WHY IS UTAH LAKE MURKY?
Water Quality

TEACHER BACKGROUND:

The teacher should preview Chapters 5 & 6 of the Utah Lake: Legacy video before the activity and watch with the class after the activity.

Chapter 5 (*YouTube Link*), (*UEN Link*)
Chapter 6 (*YouTube Link*), (*UEN Link*)

Utah Lake water is often characterized as looking turbid, muddy, or cloudy. This condition, which is common in large shallow lakes, is largely due to a combination of suspended sediments, precipitated calcium carbonate particles, and algae. Though many assume this cloudy condition is caused by "man-made pollution," these three contributors to the water's appearance are primarily derived from natural sources and do not reliably indicate the presence of "man-made pollution."

Disturbances likely to contribute to Utah Lake's existing turbid state include:

1. Elevated nutrient loading, such as phosphate from agricultural runoff and wastewater disposal, which promotes algae growth;
2. The introduction and establishment of common carp, which inhibit the aquatic vegetation;
3. Wind and wave action, which stir bottom sediments;
4. Lake level fluctuations, which causes sediments along the shoreline to become suspended.

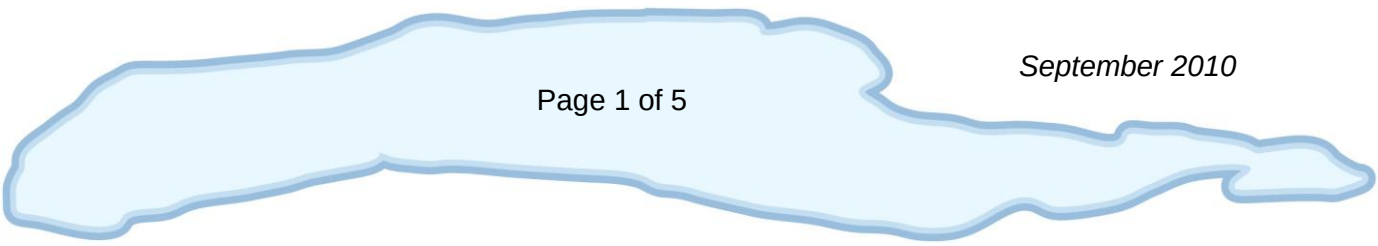
The Utah Division of Water Quality routinely samples the water quality of the lake and compares those results to State Water Quality Standards. Utah Lake maintains high quality water.

The water quality of Utah Lake upon settlement in the late 1800s is uncertain.

Phosphate

Phosphate is a nutrient that contributes to plant growth. It promotes growth of plants in aquatic systems in much the same way as it promotes the growth of agricultural crops and gardens. At low concentrations, it is critical to sustaining a healthy ecosystem but at elevated concentrations can have detrimental effects. General concerns associated with elevated phosphate concentrations include excess plant growth resulting in low oxygen levels and elevated pH.

Discharges from wastewater treatment plants contribute the largest portion (76%) of phosphate with only 8% of the total water flow into the lake. Streams without wastewater treatment plants contribute 21% of the phosphate load, with the remaining 3% coming from miscellaneous surface drains, ground water sources, and springs. It is important to note numbers represent inflow loading only and do not include internal loading, or phosphate, which is found naturally in the lake sediments. About 300 tons of phosphate flow into the lake every year. Roughly 2/3 of this load is retained in the lake. Internal loading rates have not been determined, but are likely to provide a large source of available phosphate.



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OBJECTIVE:

Activity A:
Students will be able to make connections between a shallow lake and a deeper water lake. Utah Lake is a shallow lake. Sediments can enter the water column by wind and water currents. Students will be able to identify that in a shallow lake, sedimentation occurs more readily, making the lake appear murky. Students will learn about sedimentation. Sedimentation is the process where soil particles are distributed and settled in a watery condition, a process of erosion.

Activity B:
Students will be able to understand how submerged aquatic plants help reduce sedimentation and excess nutrients in a shallow lake preserving water quality. Students will understand how submerged aquatic plants slow down water flow preventing excessive sedimentation and how plants use nutrients preventing excessive algae growth.

TEACHER MATERIALS:

- Two Tall Mason Jars
- Dirt (not potting soil)
- Water
- Pouring cups
- Plastic canvas the size of one cake pan
- 2 cake pans
- *Utah Lake: Legacy* video clip—Chapter 5 (*YouTube Link*); (*UEN Link*)
- *Utah Lake: Legacy* video clip—Chapter 6 (*YouTube Link*); (*UEN Link*)

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PROCEDURE:

ACTIVITY A: SHALLOW WATER

Consider showing the video clip Chapter 6 of the *Utah Lake: Legacy* video to the class.

What effect does the depth of the lake have on the sedimentation (murkiness) of the lake water?

Prepare one day in advance:

Controlled Variables:

- Two tall Mason jars. The dirt sediment amount at the bottom should be the same in both containers, about ½ - 1 inch of soil.
- Both containers should be slightly shaken and then allowed to settle. After a day the water should have settled and be clear.

Dependent Variable: The depth of the water.

Day One:

Add enough water to the short container so there is about ½ - 1 inch of water above the soil base. Add enough water to the tall jar so there is a large difference between the two containers, but maintain enough water in the container to add more water the next day.

Day Two:

Pour ¼ cup of water slowly into both containers and observe the resulting water clarity in both containers. The pouring water represents wind, rain, and waves. You will notice the affect that the water has on the tall jar is minimal and the affect on the shallow water is obvious.

Discuss Utah Lake is a shallow and not a deep lake, like the shallow container. Many people assume Utah Lake is 'unsafe' and polluted because it sometimes appears murky. Do you think that one container of water is more 'unsafe' than the other jar? Are the 'ingredients' of the two containers the same or different? From this experiment, can you state one reason Utah Lake may appear murkier than a deep lake such as Lake Powell or Deer Creek Reservoir?

ACTIVITY B: SUBMERGED AQUATIC VEGETATION

Day One:

Use two cake pans. Fill each cake pan with 1/2" of soil. Fill with water to reach a depth of about 1 1/2". Cut out a piece of plastic canvas that will cover the surface of the soil. Place a large piece of plastic canvas on top of the soil of one of the pans, weighing it down with rocks. This canvas will represent submerged aquatic plants.

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Day Two:

Perform the experiment again with each pan as you did in Activity A and note any difference in the amount or type of sedimentation in the water. The pan without the plastic canvas represents Utah Lake after the addition of carp. Carp have uprooted all the submerged aquatic plants that were found within the lake.

Points to discuss about this experiment that are related to water quality:

- Aquatic submerged plants help maintain water quality in two major ways.

    1. Aquatic plants slow down water flow. This slowed down water flow prevents sedimentation from occurring on a large scale. When the wind creates large waves on the surface of the lake, the submerged aquatic plants slow the water movement on the bottom of the lake where the sediments are located. The sediments that are in the water column become trapped in the leaves of submerged aquatic plants during a storm.

    2. Aquatic plants, like terrestrial (above water) plants require nutrients to grow. Farming, watering lawns, and washing clothes (you may make a list of other sources) all release nutrients into the water system that supplies water to Utah Lake. Aquatic plants use these nutrients to grow. Utah Lake lacks submerged aquatic vegetation to use up the extra nutrients because of carp. Another plant, algae, is plentiful in Utah Lake. When algae are in a nutrient rich environment, like Utah Lake, they thrive and multiply rapidly (called an algal bloom). During warm months, when algal blooms occur, Utah Lake appears green. The color is from the algae. Algae do not have roots; they remain in the water column, suspended in the water. Algae, during a bloom, block sunlight from reaching the lake bottom preventing other plants, like submerged aquatic plants from growing. Submerged aquatic plants can help prevent algal blooms from occurring.

Note for this lesson: Activity A and Activity B can both be done on the same day.

Students should view Chapter 5, *Utah Lake: Legacy* (*YouTube Link*); (*UEN Link*) after the activities and discussion.

EXTENSIONS:

Additional experiment: You may decide to grow a submerged aquatic plant (available from most pet stores) in a jar of water, and another in a jar of water with plant fertilizer.

ADDITIONAL REFERENCES:

None

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STANDARDS ADDRESSED:

Science

Standard 3: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 3: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

Indicators:

d. Explain how plants may help control the erosion of soil.

e. Research and investigate ways to provide mineral nutrients for plants to grow without soil.

Standard 5: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 1: Describe the physical characteristics of Utah's wetlands, forests, and deserts.

Indicators:

b. Describe Utah's wetlands.

c. Locate examples of areas that have characteristics of wetlands in Utah

e. Create models of wetlands.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

Indicators:

c. Describe some of the interactions between animals and plants of a given environment.

Social Studies

Standard 1: Students will understand the relationship between the physical geography in Utah and human life.

Objective 3: Analyze how human actions modify the physical environment.

Indicators:

d. Make data-supported predictions about the future needs of Utahns and the natural resources that will be necessary to meet those needs.