Activity 1 -- Water Everywhere?

Introduction:
This activity introduces the concept of limited water availability. The amount of fresh water available on land surfaces is a tiny fraction of the total amount in the world. Typically, people think that because water falls from the sky, it is an unlimited resource. The same water just keeps circulating around the water cycle. Even though water isn't abundant, it's perceived to be.

Objectives:
At the end of this lesson, students will be able to:
Differentiate various sources of water on our planet,
Identify where drinking water comes from, and
Compare freshwater availability to the total amount of water on earth.

ASD GLE's:
[5] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

[4] SD1.2 describing the water cycle to show that water circulates through the crust, oceans, and atmosphere of Earth.

Grade Level: 4-6

Estimated time:
30 minutes

Keywords:
Availability, resource, limited, freshwater, percentage, groundwater, rivers, glaciers, saltwater, ice caps, lakes, pollution, shortage, fraction, potable.

Materials:
20 liters of freshwater in a clear glass or plastic container, several small glass beakers, measuring cup, eye dropper.

Insert Instructional Video here (asking question and conducting procedure.)

Pose this question to the class:
Why should we be concerned about water? After all, 70% of the Earth's surface is covered by water. That should be enough for everyone! Water can be found almost everywhere on Earth - in the soil, rivers, oceans, lakes, underground, even in the atmosphere. But, how much of this water is actually available for human use?

Procedure:
1. Place 20 liters of fresh water into a large, clear container. This represents all the water in the world, including oceans, lakes, rivers, and ground water.
2. Remove 500 mL into a separate container. This represents the total amount of fresh water on the planet.
3. The remaining 19.5 liters in the large container represents the water in the oceans, too salty for humans to use as drinking water. It makes up 97.5 percent of the total water volume.

4. Pour out 375 mL of water from the 500 mL container. This represents all the fresh water in glaciers, ice caps, the soil, and the atmosphere. This is also unavailable for human use.
5. Remove 5 drops from the remaining 125 mL. Pour out the 125 ml - this represents all the water that is not readily available because it is deep in the ground, in remote places or polluted.
6. All that is left is 5 drops (out of 20 liters) of clean water that is available for human use - only .007 percent of all the water on the earth.

Discussion Questions:
a. Where does our drinking water come from?
b. What do you use water for?
c. How much water do you use each day? (How could you measure this?)
d. What evidence do you see of water problems in Anchorage? (Shortages?, pollution of local creeks, rivers, lakes?)
e. How has your own behavior added to these problems?
f. What can you do to preserve this precious resource?

Follow-up Activity:
Following the discussion, make a class list of things you can do to use less water.

Assessment:
List 3 sources of freshwater on our planet. _____
(rivers, lakes, streams, creeks, glaciers, groundwater, ice caps.)

Where does our drinking water come from? _____

If this container shows all the water on our planet, which choice best shows the total amount of water available for human use?

a. 

b. 

c. 

d. .

Describe what you learned about water from this activity._____
_____
_____
_____

Activity 2 -- A day in the life of Campbell Creek

Introduction:
The water quality of the local waterway will be affected by human activities within the catchment. Chemicals, sediment, sewage, litter, and fertilizers enter the waterway through stormwater runoff. This activity graphically introduces students to various human behaviors that can contribute to stormwater pollution in an urban setting as a creek makes its journey from the headwaters of the catchment to the sea.

Objectives:
At the end of this lesson, students will be able to:
Explain how individual contributions of pollution lead to cumulative diminished water quality along a catchment,
Investigate the home environment, and
Create a list of things your family can do to modify your pollution/waste footprint.

Alaska GLE's:
[5] SA1.2 using quantitative and qualitative observations to create inferences and predictions
[5] SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive
[4] SA1.2 observing, measuring, and collecting data from explorations and using this information to classify, predict, and communicate

Grade Level:
4-6

Estimated Time:
30 minutes

Keywords:
Catchment, erosion, stormwater, pollution, residential, industrial, sewage, vegetation, topsoil, storm drain, impervious

Materials:
Large transparent container (aquarium or clear plastic box)
25 film containers (or other small tub)
Various materials to represent pollution as outline in the list below
Two large glasses
Paper towels, filters, scoops, strainers and milk cartons with soil to ensure correct disposal of polluted water and clean up.

Process:
1. Fill the aquarium with clear, clean water and place it in a prominent, visible and accessible position.
2. Label each of the small containers with a characters name from the story.
3. Place or pour the appropriate materials into each container according to the Table.
4. Introduce Catchment Story.
5. Fill one large glass with water out of the aquarium, demonstrate its cleanliness by pouring from one glass to another. leave the glass aside for comparison at the end of the story.

6. Spin Catchment Story, pouring materials into aquarium at the appropriate time.
7. Display graphics and video clips of keywords and examples.

Insert Instructional Video here (Process and Catchment Story).

Name	Position	Substance	Amount
Sparky Finger	Electrition	Vinegar (acid rain)	1/2 Tub
Scree Mud	Concrete	Thick muddy water	1/2 Tub
Scotty Level	Bricklayer	Muddy water w/red paint	1/2 Tub
Tim Turf	Landscaper	Baking powder	1/2 Teaspoon
Violet Magenta	Painter	Water colored w/blue paint	1/2 Tub
Bob Buildit	Contractor	Soil and leaves	1 Cup
Col Constructor	Homeowner	Soil	2 Cups
Lilly Gardener	Landscaper	Baking soda (pesticides)	1/2 Cup
Hugo Couch	Sod Layer	Grass clippings	1/2 Tub
Ron Rancher	Farm Owner	Soil	1/2 Tub
Glen Greedy	Industry	Detergent	1 drop in full Tub
Allen Wrench	Auto Repair	Used oil	1/2 Tub
Cameron Caughtsome	Fisherman	Nylon string	Tangle of line
Mickey Slicky	Water Skier	Vegetable oil	1/4 Tub
Barbie Que	Picnicker	Litter	Cup of litter
Demo Dave	Tannery	Water and red coloring	1/2 Tub
Lazy Larry	Tour Boat	Litter	Cans, paper
Dung Aversion	Dog Owner	Thick muddy water	1/2 Tub
Elementary School	School	Litter	Chip bags, etc
Gerald Glutton	Student	Litter	Candy wrappers
Philmore Pollutee	Driver	Vegetable oil and mud, butts	1/2 Tub
Rhonda Tinkle	Homeowner	Muddy water & Toilet paper	1/2 Tub

Catchment Story
I am going to tell you a story about a very important part of our environment - it is about Campbell Creek, right here in Anchorage. The story talks about how each of us affects the creek's health.

A catchment includes all of the creeks and streams which run into a waterway. But the catchment also includes the land around the waterway. This means that although you and I may live 10 miles or more from the creek, we are still part of the catchment. Even from this distance, we can have an effect on the quality of the water in the creek.

Stormwater drains link to the local creeks. There are usually no filters in the stormwater drains and they do not go through the sewage treatment plant. This means that whatever ends up on the ground can get washed into the stormwater drain, whether it be leaves, dirt, litter, paint, or detergent, it goes straight to our local water way. These are all forms of pollution and they can have a serious impact on the plants and animals that live in the water and result in the creek having a degraded appearance.

Campbell Creek begins way up in the hills and flows down and around farms, nurseries, industrial and residential areas. Everyone has an effect on the creek all the way along.

We will follow some rain as it washes over the catchment and into the creek. As the water travels down the mountain, it arrives at the valley where **Sparky Finger (1)** is connecting electricity to a new house. The power station that produces the electricity for the area burns large amounts of coal and can release pollutant gases into the air. These pollutants combine with moisture in the atmosphere to produce acids. Rainfall carries these acids back to the earth's surface and can pollute the river.

As the water travels down the catchment, it gathers speed and enters into a new housing development. As the water passes through, **Scree Mud (2)** is doing some concrete work and some of her unmixed concrete washes into the water.

The water, still flowing, travels by **Scotty Level (3)** while he is cutting bricks, and he leaves a trail of red brick dust which is washed into a drainage pipe and then into the creek. **Tim Turf (4)** is also working in the area laying some new grass sod. He waters the sod after applying fertilizer to it, leaving a trail of chemicals streaming into the storm drain. After finishing painting the exterior of a house, **Violet Magenta (5)** washes her paint brushes at a nearby tap, letting the paint wash into the drain and then into the creek.

The creek now begins to wind through the residential part of town where **Bob Buildit (6)** and **Col Constructor (7)** are each finishing their homes in a new subdivision. Many of the trees and shrubs have been removed and when it rains the top layer of soil is eroded and adds to the silting up of the creek. This makes the water dirty and cloudy and can harm plant and animal life in the creek. Most houses like **Lilly Gardener (8)** in the developed parts of the town have a garden. To keep the insects away, Lilly uses a range of pesticides. When she has completed her spraying she turns on the sprinkler to water the plants and the pesticides wash off into the stormwater drains and into the creek. Lilly's neighbor, **Hugo Couch (9)** has just finished mowing his lawn for the third time this month and rather than putting the grass clippings on the garden for mulch, he puts them down the stormwater drain where they are washed into the creek.

As the water passes by the property of **Ron Rancher (10**), soil is washed from his front yard and the water becomes even more muddy. The trees and other plants have been removed by the builders and there is nothing to trap the soil before it goes into the creek.

Further down the creek there is an industrial area. **Glen Greedy (11)** is one of the factory owners. He likes to use detergents to keep his equipment clean. Glen sometimes hoses out his factory, allowing the water and detergent to wash into a gutter, which flows to the creek. In the detergent there are phosphates which can cause algal blooms. Some algae are poisonous to humans and other animals. When the algae dies and begins to rot, it uses up oxygen, and the water animals that rely on it may suffocate as a result.

Just down the road from Glen is **Allen Wrench (12).** Allen is doing a grease and oil change when he knocks over the drum of waste oil. This oil flows to the nearby drain and into the creek.

Look how our once clean water looks like now and it doesn't smell so good either.

But the journey isn't over yet. Coming up around the bend, the creek empties into Campbell Lake. **Cameron Caughtsome (13)** is fishing for Char from the bank. Unfortunately he leaves some fishing line behind, where it may get wrapped around a bird or animal. Also on the lake, **Mickey Slicky (14)** is out water skiing. Mickey has not been maintaining her ski boat and, as a result, some oil is leaking from the boat directly into the lake.

Barbie Que (15) is having a picnic with her family in the park at one end of the lake. They are having a great time, playing frisbee, relaxing and splashing in the lake. Then suddenly, a big gust of wind comes along and blows their litter into the water. There are plastic bags, a plastic ring from the milk container which birds can get stuck around their necks, and bottles which fish and other small creatures like frogs may swim into and may not be able to get out of.

Not only is this harmful to the animals, but what do you think about the appearance of the water?

Redevelopment is happening on the opposite side of the creek. **Demo Dave (16)** found a few drums of something that he wasn't sure of. He couldn't sell it and he would have to pay to take it to a landfill or to a hazardous waste dump so he emptied it into the old creek. The waste was chemicals from an old tannery.

Further down the catchment there is a boat out on the creek for the day. **Lazy Larry (17)** throws his bottles into the water when he's finished. He does the same with the wrappers from the food he's eating.

Also in the area lives **Dung Aversion (18)**. Dung takes his dog for a walk every morning and the dog usually does his poo during the walk. Dung would rather not deal with the pile, so if nobody is looking he quickly walks away. The poo is washed into the stormwater drain when it rains and into the creek.

At the far edge of the lagoon, children from (your) **Elementary School (19)** are returning home after another field day. The playground is covered with litter and as they walk down the street **Gerald Glutton (20)** and his friends drop their candy and chip wrappers in the gutter.

Philmore Pollutee (21) is driving home from work. The roads are choked with traffic. Oil drips out of Phil's car and onto the road. Sometimes he has to brake suddenly and leaves rubber from his tires on the road. These pollutants are washed by rain down the stormwater drain and into

the creek. As he stops at the traffic lights, Phil flicks his cigarette butt out of the car window. He does this every morning and afternoon.

Our poor water is really starting to look very sick and the ocean still around the bend. There is one more pollutant that has been entering our dirty and unhealthy water - sewage. At **Ronda Tinkle's (22)** house, the roots of her big spruce tree have found their way into her sewer pipes, which have become badly cracked and are leaking. It is raining very heavily now and there is water leaking into the sewage pipes. The pipes get overfull and start to back up, causing raw sewage to flow out the sewer overflow point and into the creek.

Entering the sea, our water that used to be so clean is now full of oils, chemicals, litter, and sewage. It looks extremely unhealthy and it doesn't smell too good either. Can you imagine what it would be like to swim in that water? Can you imagine being a fish or plant living in that water all the time?

This is what happens to the water in our creek. There are many things we can do to reduce the pollution in the catchment and most of them are pretty easy. If we take a look at our day to day activities, I'm sure we can all make a small difference and a lot of small differences make up a big difference for the health of the catchment and the plants and animals living there - and for those of us who want to swim, fish or go boating.

Assessment:
Using the map provided, 1. color the catchment blue, 2. label sources of industrial pollution, residential pollution, and an impervious surface that washes into a storm drain.
OR
Using at least 3 sentences, describe what happened to make the water so unhealthy as it moved along the catchment to the ocean.

Assessment Rubric to be Added.

Follow-up Activity:
Students complete Home Environment Checklist with parental assistance as homework.
Discussion and graphing to compare water use, energy use and car use across the class.
Make a list of things your home could do to reduce environmental impact.

Home Environmental Checklist to be Added.

Activity 3 -- Water Quality Testing Field Trip

Introduction:
In this activity, students will evaluate the water quality of various sources through a series of indicator tests. Once data is collected they will combine the information and look for patterns and relationships between land use, community attitudes and behaviors and water quality.

Objectives:
At the end of this lesson, students will be able to:
Measure toxicity of water using test kits and
predict the health of aquarium fish if they lived in watershed.
Compare and contrast water quality from various sources

Alaska GLE's:
[5] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
[5] SA1.2 using quantitative and qualitative observations to create inferences and predictions.
[5] SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive.

Grade Level:
4-6

Estimated Time:
2 hours

Keywords:
pH, acidic, base, turbidity, phosphates, nitrate, nitrite, algae, nitrification cycle, pollution, dissolved oxygen, fertilizers, toxicity

Materials:
Class recording charts, test kits, non latex gloves for each student, Interpreting Water Quality Data Chart, cleaning-up supplies, water samples from: store aquarium, upper Campbell Creek, lower Campbell Creek, pond outside store, storm drain runoff

Process:
Introduction Activity
Prior to arrival student are provided a numbered index card representing a parcel of property. They are given the instructions "You have inherited 10 acres of riverfront property and 10 million dollars. On the numbered side of the card, draw a picture of your property after development. On the other side, describe what you did." The host teacher will collect these cards and bring them to the store on Field Trip day.

1. Teachers pass out cards upon arrival and students assemble cards in order, forming a model of a river.
2. I ask for volunteers to describe what they did to develop their property and any possible pollution produced as a result.
3. I hand out small bags of miscellaneous trash to each student.
4. The student closest to the headwater puts their trash in a clear plastic bin and passes the bin to the next student in line, who places their trash in the bin and passes it on. This continues until the bins have reached the ocean on both sides of the river.
5. Hold discussion about the cumulative effect of pollution.
    ~How do the land owners at the middle or end of the river feel?
    ~Will their new property have the same value with all the pollution?
    ~Whose responsibility is the pile of trash? The last person didn't create it all.
    ~Can students downstream be affected by the actions of students upstream?
    ~Can upstream users alter the water quality of those downstream?

Water Testing Activity:
Display Recording Chart at front of room.
Display list of sample sources, don't indicate which sample goes with which source.
Bring attention to the containers with samples from 5 sources. Encourage students to interact with samples and predict which is the cleanest.
Tally individual predictions of the highest quality water on the chart.
Describe process of water testing, providing instructions, and answering questions.
Divide students into 5 groups and provide water sample.
First, the group describes smell, color, and turbidity, and predicts which sample they are working with.
Second, each group will conduct water chemistry tests for ammonia, nitrites, phosphate, dissolved oxygen, and pH according to the instructions provided.
Third, record results for each test and send a representative up to fill in your groups part of the class chart.
When all testing is complete, unveil the source of each sample and examine trends of the source.
Post "Interpreting Water Quality Data Chart" to make sense of the numbers. Hold discussion to identify pollution issues impacting on water quality and examine their potential source.

Lead tour of aquarium room, describing my job and the equipment used to mimic natural water purification processes and the chemicals used to buffer improper water chemistry.
ALTERNATELY
Create video of myself in aquarium room doing the above, but show video in conference room. (Not sure I want/can bring a group of students behind the scenes.)

Assessment:
Using 3 of the keywords and at least 3 sentences, describe which sample water you would **least** like to live in and **why**.

Activity 4 -- Conservation in Action

Introduction:
In this activity, students will apply what they have learned by creating a final project that demonstrates their own "conservation in action."

Objectives:
At the end of this lesson, students will be able to:
Choose a specific action/behavior and recommend how it can be modified/initiated to improve water quality
Create a final product, integrating concepts explored in the unit

Alaska GLE's:

Grade Level:
4-6

Estimated Time:
2-4 hours

Keywords:
conservation, political action, public service announcement,

Materials:
Access to computers for research and multimedia design, poster board, markers, pencils

Process:
Students will create a brochure, public service announcement, or poster showcasing their idea of conservation in action.
Show/tell what can 1 person do to improve the quality of local streams.
Design a stencil to spread the word that we must all monitor what flows down storm drains.
How would you teach someone to dispose of household chemicals?
How could you reduce the amount of trash that ends up in a creek?
How could you do something about the trash already in and near a creek?
How could you prevent erosion in your yard/neighborhood?
How could you reduce pet waste that washes into storm drains?
What are better alternatives to chemical fertilizers?

Final projects will be displayed at the store with permission from students and teachers.

Insert assessment rubric here

Optional Extension:
Research the regulations governing waterfront property in their communities. If they believe their waterways are being poorly treated, they may want to write letters to local government officials in support of environmentally sound land use legislation.