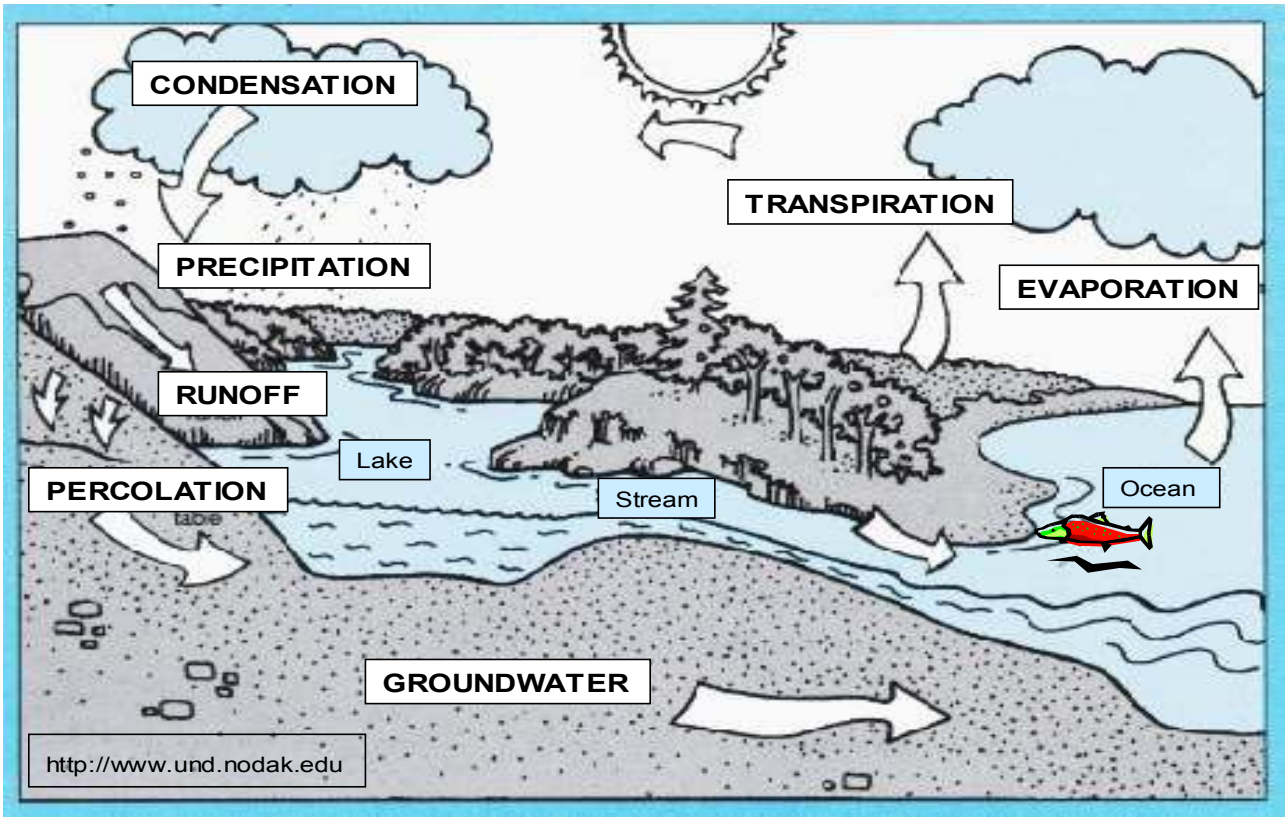
ENVIRONMENTAL POLLUTION is caused by many human activities such as, industry, vehicle emissions and agriculture. As stated earlier, pollutants (such as oil, cleaning products and fossil fuel emissions) released into aquatic ecosystems can cause premature death in many salmonids (salmon, steelhead, char and trout) species.

Environmental pollution can also cause rainwater, this is pH 5, to become more acidic, ranging between pH 4.5 and 0. Acid rain can damage plants, animals, man-made structures and make fresh water undrinkable. An example of how altered pH can negatively affect nature is salmon. Many salmonids cannot produce viable eggs if the water they live in is pH is 4.5 or lower. Adult salmonids will die at pH 3.5! Another example is that many plant species can die if soil pH is 4 or lower.

6. WATER CYCLING, GEOGRAPHY & CLIMATE

Water, world traveller!
Water is the ultimate world traveller. It has been rain in Europe, snow in Antarctica, water in the Pacific Ocean and clouds over Africa. There has also been the same amount of water now as there was 100 million years ago! You could be showering in water that a dinosaur drank 100s of millions of years ago. So how does water move continuously around the world providing us with fresh water to drink?

The *HYDROLOGIC CYCLE* is the natural process where water continuously circulates around the world. Water molecules *EVAPORATE* because the sun heats up the surface water in rivers, lakes and oceans. Water also evaporates from plant leaves through *TRANSPIRATION*. Evaporated and transpired water vapour rises into the atmosphere, *CONDENSES* and forms clouds. Clouds release water vapour as *PRECIPITATION*. Precipitation has many forms: liquid (rain) or solid (snow, sleet and hail). Once precipitation falls it can be absorbed into the soil, *RUNOFF* the land into lakes, rivers and oceans, or percolate through the soil to become *GROUNDWATER*. Much *GROUNDWATER* becomes stored in *AQUIFERS.* Aquifers are large collections of sand that is heavily saturated with water. Then the sun comes out and causes water molecules to evaporate again and the cycle continues.



Surrounded by water!
Everywhere we look in the Cariboo-Chilcotin we see water. We have large lakes, huge rivers, many streams and more tributaries than you can count. So, you would think our water comes from one of these obvious sources. In fact, our water comes from an *AQUIFER* that is located over 70 metres underneath our city! In fact, our aquifer lies 40 metres below the bottom of Williams Lake. The aquifer is recharged (refilled) by runoff from watersheds, primarily the San Jose River Watershed.

Hot & dry
Williams Lake is in the Cariboo-Chilcotin region, which is well known for its hot, dry climate. Williams Lake receives an average of 450mm of rainfall annually. For perspective, Vancouver receives 1106mm of annual rainfall, Cairo (Egypt) gets 28mm and equatorial rainforests receive 2225mm of rain annually. Our climate with good snow pack in winter and reliable rainfall in the spring and fall creates ideal conditions for wild grass species. Our climate is why the Cariboo-Chilcotin has become home for some of the most ecologically unique native grassland ecosystems in B.C. Of course our climate has also allowed Williams Lake to become home to some of the world's most recognized cattle ranches and rodeos.

The warm summers of the Cariboo-Chilcotin region have another effect: droughts and forest fires. Naturally occurring forest fires and extended droughts are common throughout this region. The grassland ecosystems that define the Cariboo-Chilcotin are adapted to rely on periodic fires to remain healthy and productive. The native plants and animals are also adapted to this region so they can survive extended droughts. In turn, the human residents of the Cariboo-Chilcotin need to adapt to its climate and ensure we do not over-use our limited water supply.

7. WATER MANAGEMENT – WHERE DOES ALL OF OUR WATER COME FROM?

How lucky we are!
Every Canadian has access to clean drinking water. Most of this water comes from infrastructure municipalities install. The infrastructure installed by municipalities transports water from the sources (lakes, rivers or aquifers) to our homes and also sanitizes waste water. Much of the world, however, does not have access to this luxury. Worldwide, 1.1 billion people lack access to clean drinking water! Basic sanitation is also absent in much of the world with 2.4 billion people worldwide lacking sanitation, mostly in Africa and Asia.

From aquifer to tap, an uphill battle!
The City of Williams Lake has one of the best water systems in the Province. The City of Williams Lake accesses its water from an aquifer over 70 metres underneath the city. The City decided to drill deep wells to access the aquifer instead of surface pumping water from Williams Lake because aquifer water is less likely to contain contaminants and requires less filtration. There are 5 wells near Scout Island that pump almost 14 million litres of water per day to the approximate 12,000 residents, and businesses, of Williams Lake!

Once the water is pumped out of the aquifer, it is transferred uphill to our homes. Since this water has to battle against gravity, there are booster stations located throughout the city. These boosters are massive pumps that push water up through the pipes that take water to our homes. It costs the City a minimum of $500,000 each year to ensure water flows out of our taps.

Flush!
Every time you flush your toilet or run a tap you are creating waste water (sewage). In nature, wetlands clean waste water by absorbing impurities, releasing clean water for animals and plants. In our towns and cities treatment plants take the place of wetlands. The City of Williams Lake is responsible for treating (purifying) our sewage. All sewage must be treated before it can be safely released back into the environment. The City of Williams Lake pays $180,000 each year to treat our sewage! Remember this next time you want to flush a Kleenex down the toilet or leave a tap running.

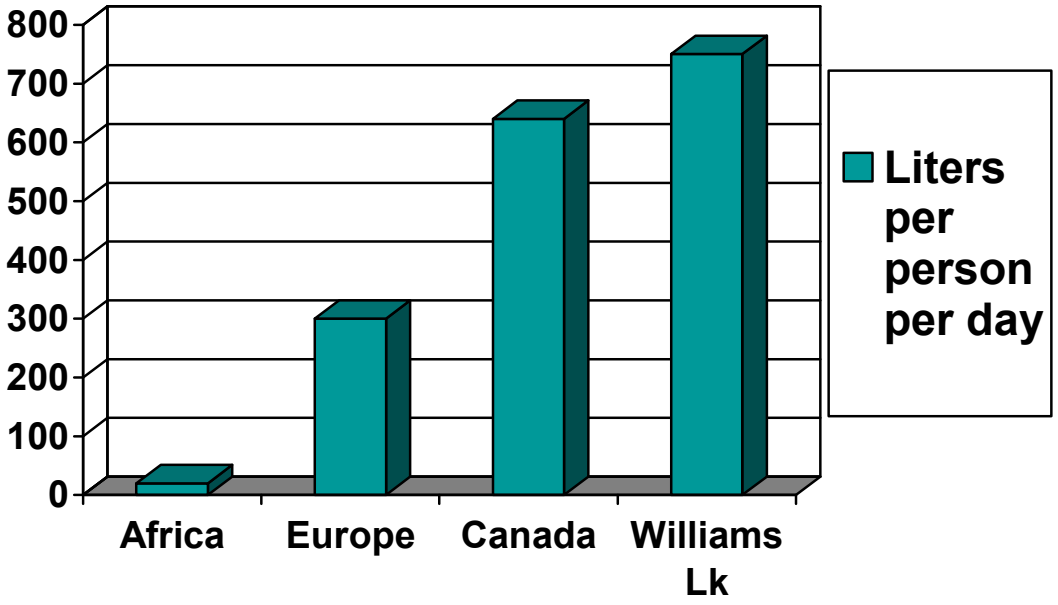
How the City of Williams Lake is being Water Wise
To ensure the City continues to have one of the best water systems in B.C., system upgrades are a continuous process. Recently, the City has invested over $12 million to improve our water system, including fixing leaky pipes, retrofitting old equipment and enhancing water flow. These improvements make the City of Williams Lake Water Wise, trying to make sure no drop is wasted getting to our homes and releasing no untreated sewage into the environment.

8. WORLD WATER – HOW DO WE SHAPE UP?

Worldwide water is becoming scarce. The deserts are increasing and many rivers are drying up. This scarcity is creating a water crisis in many countries such as Africa, the Middle East and Australia. Even though Canada has 20% of the world's fresh water supply, our rivers and lakes seem to be decreasing as well.

Unfortunately, many people are not aware of this growing water problem. Canadians realize we have an abundance of water in this country, so we forget to act responsibly towards it. Sadly, Canadians take water for granted.

Countries with limited fresh water, like Africa, tend to use substantially less water than countries with an abundance of water, like Canada. The United Nations states that every person needs only 50 litres (lt) of water per person per day! On average, every Williams Lake resident uses 750 lt of water each day! That is 110 lt more than the average Canadian, 450 lt more than the average European and 730 lt more than the average African! It is about time Williams Lake residents learn to be Water Wise.



9. WATER CONSERVATION – HOW YOU CAN BE WATER WISE

Why should we conserve water?
Water is a *RENEWABLE RESOURCE*, meaning it is a naturally occurring material that is potentially limitless, either because of continuous flow or quick recharge time. To *CONSERVE* is to care for or manage a natural resource (water, trees, animals or ecosystems) so that the supply never runs out and the quality is maintained. Practicing water conservation is important because it:

- ✓ ensures water quantity
- ✓ preserves water quality
- ✓ saves money
- ✓ maintains healthy ecosystems

To ensure water quantity Williams Lake residents need to ensure the aquifer remains full. The aquifer is currently decreasing 0.4 metres annually! This decrease is due to an extended drought, increased municipal users, and reduced permeable surfaces (due to urban development).

Water quality must be preserved. Every drop of water used must be treated before it can be safely released back into the environment. The treated water is of lesser quality than before it was treated. Another factor decreasing water quality is environmental pollution. As stated earlier, pollution alters water chemistry, making it unsuitable for humans, wildlife and plants.

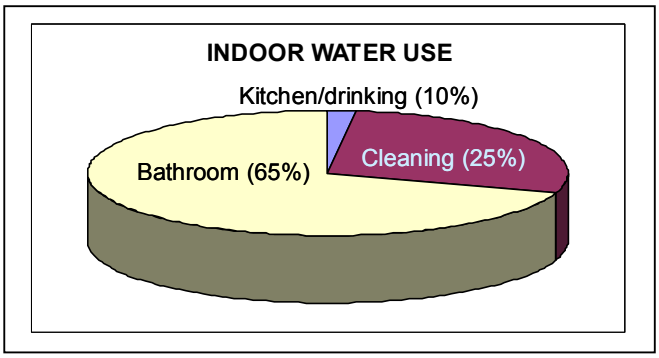
Humans need water to grow food, hydrate, run factories and generate power. But every organism in every ecosystem needs water too. Salmon need nutrients from water, trees need water to grow, and salamanders need water to reproduce. If we are wasteful with water all the fishes, animals and plants will suffer. By practicing simple water conservation around our homes we can ensure a sustainable water supply. YOU can make a difference!

How you can be Water Wise!
There are many ways to be Water Wise. Just remember the 3 R's of water conservation.

- ✓ REDUCE water use
- ✓ REPAIR leaks and drips
- ✓ *RETROFIT* broken faucets and appliances

Reducing water quantity

To ensure water quantity, we have to understand where water is used. Water is used indoors (cooking, cleaning and drinking) and outdoors (lawn maintenance, gardens and recreation). Let's examine how you can be Water Wise inside your home.



As the graph shows, bathrooms are the largest culprit of indoor water use. This is because toilets, showers and baths use lots of water. Here are some easy bathroom Water Wise tips that can save you **2000 litres** of water a week!

- Place a sealed jug full of water in the toilet reservoir to displace water, this reduces the amount of water used for each flush (do not use a brick, they degrade and plug the toilet).
- Repair leaky faucets.
- Retrofit old faucets and toilets with new low-flow ones.
- Use a waste basket for garbage, not the toilet.
- Turn off the shower when soaping and shampooing during a shower.
- Turn off the faucet when washing your face and hands or brushing your teeth.
- Have shorter showers, 5 minutes is ideal.
- Fill the bath tub only half full.

The other 35% of indoor water use is in the kitchen and cleaning. You can save **1200 litres** of water each week by following these easy Water Wise tips!

- Have a jug of cold water in the fridge so the faucet is not left running until the water is cold.
- Repair leaky faucets.
- Retrofit old faucets or appliances with new low-flow appliances.
- Only run the dishwasher and washing machine with full loads.
- Wash dishes by hand.

Being Water Wise does not stop indoors. Outdoor water use is the largest water waste offender of home water use. Here are some outdoor Water Wise tips that can save you **2500 litres** of water a week!

- Use a bucket of soapy water to wash the car, not a hose.
- Use a broom to clean driveways and sidewalks, not a hose.
- Retrofit open ended hoses with automatic spring-loaded nozzles (it stops water flow when not in use).
- Remember to turn off all sprinklers when you are done playing in them.

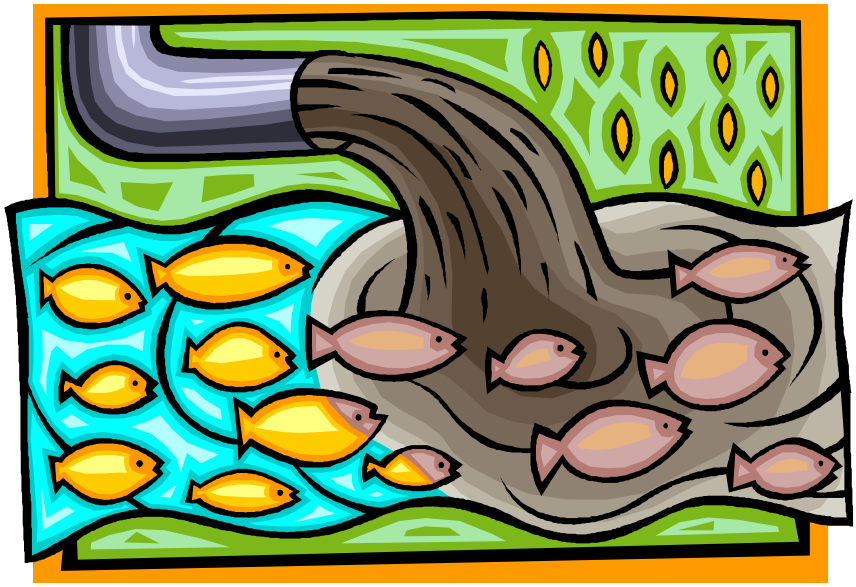
Watering lawns accounts for 75% of outdoor water use. Unfortunately most of the water that is used on lawns is lost to evaporation and runoff caused by incorrect watering practices. By following these simple Water Wise tips you can save **3000 litres** of water each week!

- Have *XEROPHYTIC* plants in your garden, such as Day Lilies, shrub Roses and Pine trees.
- Water the lawn only when it needs it, if it's dry 2-3 times a week for 30 minutes is plenty.
- Water the lawn for 30 minutes maximum, any more cannot be absorbed into the already saturated grass.
- Water the lawn between 6pm and 10am to minimize water evaporation.
- Set the lawnmower blades between 5 and 8cm high and leave grass cuttings on the lawn for an excellent fertilizer.

By following those easy water conservation tips, you can save **8700 litres** of water every week! WOW!!

Increasing water quality

To increase water quality, we need to reduce environmental pollution. Ask your parents to use environmentally friendly cleaning products; this helps keep our water free of harmful chemicals (see Follow-Up Activities: #3, Bio-Friendly Cleaners). Do not throw waste water (including soapy water to clean the car) down the storm drain. Storm drain water goes directly into the environment without treatment. There are 11 storm drains that empty into our local rivers. These rivers are home to young salmonids, many of which are raised in local classrooms. By pouring waste down storm drains you are releasing pollutants into the environment that can adversely harm those salmonids you helped to raise. To avoid this, pour waste water down indoor drains (indoor drains are always treated, removing pollutants before entering the environment). Most importantly, remember the 3 R's of being Water Wise: reduce, repair and retrofit, so only water we need is pumped out of the aquifer. By following those easy water conservation tips you can help maintain healthy ecosystems for salmon, salamanders, bears and trees.



Saving money

It costs the City of Williams Lake millions of dollars to maintain and treat our water. By wasting water we are placing extra stress on the pipes, boosters, and treatment centre. This extra stress causes infrastructure to wear out faster, resulting in the City spending extra money on repairs. If we practice responsible water conservation these expensive repairs can be avoided, allowing money to be spent on other city facilities such as parks, bike trails and recreation services.

10. PROGRAM WORKSHEETS

1. TERMINOLOGY

Objective: To help students understand key terms that will be used during the Water Wise programs.

There are 3 activities and 1 answer key in this section:

- Water Wise Chemistry : Terminology
- Water Wise Chemistry: Hydrologic Cycle
- Water Wise Conservation: Terminology
- Answer key

WATER WISE CHEMISTRY: Terminology

Draw a line from each term to their correct definition:

Water	-the liquid state of water molecules
Ice	-the temperature where water becomes a gas
Freezing point	-the gaseous state of water molecules
Steam	-the solid state of water molecules
Boiling point	-the temperature where water becomes a solid
Permeable surface	-a surface that absorbs water and other substances
Hydrogen bond	-a molecule having opposite charges at each end
Polar molecule	-the amount of stress needed to break a liquid's surface
Adhesion	-a solution that has many hydrogen ions
Capillary action	-this process makes water molecules able to move from one substance to another
Surface tension	-the binding of one substance to another substance
Specific heat	-the substance being dissolved in a solution
Solvent	-a solution that has few hydrogen ions
Solute	-amount of heat needed to heat or cool a substance
Solution	-a substance that dissolves another substance
pH scale	-the measure of how acidic or basic a solution is
Acidic	-2 or more substances that have been mixed
Basic	-a chemical bond created when a slightly positive hydrogen atom is attracted to a slightly negative atom of another molecule.

WATER WISE CHEMISTRY: Hydrologic cycle

Fill in the blanks of the diagram with the following terms:

Precipitation –condensed water vapour that falls from the sky as snow, rain, sleet or hail.

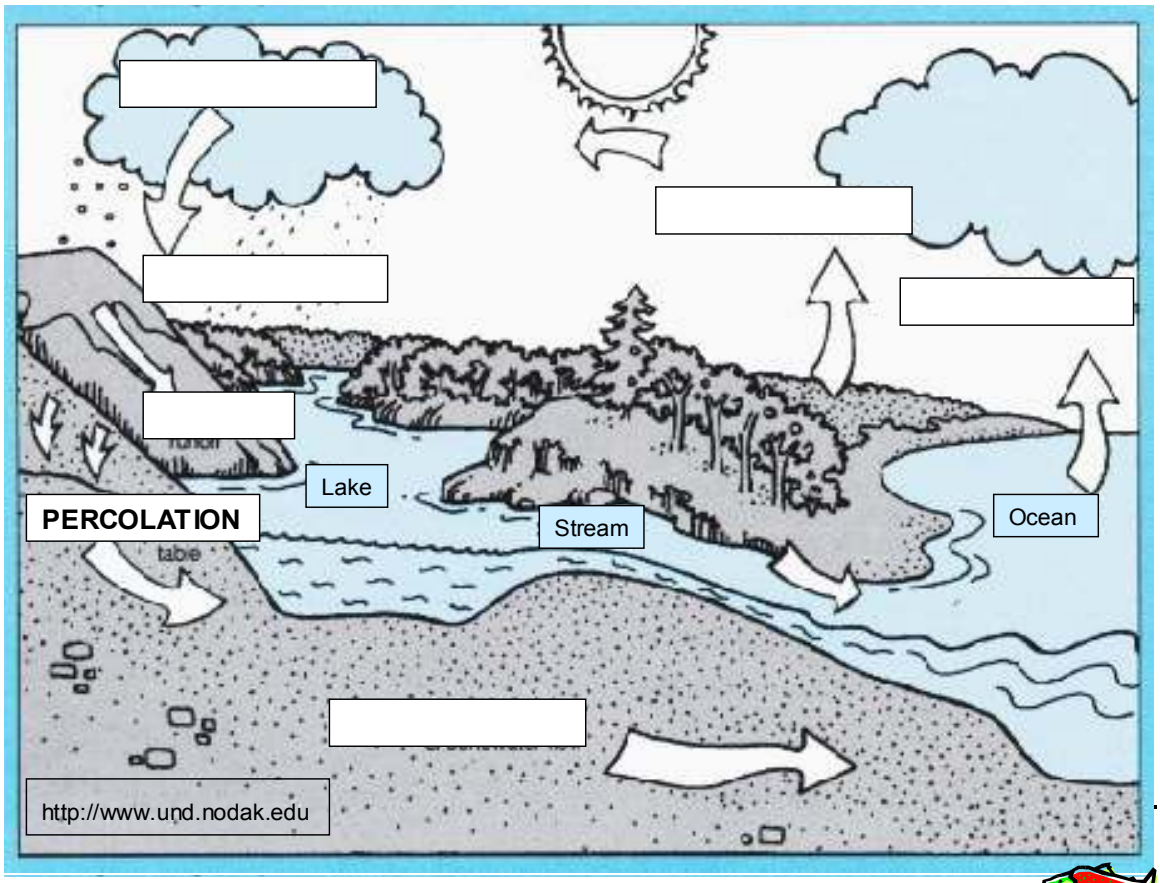
Transpiration –water that evaporates from plant leaves.

Evaporation –water that is changing states from a liquid to a gas (vapour).

Condensation –water that is changing states from a gas (vapour) to a liquid or a liquid to solid.

Runoff –water that flows over and under land, eventually flowing into an aquifer or back into rivers, lakes or oceans..

Groundwater –water that collects below the land surface and can be stored in an aquifer.



WATER WISE CONSERVATION: Terminology

Fill in the blanks with the following terms:

Conservation – caring for or managing a natural resource such as water, trees, animals and ecosystems so that the supply never runs out and the quality is maintained.

Ecosystem – all living organisms and non-living factors that exist within a defined area.

Environmental pollution – the introduction of materials, into an ecosystem, that has a negative effect on any ecosystem.

Municipality – any group of people that have self-government to decide local affairs.

Renewable resource – naturally occurring materials that are potentially limitless, either because of continuous flow or quick recharge time.

Retrofit –replacing old or broken fixtures with new, efficient ones.

Watershed – an area of land that drains all water to a river system or body of water.

Xerophyte – any plant that can live in extreme heat and drought conditions. These plant communities are called xerophytic communities.

Williams Lake is a _____ with 11,500 residents.

Environmental pollution harms many _____ in the Cariboo-Chilcotin.

By planting a _____ in your garden you can be Water Wise.

The San Jose _____ provides water to our aquifer.

When your toilet breaks, _____it with a low-flow toilet.

Water is a very precious _____,

We all need to practice responsible water _____ so there is always enough water for everyone and every fish, plant and animal.

Pouring oil down the storm drain is a form of _____.

WATER WISE CHEMISTRY: Answer key-terminology

Water
Ice
Freezing point
Steam
Boiling point
Permeable surface
Hydrogen bond
Polar molecule
Adhesion
Capillary action
Surface tension
Specific heat
Solvent
Solute
Solution
pH scale
Acidic
Basic

-the liquid state of water molecules
-the temperature where water becomes a gas
-the gaseous state of water molecules
-the solid state of water molecules
-the temperature where water becomes a solid
-a surface that absorbs water and other substances
-a molecule having opposite charges at each end
-the amount of stress needed to break a liquids surface
-a solution that contains many hydrogen ions
-this process makes water molecules able to move from one substance to another
-the binding of one substance to another substance
-the substance being dissolved in a solution
-a solution that has few hydrogen ion
-amount of heat needed to heat or cool a substance
-a substance that dissolves another substance
-the measure of how acidic or basic a solution is
-2 or more substances that have been mixed
-a chemical bond created when a slightly positive hydrogen atom is attracted to a slightly negative atom of another type

WATER WISE CHEMISTRY: Answer key-hydrologic cycle

Starting left moving clockwise: evaporation, transpiration, condensation, precipitation, runoff and groundwater.

WATER WISE CONSERVATION: Answer key-terminology

municipality, ecosystem, xerophyte, watershed, retrofit, renewable resources, conservation, environmental pollution

2. CLASS ASSESSMENT

Objective: To make students aware of the many ways they use water around the house. Encourage students to reduce their water use by showing them easy things they can do.

There are 2 activities in this section:

- How Water Wise in my Household?
- Simple Water Wise Tips

Answer These Questions and Add It Up!

Many years ago, scientists came up with a way to measure how much of the Earth we each use EACH day. It is called an Ecological Footprint. Here is a way to see how much water each household uses each week.

WEEKLY WATER FOOTPRINT

WHAT YOU DO	How many times each day 1	2	3	4	5	6	7	Total Times	Average	Actual*	Total
In the Bathroom											
◊ Toilet Flushes									x 18 L		
◊ Showers									x 100 L		
◊ Baths									x 60 L		
◊ Teeth Brushing									x 10 L		
◊ Shaving									x 20 L		
In the Kitchen											
◊ Cooking									x 20 L		
◊ Dishes by Hand									x 35 L		
◊ Dishwasher									x 50 L		
In the Laundry Room											
◊ Washing									x 225 L		
Outdoors											
◊ Carwashes									x 400 L		
◊ Gardens/ Lawn Watering (number of mins)									x35 L/ min		
Other											
◊									estimate		
									WEEKLY HOUSEHOLD TOTAL:		

*if you use less than the average, record *your* actual consumption rates

WEEKLY WATER FOOTPRINT

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In the Bathroom											
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◊ Teeth Brushing									x 10 L		
◊ Shaving									x 20 L		
In the Kitchen											
◊ Cooking									x 20 L		
◊ Dishes by Hand									x 35 L		
◊ Dishwasher									x 50 L		
In the Laundry Room											
◊ Washing									x 225 L		
Outdoors											
◊ Carwashes									x 400 L		
◊ Gardens/ Lawn Watering (number of mins)									x35 L/ min		
Other											
◊									estimate		
									WEEKLY HOUSEHOLD TOTAL:		

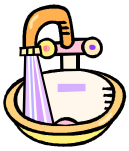
*if you use less than the average, record *your* actual consumption rates

SIMPLE WATER WISE TIPS

- Place a sealed jug of water in the toilet reservoir to displace water; this reduces the amount of water used for each flush. (Do not use a brick, it will degrade and plug your toilette.)

- Repair leaky faucets.
- Retrofit broken faucets, shower heads, toilettes and appliances
- Have shorter showers, 5 minutes is ideal.

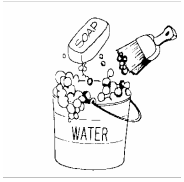
- Turn off the shower when you are soaping up and shampooing your body.



- Turn off the faucet when washing your face, hands or brushing your teeth.
- Have a jug of cold water in the fridge so the faucet is not left running until the water is cold.

- Run the dishwasher, washing machine with full loads only.

- Wash dishes by hand.



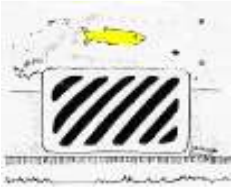
- Use a bucket of soapy water to wash the car.
- Use a broom to clean driveways and sidewalks.

- Retrofit open hoses with automatic spring-loaded nozzles.
- Remember to turn off sprinklers when you are done playing in them.

- Have xerophytic plants in the garden.

- Water your lawn 2-3 times a week for 30 minutes each watering.
  Your lawn can absorb only 2.5cm of water at one time, this amounts to 30 minutes of watering. Any more results in the water running off the lawn into the sewer or evaporating. The time of day you water also affects absorption of water into the roots. By watering between 6pm and 10am you are maximizing water absorption into roots. If you water outside those times you are loosing much water to evaporation and may actually 'sunburn' your lawn.
- One way to keep your lawn green and healthy is to set your lawnmower between 5-8cm, and leave the cut grass on the lawn as a natural fertilizer

- Use Bio-Friendly cleaners around the house.
- Do not pour anything down storm drains.

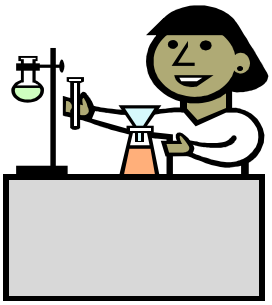


11. FOLLOW-UP ACTIVITIES: WATER CHEMISTRY

1. FUN WATER CHEMISTRY EXPERIMENTS

Objective: To emphasize water chemistry principles discussed in the Water Wise programs. There are 7 activities in this section:

- Water is in all Living Things: Drying Plants
- Adhesion & Capillary Action: Tie-Dye Bookmark
- Surface Tension: How Many Water Drops Fit on a Penny
- Solubility: Cleaning up Oil Spills
- pH Scale: Cabbage Juice Test
- Hydrologic Cycle & Water Purification: Making a Model Wetland
- Transpiration: Watch a tree breathe



Water is in all living things: Drying Plants

Explanation: Drying or smoking food is how many people around the world kept their foods from spoiling before refrigerators were invented. In fact, many First Nation peoples in Canada still smoke salmon and dry berries today. When food is dried, most of the moisture (water) is removed, making it possible to keep food over long periods.

Materials: oven/drying rack/ window sill, scale, paring knife, fruits/vegetables

Procedure:

1. slice fruits/vegetables/roots (done by teacher)
2. weigh & record slices
3. place slices in over/drying rack/window sills
4. ask students to predict & record how much the slices weight will decrease due to water loss
5. every day measure & record drying slices weight
6. stop drying slices once weights cease decreasing

Discussion: Ask students if their predictions were correct. Have students analyze their results by making graphs of weights before, during and post drying. Explain that the weight loss observed was due to water loss. Ask students if the amount of water loss was surprising.

Adhesion & Capillary Action: Tie-Dye Bookmark

Explanation: Capillary action explains how water molecules move from one substance to another. Capillary action is possible because of tiny tubes that are present in most things. These tubes allow water molecules to be absorbed into many materials such as tree fibres, cotton fabric, fish gills and living tissues.

Materials: scissors, paper/fabric/coffee filters, water-soluble markers, food dye, tape, small water-filled bowls

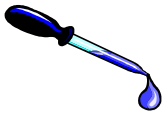
Procedures:

1. cut the paper/fabric/coffee filters into strips (done by teacher)
2. using the markers, draw several horizontal and vertical lines 3 cm from the bottom of the bookmark
3. tape the bookmarks along a shelf/window/wall so that the ends of the bookmarks touch the water in the small bowls
4. if the students want a very colourful bookmark, place a couple of food colouring drops in the small bowl of water
5. after the water has reached the top of the bookmark, remove the water and let the bookmark dry fully before using

Discussion: When the strips for the bookmarks are cut, observe the fibres at the cut end under a microscope. Ask the students why the marks on the bookmarks moved when placed in water. Explain that capillary action, through the tiny fibres (tubes) they saw in the microscope, transported water up the bookmark.

Surface Tension: How Many Water Drops Will Fit on a Penny?

Explanation: Surface tension is the amount of energy needed to stretch or break the bonds of a liquid, in this case, water's hydrogen bonds. Water has a strong surface tension, giving water the appearance of having an elastic 'skin' over its surface. This 'skin' provides a floor for lightweight objects. This property is why water forms drops and how water striders can walk on water!



Materials: bowl of water, penny, eye dropper

Procedure:

1. give each student a penny, eye dropper and small bowl of water
2. ask students to predict how many water drops will fit on their penny
3. allow students to test their predictions 3 times
4. record the average amount of drops that fit on each penny

Discussion: Ask students if their predictions were correct. Explain to them that waters strong surface tension caused the surface to bubble, allowing for many drops to fit on a small penny. Ask if this surprises them.

Solubility: Cleaning up Oil Spills

Explanation: Oil spills are very damaging to ecosystems. Have you ever wondered how oil spills are cleaned up so that fishes, birds and plant life can survive? This experiment will illustrate how oil spills are cleaned up.

Materials: a bowl half full of water, tablespoon, cotton balls, cooking oil

Procedure:

1. place bowl (water is the solvent) on a desk
2. add one tablespoon of oil (a solute) into the bowl
3. mix the solution and observe the results
4. place cotton balls into the solution and try to absorb the oil from the water

Discussion: Ask students if this would work on an oil spill. Discuss how oil spills negatively affect ecosystems. Explain that pollutants (including oil) that go down the storm drains go directly to water ways causing mini-oil spills.

pH Scale: Cabbage Juice Test

Explanation: Scientists use pH to describe the health of a water body. If the pH outside its 'healthy' range, scientists realize pollutants may be present. pH determines if the solution is acid (0-6 pH), neutral (7) or basic (8-14). Litmus paper is the tool used by scientists to determine the exact pH of a lake or stream. In this experiment cabbage juice mimics litmus paper.

Materials: one red cabbage, pot of boiling water, clear glasses, tablespoon, lemon juice, vinegar, bottled water, window cleaner and other household products

Procedure: Teachers should make the cabbage juice prior to class experiment. To make the cabbage juice, boil a red cabbage until the water is a deep purple. Let the cabbage juice cool, then place into a container to be used in pH experiment (the boiled cabbage can be eaten). To perform the experiment:

1. pour each of the test products into a clear glass
2. add one tablespoon of cabbage juice to the test products
3. observe the colour change

Discussion: Ask the students to guess what each colour represents in the pH scale. Ask students why it is important for scientists to be able to determine pH. Explain that unhealthy ecosystems can be determined by testing pH changes over time. Explain that litmus paper allows scientists to determine the exact pH of a solution.

Solution colour	pH range
Pink	0-6 (acidic)
Purple	7 (neutral)
Green	8-14 (basic)

Hydrologic Cycle & Water Purification: Making a Model Wetland

Explanation: Wetlands purify water by filtering dirty water through their intricate web of filters such as soil, vegetation and invertebrates. This experiment uses hydrologic cycle principles (evaporation, condensation and precipitation) to mimic a wetland purification system.

Materials: water, large dishpan, garden soil, drinking glass (shorter than the height of the pan), 4 clean marbles, plastic wrap, masking tape

Procedure:

1. add 5 cm of water into the dishpan with some garden soil to make muddy water
2. set the glass, open end up, in the middle of the dishpan; place a couple of marbles into the glass to keep the glass from floating
3. seal the top of the dishpan with plastic wrap, tape the edges of the plastic wrap to make a secure seal
4. place one (or two) marbles in the centre of the plastic wrap (make sure the marbles sit directly over the glass)
5. place the dishpan in the sunlight and leave it for several hours

Discussion: Ask the students why the water is the glass is clean. Explain that through evaporation, condensation and precipitation water (the dirt is too heavy) is able to move from the mud in the dishpan to the glass. Ask the students to apply these principles to Scout Island wetlands.

Transpiration: Watch a Tree Breathe

Explanation: Transpiration is the process where plants release water from their leaves. This simple experiment illustrates a complex concept that plants 'sweat'.

Materials: a tree/shrub, plastic bag, small rock, twist tie, measuring cup, measuring spoons.

Procedure:

1. locate a healthy branch on the tree/shrub, make sure it's about eye level to the students
2. inflate the plastic bag and place the pebble in the bottom of the bag
3. fit the inflated bag + pebble over the tree/shrub branch, securing the opening with a twist-tie
4. leave the bag for 24-hours
5. remove the bag from the branch and pour the water that has formed inside the bag in to a measuring cup, if there is too little water use measuring spoons
6. figure out how much water each leaf produces
7. divide the amount of water by the number of leaves on the branch, (for example, if the bag has 100 mL in it and there are 5 leaves on the branch: 100 mL ÷ 5 = 20 mL for each leaf)
8. now, figure out the total amount of water the tree/shrub produces in one 24-hour period (for example, if the tree has 100 leaves and each leaf transpires 20 mL: 100 X 20 = 2000 mL for the entire plant)

Discussion: Ask students if they are surprised that one plant can produce that much water. Explain that all plants transpire, that this process helps transport nutrients throughout the plant. This process also cools the air because transpiration absorbs heat from the air, cooling the air around a forest.

2. WATER WISE CONSERVATION QUESTIONS

Objective: To engage students in discussions about how they can be Water Wise. Enhance students' learning of water conservation and what they can do by facilitating discussion of water conservation issues and solutions.

- What causes environmental pollution?
- How can you reduce your environmental pollution?
- Why does it negatively affect salmonids to pour waste down storm drains?
- In what ways is your home not Water Wise?
- Why should you be Water Wise?
- How many things can you do in your home to be Water Wise?
- When are the correct times to water your lawn? Why?
- How many times should you water your lawn a week? Why?
- How long should you water your lawn each time you water? Why?

3. BIO-FRIENDLY CLEANERS

Objective: To teach students how they can easily make ecologically benign cleaners. Educate students that many cleaners are toxic and teach them why they should use 'kinder' cleaners.

Dish Washing Detergent

This recipe is for hand washing only. Grate 500 mL of pure soap; heat 4 L of water + soap at medium heat until it boils and soap is all dissolved. Allow to simmer at low heat for 10 minutes, stir occasionally. Remove from heat and cool, store in a covered container.

Laundry Detergent

Add 250 mL pure soap flakes (or pure soap powder) and 25 mL washing soda to each full load of laundry.

Floor & Furniture Polish

Add 15 mL lemon oil to 1 L mineral oil. Place in a spray bottle, spray on, rub it in then wipe surface clean.

Toilet Bowl Cleaner

Combine 5 mL household ammonia + 250 mL hydrogen peroxide + 2 L water.
Use gloves when cleaning with this product (ammonia can be a skin irritant).

Tub & Tile Cleaner

Dissolve 10 mL borax + 500 mL pure soap flakes (or powder) in 375 mL boiling water. Allow to cool, then add 50 mL chalk powder, mix well. Store in a sealed plastic or glass container, use at your leisure.

12. RESOURCE LIST

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13. CONTACT LIST

For more information on Williams Lake, British Columbian or Canadian water systems or conservation issues please contact:

Cariboo Chilcotin Conservation Society	(250) 398-7929 Unit 102, 197-2nd Ave North. Williams Lake, B.C. V2G 1Z5 Email: waterwise@ccconserv.org Website: www.ccconserv.org/
City of Williams Lake	(250) 392-1763 450 Mart Street Williams Lake, B.C. V2G 1N3 Email: communityservices@williamslake.ca Website: www.williamslake.ca
Ministry of Environment	(800) 663-7867 www.gov.bc.ca email: EnquiryBC@gov.bc.ca
Environment Canada: Pacific & Yukon Region	www.pyr.ec.gc.ca

To book a tour of Williams Lake's water treatment plant, contact Joe Engelberts at the City of Williams Lake (250) 392-1763 or jengelberts@williamslake.ca

To enquire about Salmon in the Classroom program, contact Tina Chestnut or Roy Argue at (250) 305-3015 or contact your local Fisheries and Oceans Canada office.

Thank you for your participating in Williams Lake Water Wise Education Program.

14. APPENDIX 1 – SUPPLEMENT FALL 2007 – WATER SHED UNIT

Water Shed Unit

What exactly is a *Water Shed*?

Water always moves downhill. As rain falls and snow melts, the water travels along the surface of the ground, in rivers and lakes and also underground as it makes it's way always downwards towards the ocean.

A watershed is the land area where all the water drains into one main river or lake. It is made up of:

- the land which drains water into a valley bottom
- the rivers or lakes that you see
- the water flowing out of sight underground

A large watershed, such as the Fraser River watershed, is made up of many smaller water sheds within it, such as the Williams Lake or Gavin Lake watershed. All the draining water from these small watersheds will eventually find their way into the larger watershed and then to the Ocean.

Almost all of a watershed is made up of land, not water; and almost all (99%) of what happens to a river or lake happens first on the land itself.

Imagine all the water molecules as they land on the surface of the ground as rain or snow, and then slowly making their way to the nearest water body. As they do so, these water molecules attach themselves to various substances along the way, because of their ability to form hydrogen bonds and so dissolve most things they come across. They then transport this substance; perhaps fertilizer, maybe cow manure, maybe oil and exhaust particles etc, with them to the main water body, where it all pools and becomes concentrated and becomes part of the river or lake. As these rivers travel or as lakes drain their water then mixes with water from other smaller watersheds, along with their contaminants, as they combine to form bigger watersheds.

Within a watershed, plants, animals and humans coexist, and are all dependent on the geography of the land, such as forests, grasslands, rivers, lakes aquifers, minerals,

mountains and valleys. Human activity can easily upset the balance and directly impact the water quality in the watershed. This activity may continue to affect further watersheds down stream. There are many ways to reduce the possible negative impacts of such activities with careful planning and awareness of the surrounding ecosystems.

What impact might some of the following have on the water quality and the wildlife populations in the watershed? What are some ways you could reduce this impact? What are the benefits of this activity in the watershed?

- Towns and Cities
- Roads
- Farming/ Agriculture
- Forestry
- Mining
- Tourism

14. APPENDIX 2 – WATER QUALITY UNIT

Water Quality Unit

The quality of water, whether in streams, groundwater, or coming out of our taps is crucial to the health and well-being of all organisms on the planet. Water quality can be affected by many things within each watershed, such as direct pollutants; run-off from roads and human settlements; agriculture, forestry and mining practices; as well as climate, topography and local weather.

Water quality factors to consider with respect to *drinking water*:

- Colour
- Odour
- Cloudiness (turbidity)
- Sediment
- Contaminants, such as pollutants (eg nitrates, phosphates, bacteria and parasites)
- Taste

Water quality factors to consider with respect to *stream health*:

- Dissolved Oxygen
- pH
- Sediment
- Temperature
- Pollutants, such as nitrates, phosphates, bacteria and viruses
- Turbidity
- Some stream characteristics that may affect water quality are: Stream depth, width, flow-rate, surrounding vegetation (riparian zones) and human activities

Some ways to measure *stream quality*:

- Dissolved oxygen,
- pH,
- Temperature,
- Nitrates and phosphates,
- Macro-invertebrates*

*Macro-invertebrates (water-bugs): Aquatic insects , snails, aquatic worms and leeches can be used as indicators of water quality, as they spend some or all of their life-cycle immersed in the water, and usually within the same area so will be directly and continuously exposed to the pollutant. Some species will be more tolerant to the effects of pollution than others, so the type of aquatic macro-invertebrate found in a stream can be used as a way to assess the level of pollution in that water.

Bottled Water

- 1.5 million tons of plastic are used each year to manufacture water bottles, requiring considerable resources and energy. A very small proportion of these bottles are recycled.

- These bottles are then shipped all over the world, using huge quantities of fuel, in turn contributing to greenhouse gas production.

- 40% of bottled water is actually municipal tap water.

- Some bottled water is ‘distilled’, which removes minerals which are actually be needed by your body, so in many cases tap water is better for you than bottled.
- Tap water is more closely regulated than the bottled water industry
- During the bottle manufacturing process, more water is used to produce the bottle, than how much water the bottle contains (approximately 3 litres of water is used to produce a 1 litre water bottle!)
- Plastic bottles leach contaminants into the bottled water, especially, over time, when they warm up or are reused. The safest plastics to store food or water in are #s 2, 4 or 5, whereas most water bottles are #1 or 7 (look on the bottom of the bottle for the number).
- In taste tests, most people cannot distinguish between bottled and tap water. In fact one large study in the U.S. showed that 75% of people preferred tap water.
- Bottled water costs around $1.50 a litre. Tap water costs about 0.1c a litre.