Lesson One: What Does the California Water Project Tell Us About Public Works Infrastructures?

Overview: This one-day lesson can be used to introduce infrastructure in a high school history, government, or economics class. It begins with a brief examination of the 2012 "UCLA Water Main Break". By focusing on a sudden and unexpected failure like this, students will begin to understand the many ways we are dependent upon our water infrastructure for basic human and social needs. After this brief introduction, students will learn a definition of infrastructure. For the remainder of the lesson, they will return to the UCLA water main break after examining how the California Water Project brings water from Northern California down to the houses and businesses in Los Angeles using dams, aqueducts, and municipal water systems. As students study the various parts of this massive state-wide system, they will be learning several characteristics of infrastructure that will guide them throughout the unit.

Objectives: Students should be able to do the following at the end of the lesson:

1. State several ways a major water main break will impact daily life.
2. Accurately define infrastructure in one sentence.
3. Illustrate at least five common features of infrastructure using the three stages of the California Water Project.

Activities:

1. After seeing two photographs of the "UCLA Break" and several related facts, students will have a discussion where they brainstorm several ways lives were affected by this malfunction.
2. In part two of this lesson, students will learn a concise definition of infrastructure. As they explore the various key parts of this definition, they will end up with a list of eight possible features of a large infrastructure system like that in California.
3. For the rest of the class, students will examine the three stages of the California Water Project taking these eight features in mind.

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1. <u>UCLA Water Main Break</u>: This lesson is designed to introduce public works infrastructures by examining the California Water project. The lesson begins with a look at the UCLA water main break that occurred in July, 2014. Use the accompanying PowerPoint presentation (three photos and six factual statements) to provide information to the students about this very disruptive public works misfortune. Then have students discuss these questions plus any others the teacher may have:

- What are several probable economic consequences of this water main break?
- Who will likely benefit? Who will likely lose?
- Over all, is this good or bad for the Los Angeles economy? Why?
- Why did this water main break?

Using the following information to help students understand not only why this water main broke, but also why and how these breaks are very expensive and quite commonplace throughout the country.

This water main was over 90 years old. Like most old pipes, it was rusting in many places, and eventually the pipe became so corroded that it broke with explosive power. On average, over 800 water main breaks occur each day in the United States. Most are small, but some are large like the UCLA break.

One might ask why this old pipe wasn't replaced. The main answer is money. There are over 7,200 miles of pipe in the Los Angeles system, and 10% of these pipes are over 90 years old. To replace all of the aging pipes would cost 8 billion dollars, which is the entire LA budget for one year. The city is gradually renovating the old water mains, but at a snail's pace. In the last five years, nine miles of pipes have been replaced. Expect more water main blowouts in the near future.

For more information on the nation's crumbling water mains, see www.watermainbreakclock.com. Be sure to find out who is sponsoring this site and what biases it might lead to.

2. Water Infrastructure Characteristics: Water mains are only one segment of the complex and important infrastructure that is needed to reliably deliver safe water to the many homes and businesses in Southern California. In part two of this introductory lesson, the teacher will first introduce the broad concept of infrastructure and then provide students with eight characteristics of most infrastructures.

Our Definition of Infrastructure: "The organized network needed to provide particular goods and/or services to a large group of people."

Eight Characteristics of Most Infrastructures:

- Very important
- Government in charge
- Expensive to maintain
- May be deteriorating
- Large and complex
- Expensive to build
- Can be controversial
- May be privately owned or managed

The teacher may want discuss this definition and these characteristics briefly now, and then let students learn them in more depth as they look at the three stages of the California Water Project in the third part of the lesson, which immediately follows.

3. California State Water Project: Part three of this lesson moves the focus of infrastructure from the local level to the state level. Students will work in groups as they examine the flow of the California Water Project from the dams to the aqueduct system to the local municipal water systems. They will determine which of the eight characteristics discussed in part two above apply to each part of the Water Project. Each group will get information from a four-page handout ("The California State Water Project") that has a photo and a few facts on each of these three stages. Have students look at this information in order to complete the checklist "Water Infrastructure Chart". In a large class debrief, ask students to share their findings about the eight characteristics and the water project. Ask students if they have questions about the water project.

Discuss implications of this activity, leading to questions like:

- Compare the conditions of the local water infrastructure where the students live with the California Water Project. What are some similarities? Differences? Any problems for the future?
- How high of a priority should improving the local state water infrastructure be?
- What are some other important public works infrastructures? Do these eight characteristics of infrastructures also apply to them? Are any in the news?

UCLA Water Main Break

July, 2014 Los Angeles, California

20,000,000 gallons of water flooded nearby neighborhoods.

UCLA Water Main Break

It took one day to completely turn off the water and five days to fix the water main and reopen Sunset Boulevard, a major LA street.

More Information about the LA Water Main Break

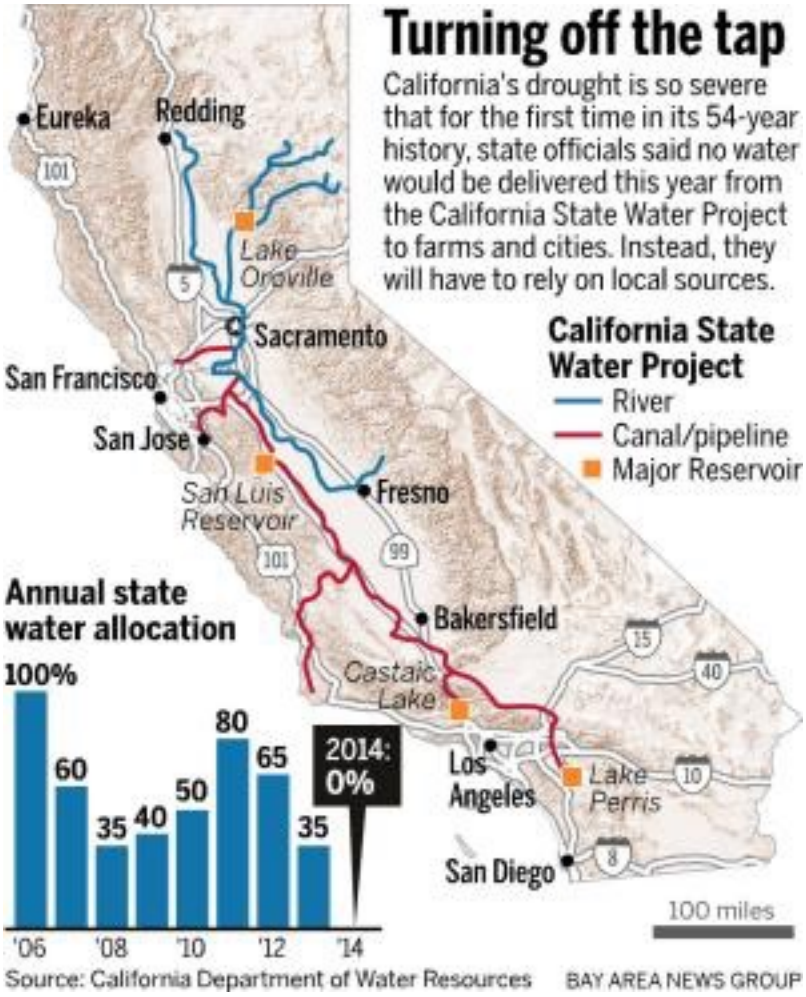
- The water main was 30 inches in diameter.
- Many UCLA buildings were flooded.
- Two large electrical transformers were knocked out.
- 700 cars were marooned in parking structures.

Questions:

- What are several probable economic consequences of this water main break?
- Who would likely benefit? Who would likely lose?
- Over all, is this good or bad for the Los Angeles economy?
- Why did this water main break?

Lesson One: What Does the California Water Project Tell Us About Public Works Infrastructures?

The California State Water Project



The California State Water project provides drinking water for more than 20 million people, most of them living in Southern California. About 30% of its water is used for Central Valley agriculture. This very complicated, far reaching, and expensive project took years to design and build, often against bitter and determined opposition by different groups. At one time, both Northern Californians and the city of Los Angeles were against it. The bond needed to fund the first stage passed in 1959 by a very narrow margin. It has continued to grow since then, and currently, it is the largest publicly built and operated water delivery system in the world. It has been estimated that this water project adds $400 billion dollars to the California economy.

Step One of the Infrastructure: Dams

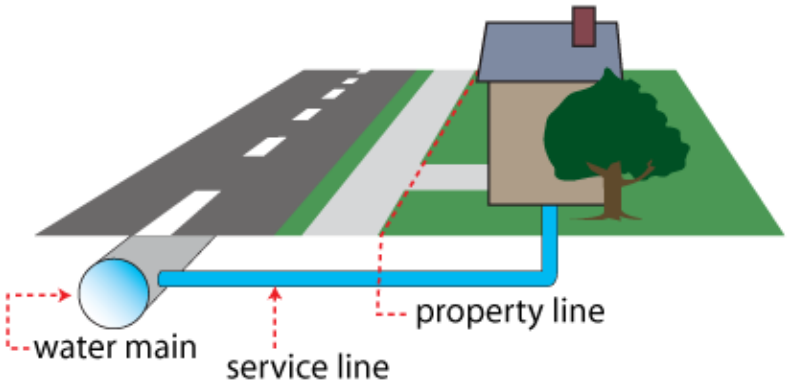
The California Water Project has constructed 21 dams since 1960, one of them being the Oroville Dam. This dam is the tallest in the United States, measuring over 770 feet from top to bottom. Behind it lies the huge Lake Oroville. These dams store runoff from Sierra mountains in the spring and deliver it to its customers throughout the year. 2014/2015 were drought years, and for the first time in history, it delivered NO water to its many customers throughout the state.

Like most dams, this dam was very controversial from the start. There were not only the usual environmental issues, but also the added regional problem of sending water from Northern California down to Southern California.

Step Two of the Infrastructure: The California Aqueduct System

The next task for the infrastructure is to move the water from the storage reservoirs to its 23 million customers. Transferring the water from the Oroville Dam and the Sacramento River in Northern California south to Los Angeles presented engineers with several problems. Over 300 miles of canals had to be built with concrete to prevent the water from disappearing into the dry earth. A typical aqueduct canal is about 30 feet deep and up to 300 feet wide. Another problem was moving the water over the Tehachapi Mountains, which are more than 2,000 feet above sea level. The canals use gravity whenever possible, but at different places in the system, massive pumping stations elevate the water up and over the Tehachapis. The Dos Amigos pumping station is the largest, lifting over 110,000 gallons of water a second! These pumping stations use so much electricity that several power lines may be needed to keep the big stations in operation. The final task is to pump the water over the Tehachapi Mountains, after which the water flows downhill to Los Angeles and other southern California cities.

Step Three of the Infrastructure: Municipal Water Systems



After a long journey, the water finally arrives in Southern California, where the Los Angeles Department of Water and Power takes responsibility for the final delivery of purified and treated water to the many homes and businesses in the city. To serve over 3.8 million residents, the city hires almost 9,000 employees and has a budget of 1.5 million dollars. The city water infrastructure includes 24 chlorination stations, 78 pumping stations, 60,000 fire hydrants, and 7,000 miles of water mains. The UCLA break occurred on one of these 7,000 miles of old, rusting pipes.

Water Infrastructure Chart

	DAMS	AQUADUCTS	MAIN SYSTEMS
very important			
government in charge			
expensive to maintain			
may be deteriorating			
large and complex			
expensive to build			
can be controversial			
parts may be privately owned			