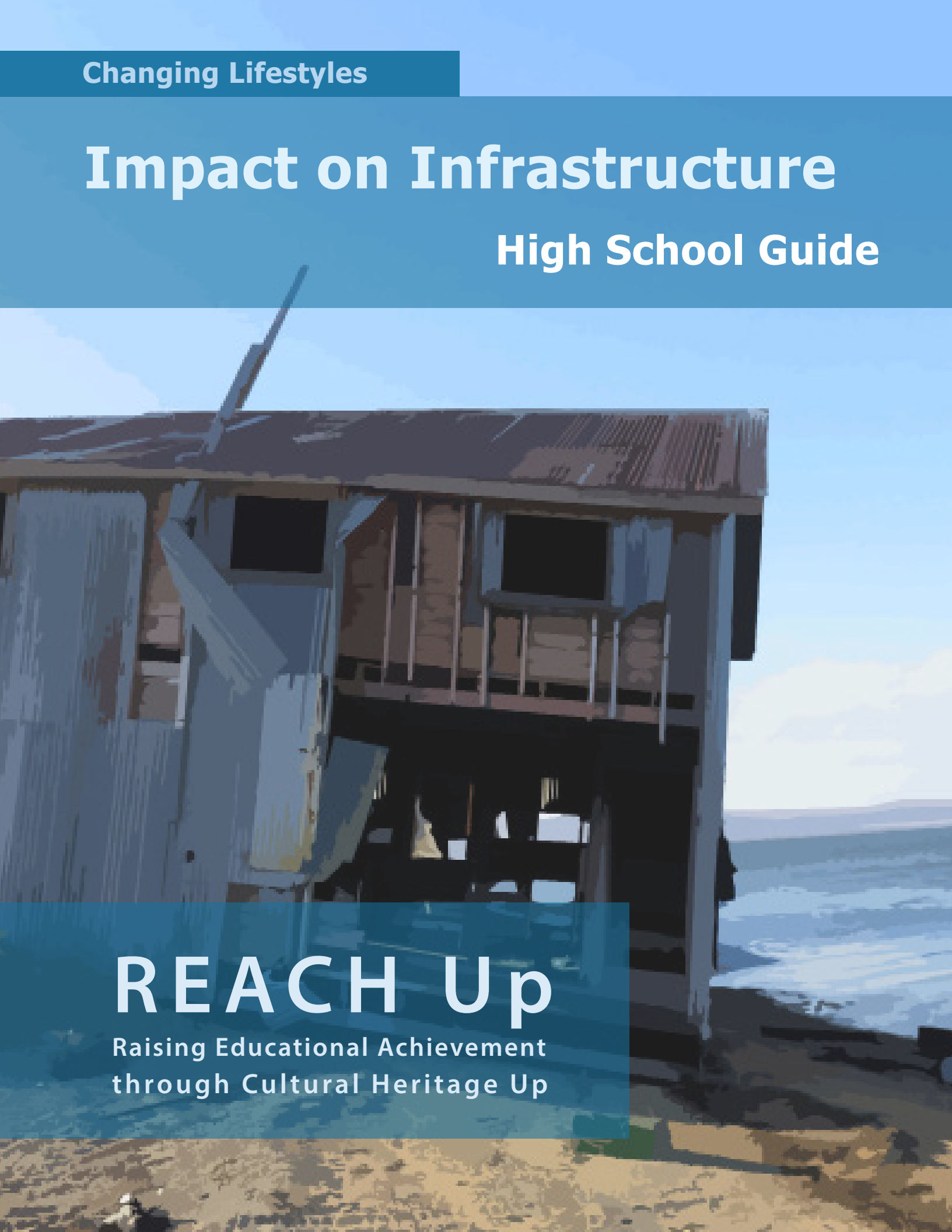
Changing Lifestyles

Impact on Infrastructure

High School Guide



REACH Up

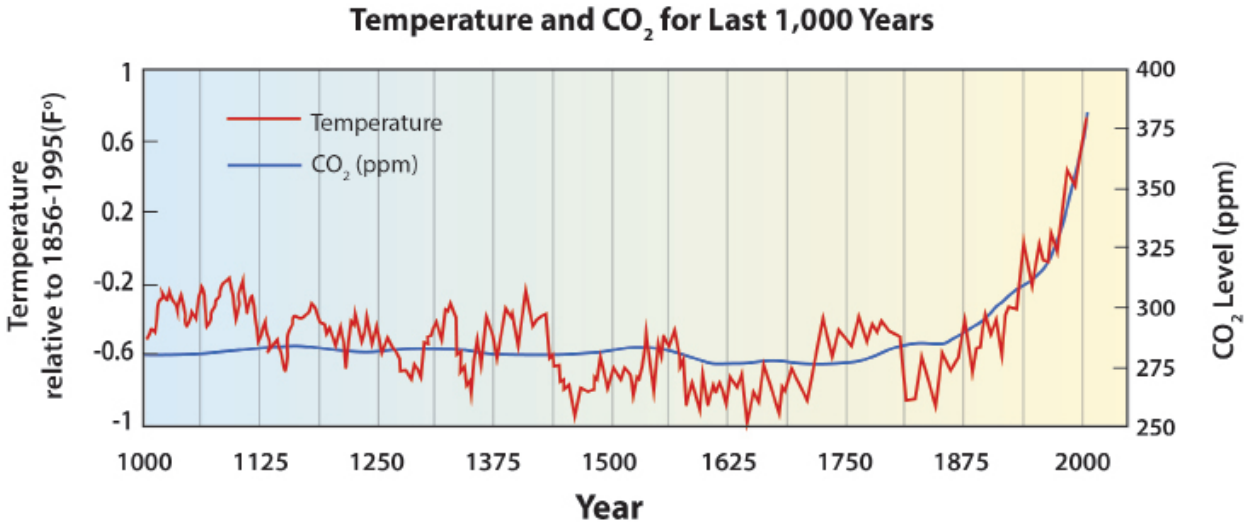
Raising Educational Achievement
through Cultural Heritage Up

Changing Lifestyles

Climate Change and Carbon Dioxide

Carbon dioxide (CO_2), like water vapor and methane, is a greenhouse gas that contributes to the warming of our global climate. Carbon dioxide is a naturally occurring substance. For example, it is produced by volcanic eruptions and forest fires. It is a product of cellular respiration, meaning people and animals produce carbon dioxide when they breathe. Carbon dioxide is also produced by burning fossil fuels such as coal, fuel oil, and gasoline.

The graph below shows that carbon dioxide in the atmosphere increased significantly, starting in the 1800s. This coincides with the Industrial Revolution, when people began making things in factories. The factories burned coal and wood to run their machines, and contributed carbon dioxide to the atmosphere from their smokestacks.



Graph showing increasing temperatures and CO_2 levels, modified from an article by Bill Chameides, PhD., Duke University. Data sources for CO_2: Law Dome ice core and Mauna Loa air samples. Data source for temperature: NOAA. *Source: Environmental Defense Fund, 2007.*

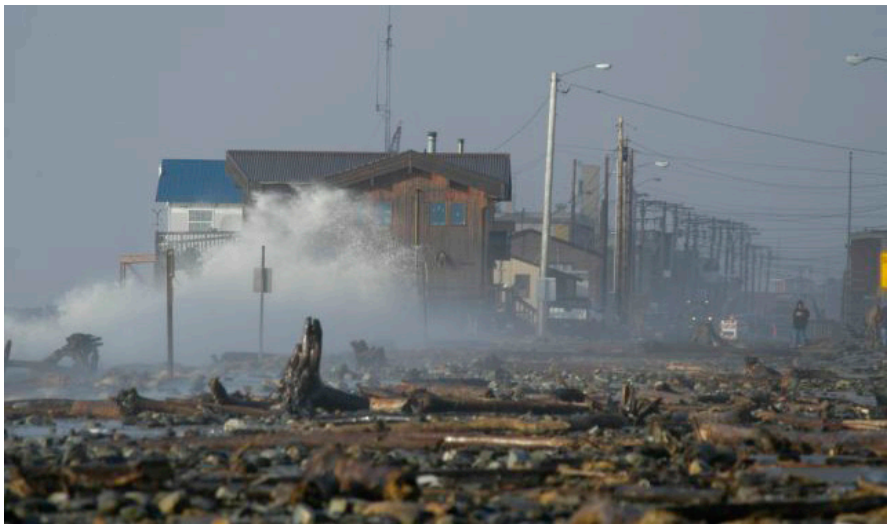
Today we contribute carbon dioxide in many ways. The factories that make the products we use, the airplanes that transport us and deliver our packages, the furnaces and woodstoves that heat our homes, and the vehicles we drive all produce carbon dioxide.

Changing Lifestyles

The landscapes in the northern part of the world are changing as a result of the warmer climate. People in the Bering Strait region are adapting their lifestyles to adjust to these changes. Some are also making lifestyle changes to reduce the amount of carbon dioxide and other pollution they create, so that they do not further contribute to the greenhouse effect and warming of the climate. How does the warming climate impact lifestyles in your community?

How is Climate Change Impacting Infrastructure in Western Alaska?

Climate change is affecting infrastructure in Alaska. Permafrost is thawing, leading to rapid erosion. Snow is melting earlier in the spring. Sea ice is disappearing, causing stronger onshore storms and increased flooding. These changes have caused houses and buildings to collapse. The changing climate also affects water pipes, sewers, and water treatment plants, making it difficult to secure safe drinking water and keep a healthy environment. Environmental changes are increasingly forcing communities to adapt more quickly than expected.



Twenty-foot waves from a 2004 Bering Sea storm pounded downtown Nome.
Photo: Department of Commerce, Community and Economic Development; Division of Community and Regional Affairs' Community Photo Library.

Water lines run over the tundra to houses in the village of Savoonga.
Photo: Yuri Bult-Ito, REACH Up.

Ask an Expert

1. Watch the video *Impact on Infrastructure* available at www.k12reach.org/videos.php.

2. Interview elders, cultural knowledge bearers, or infrastructure experts in your community. Some questions you may want to ask:
    - What was infrastructure (such as water resources, roads, and houses) like in the past compared to today?
    - How is climate change affecting infrastructure in our community (water resources, roads, buildings, etc.)?
    - Have people in our community had to make any changes to our living environment (water supply, roads, buildings, etc.)? If so, how?

3. If the person you interview speaks an Alaska Native language, ask them what language and dialects they are familiar with. Ask them to please translate the following words:
    - clear (water)
    - cloudy (water)
    - flood
    - lake
    - pond
    - rain
    - river
    - snow
    - water

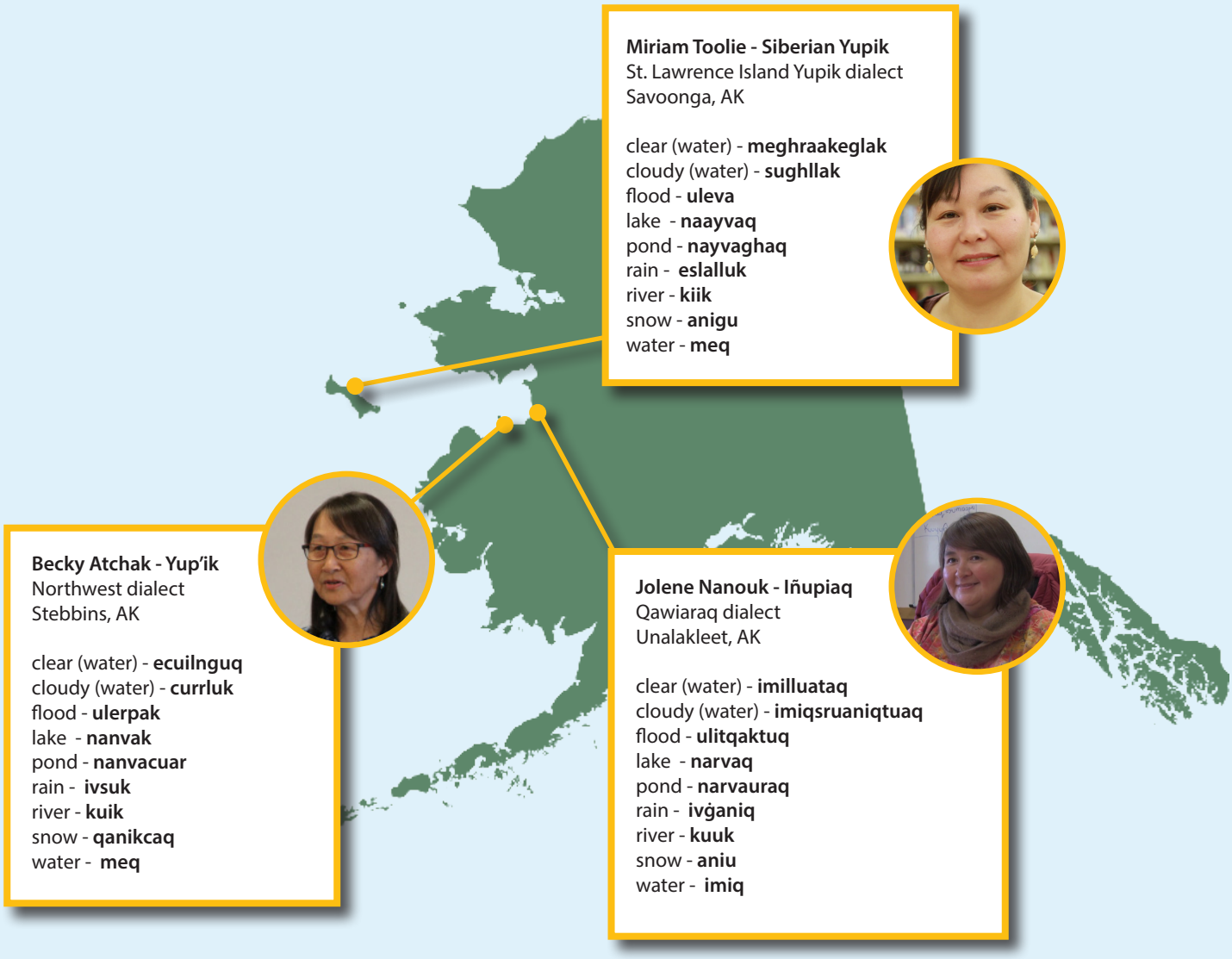
Compare your words with the translations on the Infrastructure Vocabulary page of this student guide. Are any of the terms the same or similar?

Eva Ryan discusses changes she has seen in Unalakleet that have impacted the village's infrastructure over the years. *Photo: Qian Li, REACH Up.*

Infrastructure Vocabulary

Would you like to know Alaska Native language terms related to infrastructure?

Work with your classmates to practice infrastructure vocabulary words in English and the indigenous language of your community. Your teacher will give you vocabulary cards with the English word and an illustration on one side. Write the corresponding indigenous term on the blank line on the back of each card. Use the words that you learned from a local elder or cultural knowledge bearer, or choose the translation below that is closest to your community.



Miriam Toolie - Siberian Yupik
St. Lawrence Island Yupik dialect
Savoonga, AK

clear (water) - **meghraakeglak**
cloudy (water) - **sughllak**
flood - **uleva**
lake - **naayvaq**
pond - **nayvaghaq**
rain - **eslalluk**
river - **kiik**
snow - **anigu**
water - **meq**

Becky Atchak - Yup'ik
Northwest dialect
Stebbins, AK

clear (water) - **ecuilnguq**
cloudy (water) - **currluk**
flood - **ulerpak**
lake - **nanvak**
pond - **nanvacuar**
rain - **ivsuk**
river - **kuik**
snow - **qanikcaq**
water - **meq**

Jolene Nanouk - Iñupiaq
Qawiaraq dialect
Unalakleet, AK

clear (water) - **imilluataq**
cloudy (water) - **imiqsruaniqtuaq**
flood - **ulitqaktuq**
lake - **narvaq**
pond - **narvauraq**
rain - **ivġaniq**
river - **kuuk**
snow - **aniu**
water - **imiq**

What Challenges Do Communities Have to Secure Quality Water?

Water is one of few resources for which there is no substitute. As the climate changes in the Arctic, current water sources may be less available and water quality may deteriorate.

Much of the municipal or drinking water in rural Alaska comes from surface water sources because permafrost ground makes it difficult to drill deep wells. Traditionally, Native people melted ice and snow to live through the winter when all precipitation was frozen. Today, communities have water tanks to hold enough water to last several months. Many communities have filtration plants to clean surface water that is taken from a variety of sources including snow catchment basins, lakes, creeks, and rivers.

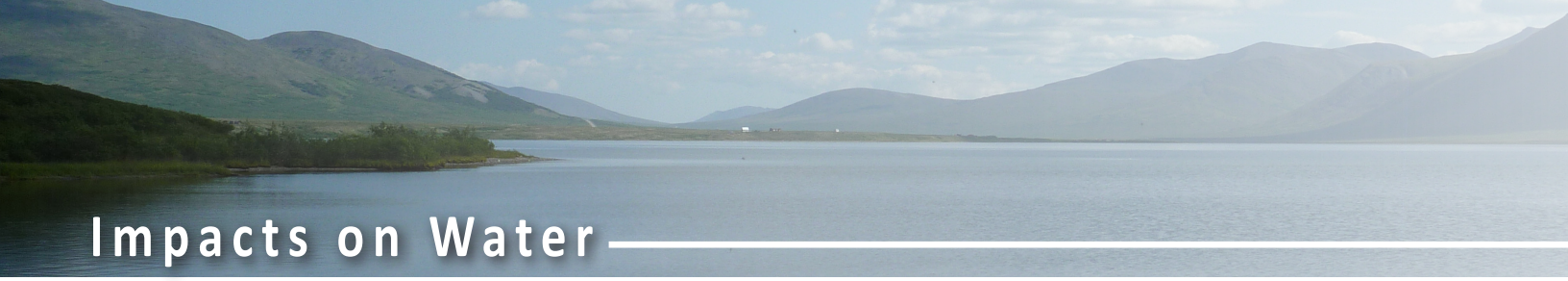
A man drives a four-wheeler, towing a pump and water testing instruments by a sewage lagoon in Nunapitchuk. White plastic bags from honeybuckets float in the lagoon. *Photo: Alaska Department of Environmental Conservation, Division of Water.*

Concerns are high about the safety of water and the possibility of running out of clean water before the end of each winter, especially in communities where water and sewer lines are not in place. People are also concerned about access to sustainable water sources, as increasing temperatures accelerate permafrost thaw; thawing permafrost leads to shrinking lakes and shifting ground can cause water pipes to break.

Different communities have different water and sewer systems. According to the Alaska Department of Environmental Conservation, the following types of water and sewer systems are currently in use in rural Alaska. Each system has some challenges:

- Washeterias and central watering points – 36 villages
  This system doesn't provide drinking water to homes or wastewater removal. Communities with this service level are said to have "unserved" systems.
- Individual wells and septic systems – 20 villages
  Water wells and septic systems often do not meet the minimum separation distances for safety. Wells can become contaminated with inadequately treated sewage.
- Water and sewer truck or trailer haul systems – 12 villages
  This type of system poses extremely high operating costs.
- Piped water and sewer systems – 105 villages
  This system provides centralized treatment, storage, and piped distribution directly to homes. Piped systems are, however, increasingly expensive to construct and maintain.

Workers enter the water well plant in Gambell. *Photo: Department of Commerce, Community and Economic Development; Division of Community and Regional Affairs' Community Photo Library.*



Impacts on Water

What types of water and sewer systems do you have in your community? How about your neighboring communities?

Water Sources in Bering Strait Communities

Community	Ground Water	Filtered Ground Water	Surface Water
Brevig Mission	X		
Elim			X
Gambell		X	
Golovin			X
Koyuk		X	
Little Diomede			X
Savoonga	X		
Shaktoolik			X
Shishmaref			X
St. Michael			X
Stebbins			X
Teller (Nome utilities)	X		
Unalakleet		X	
Wales	X		
White Mountain	X		

The drinking water in Stebbins and St. Michael, for example, comes from an area known as the Clear Lakes. Where does the water in the pipes or the washeteria in your community come from?

The Clear Lakes between Stebbins and St. Michael were formed by the craters of old volcanoes. *Photo: Putt Clark, REACH Up.*

Water Quality

Part 1 — Factors that Affect Water Quality

Materials

- Student Worksheet: *Water Quality - Part 1* (or student notebook)
- Student Information Sheet: *Water Quality Factors*
- Water sample bottles
- Labeling tape and Marker

Introduction (Whole Class)

1. There are many sources of water around you. List on the student worksheet (or in your notebook) all the water sources you can think of and share with the class.
2. Can you drink water from all the sources you listed? Discuss with the class why you think you can or cannot.
3. Many factors affect water quality. Learn about some of these factors with the class, using the *Water Quality Factors* sheet.

Procedure (Small Groups)

1. Collect a sample of school tap water in a water sample bottle. Using tape and a marker, label the bottle "Tap water."
2. Collect samples of water from different local sources in water sample bottles. These may include:
    - Rain/Snow (around school, houses, roads, buildings, etc.)
    - Washeteria
    - River
    - Lake/Pond
    - Puddle
    - Ocean/Slough
    - Bottled water

    Each group must have samples from three different sources in addition to the sample of school tap water.
3. Using tape and a marker, label each bottle with the location where you collected the water.

Water Quality

Part 2 — Analyzing Water Quality

Materials

- Water samples
- Correctly calibrated pH, nitrate, and turbidity sensors
- Distilled water
- 250ml and 100ml beakers
- Student Worksheet: *Water Quality - Part 2*
- Student Information Sheet: *Water Quality Analysis Procedure Guide*
- Student Information Sheet: *Water Quality Factors*

Procedure (Small Groups)

1. Have water samples collected in Part 1 ready. Each group should have school tap water and water samples from three other sources.
2. With your teacher and class, review instructions for using the sensors by referring to the *Water Quality Analysis Procedure Guide*. You may also wish to consult instructions provided by the supplier, including any safety precautions.
3. Assess water samples and record your findings on your worksheet.
4. When the tests are complete, record your group's findings on the board for others. Copy other groups' data on your own worksheet.

Discuss (Whole Class)

- How similar or different were the results for the water samples analyzed?
- What could each sample of water be used for (e.g., drinking water, shower, irrigation)? Consult the chart on the last page of the *Water Quality Factors* sheet for reference.

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