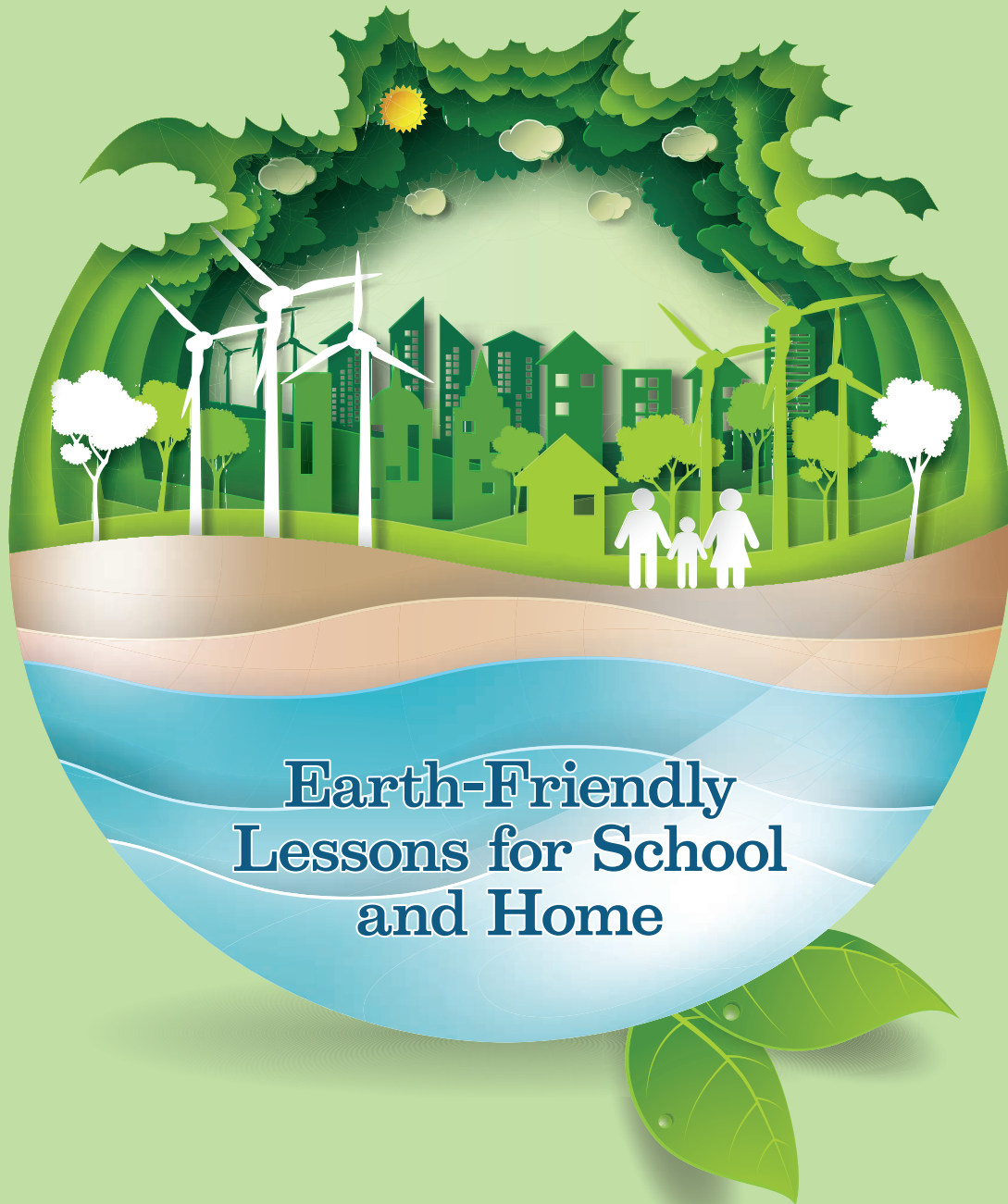


Los Angeles Department of Water and Power

# Water, Energy, the Environment and You



Earth-Friendly  
Lessons for School  
and Home



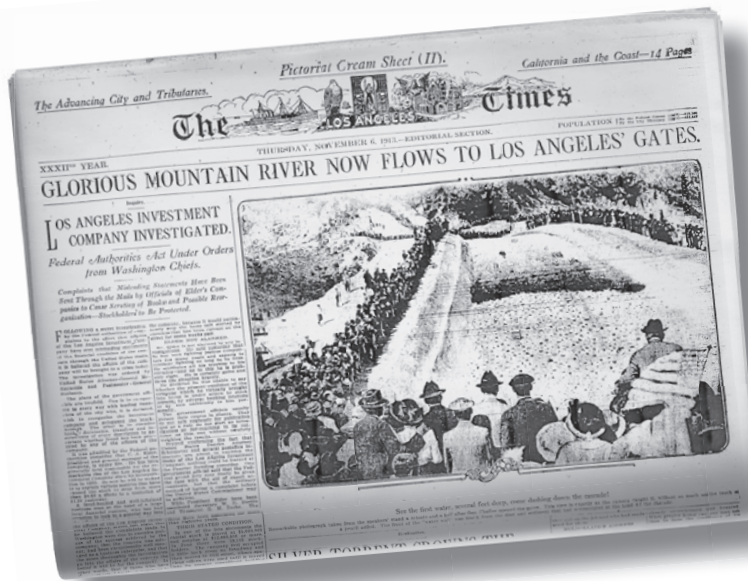
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**Los Angeles Times**  
IN EDUCATION



Los Angeles Department of Water and Power

# Water, Energy, the Environment and You



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Los Angeles Times in Education

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Special thanks to the Los Angeles Department of Water and Power  
and the Metropolitan Water District  
for their assistance in preparing this guide.



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## TEACHER INTRODUCTION

Welcome to **Water, Energy, the Environment and You** sponsored by the Los Angeles Department of Water and Power. This teacher's guide is one of the many exciting, newspaper-based study units from the award-winning Los Angeles Times in Education program.

We encourage you to incorporate The Times daily eNewspaper, a digital replica of the printed paper, into all content areas in order to help your students make real-world connections with classroom learning, and to develop daily reading habits. All lessons and activities were developed to support the California State Frameworks, and most include extension activities, discussion questions and worksheets that provide assessment opportunities to measure student progress.

Each of the lessons included in **Water, Energy, the Environment and You** will assist your students in learning about water, energy and air quality in Los Angeles. Students will use the newspaper to acquaint themselves with various forms of energy, find examples of green power in L.A., make smarter energy choices, and learn to interpret air quality data.

A special thank you to the Department of Water and Power for their help in developing the lessons. The DWP also offers additional teaching materials. Please see the insert in this packet, or visit **ladwp.com**

We hope you will find this new study unit and the Los Angeles Times to be an effective and meaningful part of your instructional program. You are encouraged to share your students' work and your thoughts on how these resources helped to reinforce classroom goals.

To learn more about other Times in Education programs, please call our Los Angeles regional office at **213-237-2915**.



Los Angeles  
Department of  
Water & Power

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September 4, 2018

Dear Educator:

Subject: Los Angeles Department of Water and Power's *Water, Energy, the Environment and You* Times in Education Program

The Los Angeles Department of Water and Power (LADWP) is pleased to continue our partnership with the Times in Education Program (TIE) through our sponsorship of three curricula: *Water, Energy, the Environment and You*, *Conservation Connection – Energy Efficiency* and the newest lesson *Conservation Connection – Water Conservation*.

Lessons cover Water Conservation and the importance of increasing our Local Water Supply Sources as well as Energy Supply Sources and Renewable Energy. The packet also includes Conservation Checklists for use at home and on school campuses and additional conservation information for families. Lessons are also included that cover information about careers in water and electric utilities.

This year students that participate in TIE will have an opportunity to enter an art poster contest. LADWP is asking students to help communicate with our community about the importance of saving water and energy through two major city and LADWP campaigns: "Save the Drop" and "Save Energy LA."

LADWP is proud to be recognized as one of the City's leading educational partnership organizations. Information about our specific education programs is provided as an attachment in the TIE packet and is also available at the LADWP website, [www.ladwp.com/education](http://www.ladwp.com/education)

I hope you find TIE both beneficial and enjoyable for you and your students. Thank you for your interest in LADWP education programs.

If you have any questions about his program or our other education activities, please contact Mr. Walter S. Zeisl, Manager of Education Outreach, at (213) 367-1342 or email him at [walter.zeisl@ladwp.com](mailto:walter.zeisl@ladwp.com)

Sincerely,

David H. Wright  
General Manager

## LETTER TO PARENTS

Dear Parents,

During the next 12 weeks our class will be participating in an exciting environmental resource program, sponsored by the Los Angeles Department of Water and Power (LADWP), called, **“Water, Energy, the Environment and You.”**

This program helps bring to the classroom real-world issues on water, energy resources and conservation. There are lessons on careers with electric and water utilities as well as new water recycling lessons on groundwater remediation and storm water capture. Also there are lessons on the history of water as well as a section about the Los Angeles Aqueduct Centennial on November 5, 2013.

The program includes water and energy conservation surveys that students work on with you at home. In addition, the program also includes an art poster contest where students can participate individually or on a team.

We hope that you will share the excitement and opportunities for learning that this program provides by having discussions at home. As always, your interest and support are integral to the classroom learning experience.

If you have questions or need additional information about the program, let me know. Additional information about “Water, Energy, the Environment and You” is also available at the LADWP website, [ladwp.com/education](http://ladwp.com/education)

Sincerely,

Teacher



## WILLIAM MULHOLLAND'S PROMISE TO FUTURE GENERATIONS

William Mulholland had big ideas for a small western town called Los Angeles. When he arrived on horseback as a 21-year-old man in 1877, fewer than 10,000 people lived in Los Angeles. Los Angeles was just 100 years old at the time. Because of William Mulholland's vision and dedication, Los Angeles grew from a small dry town to the world-class city where 3.9 million people live, work and play together.

Los Angeles began as a Spanish pueblo in 1781. The 44 people who began the pueblo settled on the banks of the Los Angeles River. At that time, the river was called El Rio de la Porciuncula. The river was their best source of water in a dry area. As the pueblo grew, it became necessary for more and more water to reach more and more people. The settlers shared the water by constructing a crude diversion system. Simple dams, waterwheels and canals distributed the water. The canals were nothing more than open ditches. A ditch was called a "zanja," pronounced san-ha.

Los Angeles became an American city in 1850. Five years later, on the other side of the world, in Belfast, Ireland, William Mulholland was born. He attended school until he was 14. He had a curiosity for the world and he left home and sailed the seas as an apprentice sailor for several years. He came to America and worked on the Great Lakes and in the lumber camps of Michigan. He had read Nordhoff's "History of California," and he decided to see the Pacific Coast himself.

He made the voyage from the East Coast to the Isthmus of Panama by ship. A train ticket across the Isthmus, from the Atlantic Ocean to the Pacific Ocean, would have cost him \$25 in gold. Instead, he chose to walk the whole 47 miles from Colon to Balboa. He then paid for his passage from Panama to San Francisco by working as a member of several ships' crews. He sailed into the San Francisco Bay in January 1877.

Mulholland traveled to Los Angeles and found it to be a place after his own heart. He became a zanjero, one of the handful of men who tended the zanjias, the ditches that carried water from the Los Angeles River to the rest of the city. The zanjias needed attention all year round. His job was to make sure the ditch stayed in good clean condition so it carried water correctly. It was a hard job. When he got home after work, he studied



mathematics, hydraulics, geology and other subjects from textbooks on his own. By the 1880s there were 10 zanjias that served the citizens of Los Angeles. The zanjias covered an extensive 93 miles.

In 1886, Mulholland became the superintendent of the Los Angeles City Water Company. It was a private company that the city of Los Angeles would later buy in 1902. After the city of Los Angeles acquired the water company, it named William Mulholland as its superintendent and he continued to serve Angelenos. He was in charge of six reservoirs that could hold 65,821,902 gallons of water, two pumping stations, 535 fire hydrants, 325 miles of pipe and 319 water meters. He had the responsibility of making sure that there would be enough water for the growing thirst of a rapidly developing city. In carrying out his responsibilities, Mulholland's self studies during his years as a zanjero would soon become very useful.

Los Angeles was a town caught between a hot desert and a salty sea. The Angelenos of the late 1800s were at the mercy of the generosity of The Los Angeles River. The Los Angeles River was only as generous as the weather and seasons. The Los Angeles River and other local supplies would not be able to provide enough water for everyone if the population grew above 500,000. Unless there was a way to find more water, the growth of the city would be stunted forever. Without additional sources of water, Los Angeles would always remain a one-river town.

In 1906, as a part of his efforts to ensure a stable water supply, William Mulholland worked on building the Silver Lake Reservoir. He drew upon the knowledge he gained from his self-studies and was the first engineer in America to use hydraulic sluicing to build a dam. The Silver Lake Reservoir served the people of Los Angeles for 100 years. That same year, the first steel tank in a modern water system was built on LeMoyene Avenue in Echo Park. There are hundreds of steel tank reservoirs now.

## WILLIAM MULHOLLAND'S PROMISE TO FUTURE GENERATIONS

Los Angeles suffered from below-average rainfall for seven of the eleven years between 1893 and 1903. However, the population of Los Angeles was still growing. It was clear for anyone to see that the



demand for water was soon going to outpace supply. The citizens of Los Angeles voted in 1907 to construct the Los Angeles Aqueduct. It would bring fresh water from the melting snows of

the eastern High Sierras that flowed into the Owens Valley. The Owens Valley is located about 250 miles north of Los Angeles. The cost of the project was \$24,000,000 — a truly whopping sum of money in those days. It was a big investment, but it was important to make it in order to protect the future of Los Angeles. The man in charge of the project was to be William Mulholland. It was a big responsibility, but Mulholland was a hard worker and he had confidence.

The construction for the aqueduct that would connect the Owens River to Los Angeles began in 1907, but work on the project began much earlier. It was important to secure the rights to the water that flowed in the Owens Valley. Mulholland had already surveyed the Owens Valley and confirmed its potential as a source of water. There was a community of people who lived in the Owens Valley who used the water. There was going to be competition for the water between the citizens of the Owens Valley and the citizens of Los Angeles. Los Angeles bought land — and the water rights that go with it — to establish its rights to the water. The city also had to acquire rights of way through three counties to build the aqueduct that carried the water.

The 100,000 men and women of all backgrounds who worked under Mulholland's leadership finished the 233-mile-long project in six years. The workforce numbered about 3,000 at any one time. It was difficult work, and there was a lot of turnover. They finished the most difficult engineering project ever embarked upon by any city in America on time and within budget. The concept was simple. Instead of using pumps to move the water, the

aqueduct would take advantage of gravity to deliver water from Owens Valley to Los Angeles. The construction itself was not so simple and the project faced tremendous engineering challenges. Under Mulholland's leadership, the workers eventually blasted and excavated 164 tunnels, totaling more than 52 miles in length. They built channels and where channels were not feasible, they built pipes. Some of the pipes were big enough to drive a car through.

On November 5, 1913, William Mulholland presented Los Angeles with water from its first aqueduct. The aqueduct's path ended in the northern San Fernando Valley. The spectacular ceremony that introduced

the water to Los Angeles was held there. Mr. Mulholland began by dedicating the aqueduct, "to you and your children and your children's children for all time." He



turned the aqueduct over to the mayor, who in turn accepted it on behalf of the people of Los Angeles. Mr. Mulholland's famous words were short and sweet, "There it is, take it."

Los Angeles continued to grow and within ten years, as Superintendent of the city's Water Department, Mulholland began to look for water again. The city built the Hollywood Reservoir. Work was begun on the Mulholland dam, the first concrete gravity-type dam built by the department. Mulholland also began looking for additional water supply sources. He participated in the planning and helped to establish the route for the Colorado River Aqueduct, that would begin bringing water from the Colorado River to Los Angeles in 1941.

In 1925, the Los Angeles city charter established the Department of Water and Power. William Mulholland was appointed as the chief engineer and general manager for the Bureau of Water Works and Supply. He oversaw the work that would make the water system in Los Angeles one hundred percent metered by 1927.

# WILLIAM MULHOLLAND'S PROMISE TO FUTURE GENERATIONS



Los Angeles continues to meter the use of its water. Metering helps planners keep track of water consumption, and perhaps more importantly, metering helps planners to anticipate future need.

Without the information that metering provides, our city would be in no better position than the pueblo dwellers whose dependence on their early water source went from day to day. Metering also helps in conserving water as it shows the Los Angeles residents exactly how much water they use.

William Mulholland had a remarkable life. During his half-century of service to the people of Los Angeles, he held many jobs. He started as a zanjero and eventually became superintendent, and ultimately general manager of the Los Angeles Department of Water and Power.

Angelenos benefited every day from his work during his half-century of service, and we still benefit today. However, his life was not without tragedy.

Three minutes before midnight on March 12, 1928, the St. Francis Dam gave way, releasing flood waters which destroyed farms, communities and everything in their path. More than 38,000 acre-feet of water surged down San Francisquito Canyon and through the Santa Clara Valley. More than 450 people died including 63 LADWP employees of San Francisquito Power Plant No. 2 and their families.

Using modern technology, experts today believe that uplift in the soil and water along with the geology and unstable land (due to an ancient landslide undetectable in the 1920s) was responsible for the collapse of the dam. But these factors were not well understood in Mulholland's day. The Chief took responsibility for the tragedy. At the Coroner's inquest he said: "If there is an error of human judgment, I was the human."

The St. Francis Dam tragedy marked an end to Mulholland's professional career. In December 1928, Mulholland retired as chief engineer and

general manager of the Department of Water and Power. Following the collapse of the dam, his vision for additional water supplies for Southern California continued.

The creation of the Metropolitan Water District of Southern California (MWD) in 1928, a special district to provide water to Los Angeles and other cities in Southern California, was due in part to his efforts. In addition, he had helped to plan and design the Colorado River Aqueduct, completed by the MWD in 1941. He was also a major supporter for the Boulder Dam Project, now known as Hoover Dam. The dam was completed in 1935 and began to provide hydropower to Los Angeles in 1936.

In 1935, William Mulholland passed away, many miles from his native Ireland.

Los Angeles was not the first place to take advantage of aqueducts, but when Mulholland oversaw the creation of the aqueducts that carried water to Los Angeles, he knew he was doing something special.

The ancient Romans had the engineers of their time fashion a complex system of nine aqueducts to bring about 85 million gallons of water a day to Rome. The man in charge of their waterworks, Frontius, eventually increased the total number of aqueducts bringing fresh water to the households of the ancient city to fourteen. Centuries later, aqueducts again became the lifeline of an important metropolis. The Los Angeles Aqueduct alone has carried a daily average of about 400 million gallons of water to Los Angeles. As a result of William Mulholland's historic foresight and tireless work, people of every age and background in Los Angeles know that no matter what the weather or season, they can always expect cool fresh water at the turn of a faucet.

Now, the torch that was carried so long and so high by William Mulholland has been passed to all Angelenos. As residents of Los Angeles and consumers of Owens Valley water, we can appreciate the tremendous achievements that were made to bring water to L.A. By always using water wisely, we can keep alive Mulholland's promise to the future and help preserve the pristine, undeveloped conditions left in the Owens Valley for everyone to enjoy.

# WILLIAM MULHOLLAND'S PROMISE TO FUTURE GENERATIONS

## LOS ANGELES AQUEDUCT CENTENNIAL CELEBRATION

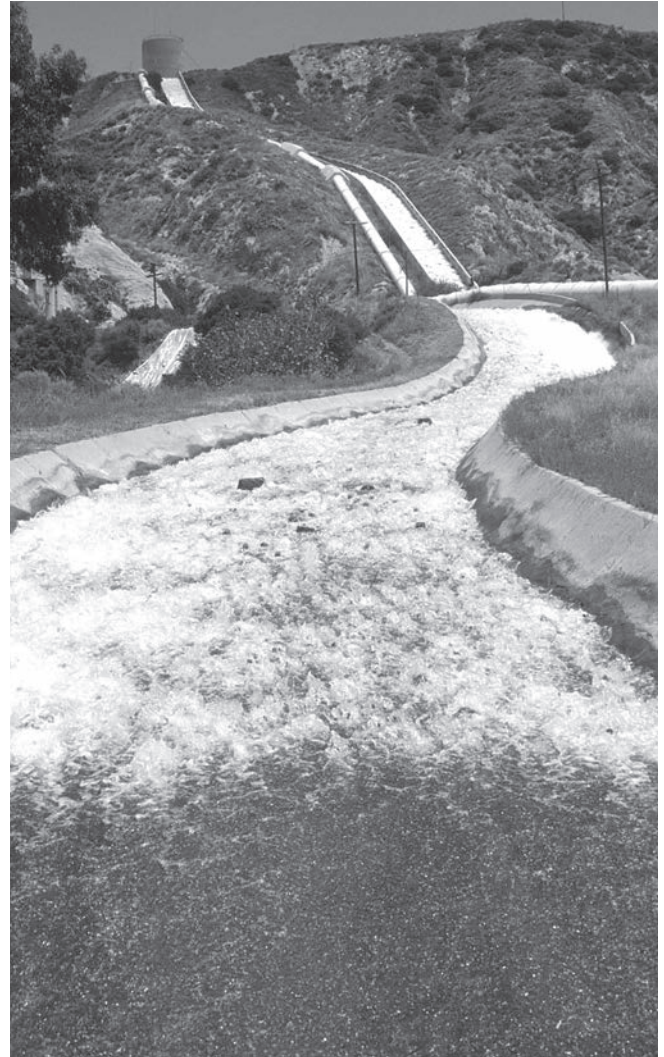
November 5, 2013, marked the centennial, the 100th anniversary of the Los Angeles Aqueduct's completion. The year 2013 was called "The Year of the Aqueduct."

The completion of the Los Angeles Aqueduct resulted in significant changes to the economic, cultural, political and historic landscape, not only in the city of Los Angeles, but also in Southern California as a whole.

Los Angeles would simply not exist as a major city or metropolitan area without the Los Angeles Aqueduct and the other water conveyances that subsequently brought additional supplies to the area — the Colorado River Aqueduct and the California Aqueduct.

The first electric power developed by the city of Los Angeles was used during construction of the Los Angeles Aqueduct. These initial plants generated power from creeks flowing into the Owens River and then the aqueduct. Additional hydroelectric plants were also built later along the aqueduct itself. The largest ones are Power Plants 1 and 2 that were completed in 1917 and 1919 respectively. These plants continue to operate today providing clean energy to the residences and businesses in the city of Los Angeles.

Many local community, citywide, and region-wide activities were held to celebrate the important and historic centennial milestone.



# LOS ANGELES AQUEDUCT CENTENNIAL — WHY DID WE CELEBRATE IT?

## INTRODUCTION

The 100th anniversary of Los Angeles Aqueduct’s completion, the centennial, was on November 5, 2013. In honor of the occasion, the year 2013 was proclaimed “The Year of the Aqueduct.”

## RESEARCH

Reviewing the Los Angeles Times daily eNewspaper, as well as other source material such as books like “Vision or Villainy” by Abraham Hoffman or “William Mulholland and the Rise of Los Angeles” by his granddaughter Catherine Mulholland, answer these questions or write a 500 word essay that responds to the questions below:

## QUESTIONS

What is the importance of the aqueduct to the city of Los Angeles and Southern California?

---

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What changes occurred to the city of Los Angeles and Southern California that resulted from the completion of the aqueduct?

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If the Los Angeles Aqueduct had not been built, what do you think Los Angeles and Southern California would be like now?

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Why is it important to continue to conserve water?

---

---

What is the relationship between the importance of conserving water and the Los Angeles Aqueduct?

---

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After your study of the Los Angeles Aqueduct, why do you think it is important to you and your family?

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GRADES 4-12 ENGLISH/LANGUAGE ARTS  
CORE STANDARDS MATRIX\*

		Water in Motion	Water in the News	Ways to Save	Water Aware	Groundwater Challenge	Capturing the Rain	All Water Is Recycled	Energy Sources	Fuel From Fossils	Renewable Resources	Energy Costs and Benefits	Green Power – Renewable Energy	Care About Air	Mapping the Air	Careers in Water and Power
<b>GRADE 4</b>																
RI 4	Determine meaning of words		X								X	X		X		
RI 7	Understand charts and graphs			X						X						
RI 9	Integrate text from two sources															X
W 1	Write opinion pieces															X
W 2	Write informative texts							X								
SL 1	Engage in collaborative discussions	X	X			X		X	X		X	X	X			X
SL 2	Paraphrase a text aloud															
<b>GRADE 5</b>																
RI 3	Explain relationships based on text															X
RI 4	Determine meaning of words		X					X			X	X		X		
RI 9	Integrate text from multiple sources															X
W 1	Write opinion pieces			X												
W 2	Write informative texts							X								
SL 1	Engage in collaborative discussions	X	X			X		X	X		X	X	X			X
SL 2	Summarize a text aloud															
<b>GRADE 6</b>																
RH 7	Integrate charts and graphs	X	X													
RI 4	Determine the meaning of words		X					X			X	X		X		
W 2	Write informative texts							X								
WHST 1	Write discipline-specific arguments			X												
WHST 4	Write for an audience			X												
SL 1	Engage in collaborative discussions	X	X			X		X	X		X	X	X			X
SL 2	Interpret visual data	X	X													

# GRADES 4-12 ENGLISH/LANGUAGE ARTS CORE STANDARDS MATRIX\*

		Water in Motion	Water in the News	Ways to Save	Water Aware	Groundwater Challenge	Capturing the Rain	All Water Is Recycled	Energy Sources	Fuel From Fossils	Renewable Resources	Energy Costs and Benefits	Green Power – Renewable Energy	Care About Air	Mapping the Air	Careers in Water and Power
<b>GRADE 7</b>																
RH 7	Integrate charts and graphs	X	X													
W 2	Write informative texts							X								
WHST 1	Write discipline-specific arguments			X												
WHST 4	Write for an audience			X												
SL 1	Engage in collaborative discussions	X	X			X		X	X		X	X	X			X
<b>GRADE 8</b>																
RH 7	Integrate charts and graphs	X	X													
W 2	Write informative texts							X								
WHST 1	Write discipline-specific arguments			X												
WHST 4	Write for an audience			X												
SL 1	Engage in collaborative discussions	X	X			X		X	X		X	X	X			X
<b>GRADES 9-10</b>																
RH 7	Integrate charts and graphs	X	X													
W 2	Write informative texts							X								
WHST 1	Write discipline-specific arguments			X												
WHST 4	Write for an audience			X												
SL 1	Engage in collaborative discussions	X	X			X		X	X		X	X	X			X
<b>GRADES 11-12</b>																
RH 7	Integrate charts and graphs	X	X													
W 2	Write informative texts							X								
WHST 1	Write discipline-specific arguments			X												
WHST 4	Write for an audience			X												
SL 1	Engage in collaborative discussions	X	X			X		X	X		X	X	X			X

\*Standards of English are not explicitly taught by the lesson itself, but they can be easily integrated.

# GRADES 4-12 SCIENCE CONTENT STANDARDS MATRIX

	Water in Motion	Water in the News	Ways to Save	Water Aware	Groundwater Challenge	Capturing the Rain	All Water Is Recycled	Energy Sources	Fuel From Fossils	Renewable Resources	Energy Costs and Benefits	Green Power – Renewable Energy	Care About Air	Mapping the Air	Careers in Water and Power
<b>GRADE 4 – PHYSICAL SCIENCES</b>															
1.g Electrical energy								X	X						
<b>GRADE 4 – LIFE SCIENCES</b>															
3.b Plants and animals in different environments				X			X								
<b>GRADE 4 – EARTH SCIENCES</b>															
5.c Water movement	X	X		X	X	X									
<b>GRADE 4 – INVESTIGATION, ETC.</b>															
6.a Inference vs. observation		X			X	X	X								
6.c Cause and effect		X			X										
6.d Predictions and conclusions		X									X				
<b>GRADE 5 – EARTH SCIENCES</b>															
3.a-c Water cycle								X	X		X	X	X	X	
4.a-d Weather							X								
<b>GRADE 5 – INVESTIGATION, ETC.</b>															
6.b Testable questions											X				
<b>GRADE 6 – EARTH SCIENCES</b>															
4.a-b Solar energy								X	X			X			
6.a Energy sources							X	X	X			X			
6.b Renewable and non-renewable resources				X			X	X	X	X	X	X			X
6.c Origins of materials used in common objects									X	X					
<b>GRADE 6 – INVESTIGATION, ETC.</b>															
7.a Hypotheses		X			X						X				
7.e Explanations consistent with data		X			X	X									
<b>GRADE 7 – INVESTIGATION, ETC.</b>															
7.a Collect, test and display data	X					X								X	
7.b Use a variety of resources		X	X			X	X								X



# GRADES 4-12 SCIENCE CONTENT STANDARDS MATRIX

	Water in Motion	Water in the News	Ways to Save	Water Aware	Groundwater Challenge	Capturing the Rain	All Water Is Recycled	Energy Sources	Fuel From Fossils	Renewable Resources	Energy Costs and Benefits	Green Power – Renewable Energy	Care About Air	Mapping the Air	Careers in Water and Power
<b>GRADE 8 – INVESTIGATION, ETC.</b>															
9.b Evaluate data		X										X			
<b>GRADE 9-12 – BIOLOGY AND LIFE SCIENCES</b>															
6.b Changes due to human activity		X	X		X						X		X		
6.d The water cycle in an ecosystem	X	X		X			X								
<b>GRADE 9-12 – EARTH SCIENCES</b>															
4.a Energy use vs. supply								X	X		X				
4.c-d Greenhouse gases													X	X	
5.a-g Winds and ocean currents														X	
6.d Predicting greenhouse gases									X				X	X	
8.a-c Atmospheric changes, human impacts											X		X	X	
<b>GRADE 9-12 – INVESTIGATION, ETC.</b>															
1.d Formulate explanations		X			X	X	X				X				
1.l Problems requiring multi-disciplinary solutions	X	X		X											X
1.m Science-based societal issues	X	X	X	X			X	X	X	X	X				X



PART 1

# Introduction to Water Supplies

## INTRODUCTION TO WATER SUPPLIES

### INTRODUCTION

Part II of “Water, Energy, the Environment and You” provides information on the four local water supply source strategies: water conservation, water recycling, storm water capture and groundwater clean-up. In these sections, you will learn ways to save water, how to be aware of your water usage, the importance of groundwater and how water is recycled. LADWP is excited to share this information with you so that together, we can conserve water and help Los Angeles thrive!

In Los Angeles, our water supplies are limited. Almost 90% of the water that you use in Los Angeles is imported through aqueducts that run several hundred miles long. LADWP’s goal is to reduce this usage to 60%. Take a look at pages 24 and 25 to see the current water sources in California. These water supplies have all become limited due to environmental concerns, lawsuits or use by other states.

### HOW ARE OUR WATER SUPPLIES LIMITED?

Environmental concerns include drastic limitation of the water from the California Delta in the northern part of the state through the California Aqueduct due to lawsuits and court orders to protect endangered smelt fish and salmon. In addition, the Delta has miles of old levees which can fail during major earthquake events. If they do, it would cause difficulty supplying water to much of California including Los Angeles. In addition, much water from the Los Angeles Aqueduct is used to control dust on Owens Lake, rewatering 62 miles of the original lower Owens River and other projects.

### CAN’T WE USE ANOTHER WATER SOURCE?

It is unlikely. The Colorado River provides water for several other growing states in addition to California. So the Colorado River Aqueduct which pumps water from that source will not likely be able to increase these supplies in the future.

### HOW IS DWP HELPING?

Through water conservation, water recycling, storm water capture and groundwater clean-up, of course!

LADWP has rebates to encourage customers to conserve water by replacing grass lawns and other high water use landscaping with California friendly plants. Los Angeles uses as much water as it did 40 years ago with 1 million more people. This was accomplished by strong water conservation ethic and the installation of water conserving toilets and shower heads. Los Angeles has the lowest water use per person compared to any other large city of over a million population in the nation. Not only do we need to keep up this effort, we need to increase it!

LADWP is developing a plan not only to increase the use of recycled water for industrial purposes, but to follow the lead of Orange County to purify the water to such an extent that it can be pumped into the groundwater basin and reused in future years.

LADWP also has plans to support programs that will enable rainwater to be captured to use it for outdoor irrigation.

LADWP also plans to clean our groundwater. We have a large amount of natural water underground that can be used especially during emergencies but a lot of it has become polluted. This pollution occurred from industrial uses in the 1940s. LADWP is developing a plan to clean up the water through new treatment plants so this resource can be more extensively used in the future.

### **HOW CAN I HELP RIGHT NOW?**

In 2009, a water ordinance was passed to help Los Angeles residents conserve water. The ordinance restricted watering your lawn to three days per week and prohibited watering your sidewalks, walkways and driveways as well as enforcing other water saving measures (see “Fact Sheet” in your packet). Angelenos are now urged to water lawns two days a week due to the drought. With our record-low water use, Los Angeles became the city with the lowest water use per person of any major U.S. city with a population of over one million people. The Sierra Club even ranked the city of Los Angeles first in its water conservation scorecard for Los Angeles and Orange Counties! We did a great job conserving water by restricting outdoor water use, but we want to improve our efforts! LADWP needs your help to keep our city running efficiently for years to come and to stay at #1.

### **WHY PLANTING?**

Los Angeles has managed to cut its water usage to that of 1977 and 1978 through maintaining a strong water conservation ethic and the installation of water conserving toilets and shower heads, but 40% of a typical family’s water usage is still from outdoor use. Think about it; your lawn might use more water than you do!

Los Angeles has the lowest water use per person compared to larger cities, but we need to increase this effort for future generations. LADWP has rebates to encourage customers to replace grass lawns and other high water use landscaping with plants such as agave, aloe, and green fescue to name a few. It’s time to focus on California Friendly Landscape, starting with your own home and garden. By selecting plants that are friendly to Los Angeles’ climate, we can use less water while still keeping our yards looking great!

### **I WANT TO KNOW MORE!**

Visit [www.ladwp.com/waterconservation](http://www.ladwp.com/waterconservation) for information about saving water in your home and garden.

## WATER IN MOTION

### INTRODUCTION

People and the water they need aren't always located in the same place. This is especially true in California.

### OBJECTIVE

Understanding where our water comes from and the difficult journey it takes to reach us can help students to appreciate (and conserve) our water supply. About two-thirds of the state's water supply is located in Northern California, but two-thirds of the population is in Southern California.

### MATERIALS

The Times daily eNewspaper, map(s) of California, art supplies, copies of Water in Motion worksheet "Water Words," Water Supplies and Water Replacement Graphs from the Los Angeles Department of Water and Power.

### PROCEDURES

1. Discuss with the class some of the basic facts about water in California and in Los Angeles in particular. For example:
  - a) Discuss the major water supply facilities in California, including the State Water Project, the federal Central Valley Project,\* the Los Angeles Aqueduct, and the Colorado River Aqueduct.
  - b) See how many of these facilities students can find on a map of California. In addition to the aqueducts, students should also look for reservoirs and dams (such as Oroville and Folsom in Northern California) that are part of the state's water supply system.
  - c) Discuss the three primary sources of the Los Angeles city water supply. These are the Eastern Sierra Nevada area through the Los Angeles Aqueduct, groundwater supplies and the Metropolitan Water District (MWD). MWD receives water from the California Aqueduct, which is runoff from the Western Sierra Nevada and the Colorado River Aqueduct which receives water from the Western Rocky Mountains.
2. Either distribute blank outline maps of California, have students draw or trace their own maps of California, or distribute Water Sources California Map (new page) and Water Supply Sources (new page) with pie charts from the Los Angeles Department of Water and Power. Students should then plot significant water sources and facilities on their maps.
3. During the course of the class newspaper-based studies, have students locate various news items on their maps. Ask students to consider how many of these news items could impact or be related to water supply issues.
4. Every few days, ask students to share and discuss some of the news items they have collected from locations that play a part in California's water supply system. In discussing these news items with the class, help students realize that every drop of water that is conserved is one less drop that has to be moved from place to place. Also, ask students to consider how things that happen in far-away places can have impacts close to home (and vice-versa).

### EXTENSION

As students complete this lesson (and other water-related lessons using The Times), have them keep a "Water Words" vocabulary list. For each new water-related term that students encounter, have them write the word, its dictionary definition, and a sentence using the word on the attached Water in Motion worksheet on page 23.

\*Does not serve Los Angeles

# WATER IN MOTION WORKSHEET

**DIRECTIONS:** For each new water-related term that you encounter, write the word, its dictionary definition, and a sentence using the word on this Water Words vocabulary list. (Use additional pages as necessary.)

Word:

Dictionary definition:

Sentence:

Word:

Dictionary definition:

Sentence:

Word:

Dictionary definition:

Sentence:

# WATER SOURCES CALIFORNIA MAP



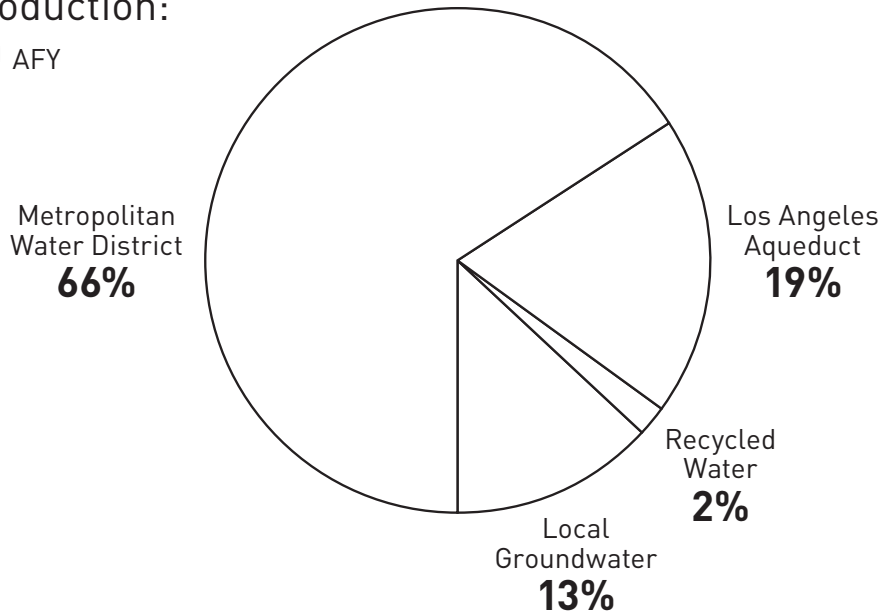
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# LOS ANGELES WATER SUPPLY RELIABILITY

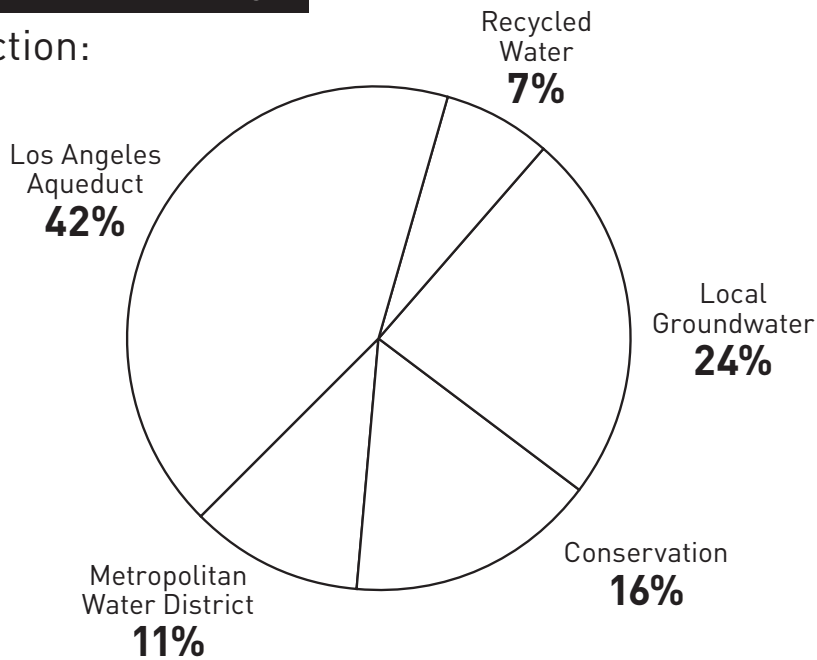
## Fiscal Year End 2013-2017

Total Production:  
**532,600** AFY



## Fiscal Year 2039-2040 Average

Total Production:  
**675,700** AFY



Note: Charts do not include 118,034 AF of historical conservation.

## WATER IN THE NEWS

### INTRODUCTION

Water can never be taken for granted in a place like California. Topics such as where water comes from, how it's transported, how it's used, and how it's conserved are not only important to our way of life, they often make headline news.

### OBJECTIVE

Students will look for stories about water issues in the news, then analyze these issues and develop their own recommended actions for addressing them.

### MATERIALS

The Times daily eNewspaper and copies of Water in the News worksheets. Also provide copy of Annual Water Quality Report (one copy in packet) and refer students to the information online by going to [ladwp.com/waterqualityreport](http://ladwp.com/waterqualityreport).

### PROCEDURES

1. Discuss with the class the meaning of terms such as aqueduct, agriculture, conservation, dam, desalination, drought, pollution, reservoir, runoff, snow pack, urban, and water supply. Ask students to consider how each of these terms impacts our supply and use of water. Lead a class discussion on the general subject of water in California (where it comes from, how it's used, etc.).
2. Share The Times eNewspaper with students. Over a period of several days, ask students to look for and save news items about water in California. Students can look for news items containing the key words discussed in Step 1 above, as well as related stories about topics such as the weather or proposed legislation in Sacramento.
3. Assign students to log into [ladwp.com](http://ladwp.com) and type "Annual Water Quality Report" into the search field — English or Spanish. Tell students to read the report.
4. Distribute Water in the News worksheets. Direct students to complete their worksheets using three of the news items they have collected. For each item, students should fill in the following information on their worksheets:
  - a) headline
  - b) issue involved
  - c) how the action described in the news might impact water use or conservation
5. Students should complete their worksheets by using the news items they collected to identify three actions that contribute to water pollution and water shortages, and three actions that help protect or conserve our water supply.
6. Divide the class into small groups. Ask each group to consider the news items that group members collected. Each group should select one news item, and based on the problem or proposal identified in that news item, prepare a presentation to the class explaining what the issue or problem is, what people in the news have proposed to do about it, and what the group would propose to do about it.
7. Have each group make its presentation to the class. Encourage students to ask questions and discuss the ideas presented.

### EXTENSION

Get involved! The class may decide to get more involved with one or more of the issues discovered in this lesson. Students can write letters to elected officials expressing their opinions and ideas. Students can make posters to display at school or in appropriate places around the community. Students can talk to their friends, parents and others to get more people involved. Students can find out more about organizations that may already be working on some of the issues they care about.

# WATER IN THE NEWS WORKSHEET

**DIRECTIONS, PART 1:** Individually, select three articles from the Los Angeles Times that are about our water supply. Look for articles that use terms such as agriculture, conservation, dam, desalination, drought, pollution, reservoir, runoff, snowpack, urban, and water supply. Determine what issue these articles are about and describe how this impacts our water use or conservation. Think about ways that you would solve the issue. Record your findings below.

**HEADLINE #1**

**HEADLINE #2**

**HEADLINE #3**

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Issue involved:

Issue involved:

Issue involved:

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How does the issue impact water use or conservation?:

How does the issue impact water use or conservation?:

How does the issue impact water use or conservation?:

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Use additional pages as necessary

# WATER IN THE NEWS WORKSHEET *(continued)*

**DIRECTIONS, PART 2:** As a group, discuss the articles that each group member read. Select one article that you would like to present to the class. Think about what you would have done to solve the issue. Be prepared to discuss and defend your group's solution.

Your group's headline:

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What was the proposed solution?:

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What was your group's solution?:

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Use additional pages as necessary

PART 2

# Local Water Supplies

# WAYS TO SAVE — WATER CONSERVATION

## INTRODUCTION

People often take water for granted, without even thinking about how they could use this precious resource more efficiently.

## OBJECTIVE

Students will save pictures of water use they find over a period of days, then for each use depicted, identify ways that water could be used more efficiently.

## MATERIALS

The Times daily eNewspaper, scissors, paste, lined paper, bulletin board. Also, have students access water-related websites.

## PROCEDURES

1. Ask students to think about some of the ways they use water.
2. Share The Times eNewspaper with students. Direct students to look for examples of water use in news stories and advertisements in The Times. Have students share the examples they find over a period of several days.
3. Instruct students to print and paste the pictures of water use they have collected on which to write, or have them use a photo editing program to create a single page with their collected images and text boxes.
4. Within the text boxes, have students identify the action in the picture. Students should then identify and write alternatives to that action that could help conserve water. For example, if the picture shows someone washing their driveway with a hose, students might suggest that they sweep instead. If the picture shows a golf course or lush garden, students might suggest that using recycled water could help conserve fresh water.
5. Make a bulletin board or a class website depicting the Ways to Save that the class has identified.
6. Have class log on to [ladwp.com](http://ladwp.com), click on About Us, Water, Conservation, Rebates and Free Items, and also to the website [bewaterwise.com](http://bewaterwise.com). Have students make a list of conservation programs and opportunities that are available.

## EXTENSION

Have students write a letter, convincing others to conserve water. Include information about conservation programs available and examples of easy ways to conserve.

# WATER AWARE

## INTRODUCTION

Water usage is an integral part of our lives, both indoors and out. Being aware of how the water is used – or wasted – is the first step toward making wise choices in conserving this precious resource.

## OBJECTIVE

Students will identify the many ways they can help conserve water outdoors.

## MATERIALS

The Times daily eNewspaper, scissors, glue, copies of the Water Aware worksheet. Make copies of LADWP Fact Sheet on Water Conservation Ordinance (city law) or have students go online to [ladwp.com](http://ladwp.com), then type in “water conservation ordinance” and first item on the list – conservation.

## PROCEDURES

1. Ask students where they have seen water used outdoors. Make a list of students’ responses on the board. Possible uses include sprinklers, watering plants by hand (with a hose), washing down sidewalks and driveways, washing cars, washing pets, etc.
2. Distribute Water Aware worksheets and share with students The Times daily eNewspaper. Make copies of “Water Conservation Ordinance” or have students log on to [ladwp.com](http://ladwp.com) and type “water conservation ordinance” in search field.
3. Working individually or in small groups, ask students to skim the newspaper looking for articles related to water conservation, advertisements for water-saving products, and any other items that they believe could help to reduce water consumption. Also have the students review the ordinance.
4. Direct students to complete their worksheets by identifying and describing a type of outdoor water usage, then discussing ways that the same task could be accomplished in a more water-efficient manner. Examples of more efficient ways to use water outdoors could include running sprinklers in the evening or early morning when there is less evaporation, using a weather-based controller so that automatic sprinklers don’t run when it’s raining, sweeping sidewalks instead of hosing them down, taking cars to a car wash, or washing pets in the bathtub.
5. Regarding item number three on the worksheet, discuss with the class the concept of using native species and other “California friendly” plants for landscaping. Students can research the water requirements of different plants in their own yards, at a local nursery, or even in classroom experiments. More information about low-water-use plants can be obtained at [bewaterwise.com](http://bewaterwise.com), click on Garden Spot and by searching the term “xeriscape” on an Internet search engine.

## EXTENSION

Students can bring their ideas home. Ask students to design an ecologically friendly garden for school or for home. Have them incorporate native or California-friendly plant species and water-conserving gardening techniques and technologies.

# WATER AWARE WORKSHEET

**DIRECTIONS:** Being aware of how water is used — and how it could be more efficiently used — is the first step toward conservation of this precious resource. Can you think of ways to accomplish the same goal without using as much water?

Type of outdoor water usage:	1.	2.	3. Watering plants
Describe this use of water. Include important details such as time of day, who does it, how often, etc.			
How else could this same task be accomplished? Could water be used more wisely? How?			

Now, look through The Times daily eNewspaper. Make a collage of wise water usage or tools that can help people save water.



# GROUNDWATER CHALLENGE

## INTRODUCTION

Approximately 13% of the Los Angeles water supply comes from groundwater — water that is pumped out of the ground. This important source of water reduces our dependence on other costly sources, such as imported water, and acts as a water bank that we can draw on in times of drought. Unfortunately, groundwater is vulnerable to contamination by chemical pollutants and can be depleted if groundwater basins are not recharged.

## OBJECTIVE

Working in groups, students will identify items and activities in the news that can impact groundwater supplies and compete with other groups to identify the most potential impacts.

## MATERIALS

The Times daily eNewspaper and copies of Groundwater Challenge worksheet.

## PROCEDURES

1. Discuss with the class the importance of groundwater to the Los Angeles water supply. Explain how some of the water on the surface (rainwater, water from rivers and streams, water used for irrigation, etc.) seeps into the ground and collects in “groundwater basins” under the ground. This water can later be pumped out and used by people, and comprises 11% or more of our water supply.
2. Ask the class to suggest some potential threats to groundwater supplies and some things people could do to enhance and protect groundwater supplies. Students can obtain information by visiting [ladwp.com](http://ladwp.com) and searching for the word “groundwater.”

3. Select one or more items from The Times (for example, pictures, ads, or news stories about a factory, a golf course, a park, and/or a parking lot). Share these items with the class, and help students develop hypotheses about potential groundwater issues that could be caused by each item. For example, chemicals or waste items from the factory could seep into the groundwater, open space like parks or golf courses could help recharge groundwater supplies but fertilizers and pesticides can contaminate groundwater, paved parking lots can block water from seeping into the ground, etc.
4. Divide the class into groups, distribute worksheets, and share with students the daily eNewspaper. Ask students to scan The Times to find pictures, news stories, or ads about items or activities that could affect our groundwater. Each group should print one or more items and then complete its worksheet by identifying a hypothesis to explain possible positive or negative impacts associated with each item. Encourage students to be creative and to explain the process by which each item in the news could affect groundwater.
5. Have groups exchange their news items (but not their worksheets) with another group. Then each group will identify as many possible groundwater impacts as it can from the other group’s news item. The winner of this challenge is the group that can identify and explain the most positive and negative impacts that items in the news could have on groundwater.

## EXTENSION

Students can test one or more of the hypotheses they developed in this lesson by designing an experiment, using additional research sources or gathering their own data.

# GROUNDWATER CHALLENGE WORKSHEET

## NEWS ITEM #1

1. What item or activity is depicted or described?

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2. What are some hypotheses about how this item or activity could have positive impacts on groundwater supplies?

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3. What are some hypotheses about how this item or activity could have negative impacts on groundwater supplies?

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## NEWS ITEM #2

1. What item or activity is depicted or described?

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2. What are some hypotheses about how this item or activity could have positive impacts on groundwater supplies?

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3. What are some hypotheses about how this item or activity could have negative impacts on groundwater supplies?

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## NEWS ITEM #3

1. What item or activity is depicted or described?

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2. What are some hypotheses about how this item or activity could have positive impacts on groundwater supplies?

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3. What are some hypotheses about how this item or activity could have negative impacts on groundwater supplies?

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Use additional pages as necessary

# CAPTURING THE RAIN

## INTRODUCTION

When it rains in Southern California, most of the rainwater flows into storm drains that empty into the ocean. This water, called storm water runoff, is a potentially significant source of water for people if we can find ways to capture it.

## OBJECTIVE

Students will explore opportunities to contribute to the water supply by capturing storm water, both on a macro level by looking for opportunities in the newspaper, and on a micro level in their own homes and neighborhoods.

## MATERIALS

The Times daily eNewspaper and copies of Capturing the Rain worksheet.

## PROCEDURES

1. Ask students to think about what happens when it rains in Southern California. All of us have seen streets and parking lots flooded with storm water, rivers of storm water rushing down gutters and overflowing from storm drains, and torrents of rainwater roaring down flood control channels into the ocean. Imagine how it would help our water supply if we could use all that rainwater!
2. Discuss ways that storm water can be used, how it recharges groundwater, how it can be captured for use, and how runoff not only wastes water but also carries pollutants into the ocean.
3. Direct students to The Times eNewspaper. Working individually or in small groups, have students look for examples of homes, business or government entities making efforts to capture storm water or help it soak into the ground. Students can describe one such example in Part 1 of their worksheets.
4. Students can complete Part 2 of their worksheets by describing another example from the news of an action that some person, business, or organization could take to make better use of storm water.
5. Help students do additional research online or using other sources. Some websites students can visit include searching “rain garden” at [ladwp.com](http://ladwp.com) or at [treepeople.org](http://treepeople.org), [laraingarden.org](http://laraingarden.org) and visiting [lastormwater.org](http://lastormwater.org).
6. Using the information they have acquired in the previous steps of this lesson, have students complete Part 3 of their worksheets by developing an action plan consisting of things they can do at school and around their homes to capture and use storm water or help it soak into the ground.

## EXTENSION

Students can participate in programs such as the rain garden program sponsored by Generation Water, TreePeople, and the Los Angeles Department of Water and Power.

## CAPTURING THE RAIN WORKSHEET

**PART 1.** Describe an example in the news of a person, business, or government agency making efforts to capture storm water or help it soak into the ground.

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**PART 2.** Describe an action that some person, business, or organization in the news could take to make better use of storm water.

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**PART 3.** Describe some things that you can do to help collect and use storm water or allow it to soak into the ground.

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# ALL WATER IS RECYCLED

## INTRODUCTION

For centuries “used” water has been discharged into rivers and streams. The water from these channels is used as a source of drinking water for downstream users. This happens all over the world, including Los Angeles

Almost 90% of the water we use in the city of Los Angeles is imported from long distances. This water comes from the Eastern Sierra Mountains through the Los Angeles Aqueduct (about 250 miles north); the Western Sierra Mountains through the California Aqueduct (about 500 miles north); and the Colorado River through the Colorado River Aqueduct (about 300 miles east).

After we use water, it goes down the drain and into the sewer. In Los Angeles, the water is cleaned and much of it ends up in the Pacific Ocean. Before it does, the water can be recycled several times for beneficial purposes.

The city’s water supply is limited due to growing demand, unpredictable snowfall and legal restrictions. This limited supply adds to the Southern California water crisis. Recycled water is a safe, local and reliable solution to protect this precious resource.

## OBJECTIVE

Students will learn about the water recycling process and suggest ways that recycled water can be used in settings they see depicted in the newspaper.

## MATERIALS

The Times daily eNewspaper and copies of attached Recycled Water worksheet.

## PROCEDURES

1. Ask the class to name things that can be recycled. Write their responses on the board. Possible answers could include aluminum cans, glass bottles, paper, etc. Ask students to discuss the benefits of recycling.
2. Explain that the water we use can be recycled too. Discuss the water cycle with the class to emphasize that all water is continually recycled. Diagrams and discussions of the water cycle can be found on the Internet at [ga.water.usgs.gov/edu/watercycle.html](http://ga.water.usgs.gov/edu/watercycle.html).
3. Then discuss with the class how the water we get from our tap can be used more than once before it drains into the ocean and becomes part of the water cycle again. Water that we use more than once is called recycled water
4. Provide students with a brief overview of how water is recycled, emphasizing the following steps of the process and uses of recycled water at each step. (Note that one full color diagram of the process regarding steps in cleaning groundwater is included with the packet you received from the Times that accompanies the Teacher’s Guide, “Water, Energy, the Environment and You.”)

**Primary Treatment:** Water sits in settling tanks, with large items allowed to sink to the bottom and floating oils and other items skimmed off the top. The sludge that sinks to the bottom can be treated and used as fertilizer.

**Secondary Treatment:** Air is bubbled through the water to help breed microbes, which consume organic materials in the water. Chlorine can also be added to kill germs. Secondary treated water is clean enough to be released into rivers or the ocean, and may also be used as irrigation water.

**Tertiary Treatment:** Water is filtered through sand or other materials to remove any remaining particles and chemicals. Chlorine or other disinfectants may be added. Tertiary treated water is commonly called “recycled water.” It may be released into rivers or the ocean. When water is treated to this level, it can be safely used to irrigate parks, playgrounds and landscaping as well as to flush toilets in office buildings and in the cooling process at power plants or other industries.

## ALL WATER IS RECYCLED *(continued)*

**Advanced Treatment:** Additional treatment, including reverse osmosis and micro filtration, may be used to clean water even further. This process is called Advanced Treatment. It is even possible to treat wastewater to the point that it is safe to drink.

**Groundwater Replenishment:** This process allows advance-treated recycled water to percolate underground, blended with regular groundwater and eventually pumped out of the ground and added to the drinking water supply. This process is already used in Orange County, California. It has not yet been used in the city of Los Angeles.

5. Share with students The Times daily eNewspaper. Explain to students that they should look through their newspaper for pictures of places, industries, etc. that use water and could use recycled water. For examples, students may select a picture of greenbelts or golf courses from The Times; a picture of a factory; a picture showing an agricultural area or farm; a picture from the Food section depicting fruits or vegetables; a picture of a baseball or football field from the Sports section.
6. After students have collected several such pictures (maybe over several days) direct them to select one picture to use for the remainder of the lesson.
7. Distribute worksheets. Have students print and paste their pictures at the top of their worksheets.
8. Students can then complete their worksheets by writing a paragraph describing how the pictured item or place could use recycled water. Students should refer to the class discussion of the different stages of water treatment and discuss which stage of treated water could be used in the setting they have chosen.

### LESSON EXTENSION – DISCUSSION

1. You may wish to hold a discussion with your students regarding the Advanced Treatment and Groundwater Replenishment process. Ask your students the following question: What are the pros and cons of drinking water after it has been treated at the advanced level and gone through the Groundwater Replenishment Process, if state and county health officials determine through scientific testing that it is safe?
2. Write student responses on the board.
3. You may wish to assign the question as homework for an essay that may require additional research and study.
4. Have students who wrote an essay based on additional research present a summary of their findings through a brief presentation to the rest of the class.

# ALL WATER IS RECYCLED WORKSHEET

**NAME:** \_\_\_\_\_

**DIRECTIONS:** At the top of this worksheet, paste a picture you have selected from The Times that shows a place or thing that uses water. Then, in the space below, write a paragraph describing how the pictured place or thing could use recycled water. What kind of recycled water (what level of treatment) would be required?



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PART 3

# Get Energized!

## ENERGY SOURCES

### INTRODUCTION

Energy comes from many different sources. Fossil fuels, including coal, petroleum and natural gas, supply about 90 percent of the world's energy. Other important energy sources include nuclear energy, hydroelectric power, solar energy, geothermal energy, wind power and biomass.

### OBJECTIVE

Students will identify sources of energy and consider different ways in which these energy sources are used.

### MATERIALS

The Times daily eNewspaper and copies of Energy Sources worksheet.

### PROCEDURES

1. Discuss with the class various sources of energy (fossil fuels, nuclear, hydroelectric, solar, geothermal, etc.) as well as the different forms that sources of stored energy can take (coal, wood, batteries, etc).
2. Ask students to give examples of different sources of energy they are familiar with at home, school or in their community. For example, within the category of fossil fuels are energy sources such as gasoline, heating oil, coal, diesel, etc. Make a list of different forms of energy on the board.
3. Share with students The Times daily eNewspaper and copies of the Energy Sources worksheet. Have students fill in the first column on their worksheets by finding examples of different energy sources in The Times. Students can then fill in the second column on their worksheets by describing how the energy is being used in each example they found. For example, the energy source gasoline is used to power a car.
4. Ask students to share the items they found with the class. For each item shared with the class, lead a discussion about other uses of that energy source. Students should then list these items in the third column of their worksheets.
5. Finally, discuss alternatives to the energy sources used by each item students found in the newspaper. For example, in addition to gasoline, cars can also be powered by electricity or natural gas. Students should use column four to suggest alternative energy sources for each item on their worksheets.

### EXTENSION

Students can conduct an energy survey of their homes, listing various items that require energy and identifying which energy source is used for each. Remind students to think both large and small, from solar powered calculators to cars, heaters, air conditioners, appliances, lights, etc. When students have completed their lists, ask them to consider ways they could conserve energy either by using items more efficiently or by changing energy sources.

# ENERGY SOURCES WORKSHEET

**DIRECTIONS:** Using The Times, find examples of different energy sources. For each energy source you find, fill in the table by describing how it is used, other uses for this energy source, and alternatives to using this energy source.

ENERGY SOURCE	HOW IS IT USED?	OTHER USES	ALTERNATIVES

# FUEL FROM FOSSILS

## INTRODUCTION

The earth's most important energy source is fossil fuels. Fossil fuels include coal, oil, gasoline, natural gas, propane, kerosene, and diesel fuel. They are also used to produce plastics, fertilizers, and many synthetic fibers. These substances originate from the fossilized remains of prehistoric plants and animals. Because it takes a very long time for these substances to form and they are finite, they are called non-renewable resources. Carbon is a by-product of fossil fuel combustion. When combined with oxygen, carbon forms carbon dioxide, which adds to the risk of global warming.

## OBJECTIVE

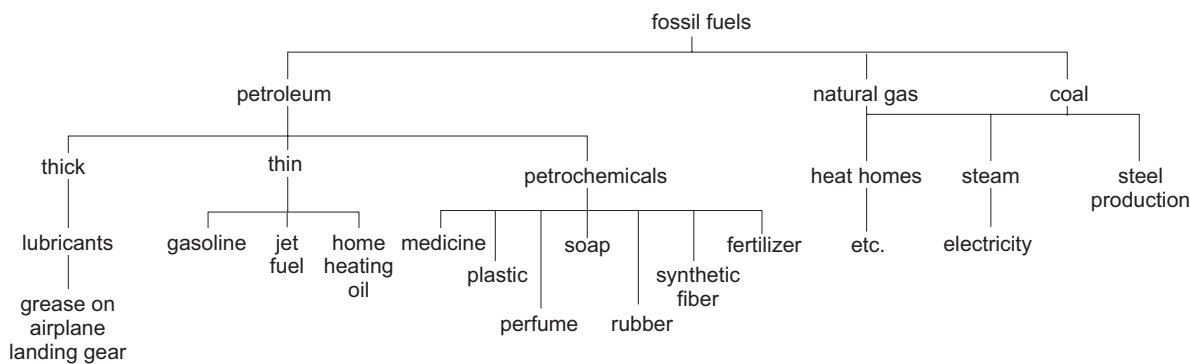
Students will identify different fossil fuels and their uses, then consider the advantages and disadvantages of fossil fuels as an energy source.

## MATERIALS

The Times daily eNewspaper and copies of Fuel From Fossils worksheet.

## PROCEDURES

1. Discuss with the class the different kinds of fossil fuels. Refer to the chart at the bottom of this page as necessary. Ask students to name examples of fossil fuel products they or their families use.
2. Share with students The Times daily eNewspaper. Ask students to look through the newspaper for examples of products that use fossil fuels or pictures of items manufactured from fossil fuels.
3. Distribute copies of the Fuel From Fossils worksheet and have students list the items they find in the left column of the worksheet.
4. Select an item from one student's list, and discuss with the class what kind of fossil fuel that item uses. Repeat with several other items from students' lists. Then ask the class to complete the middle column of their worksheets.
5. Select an item from one student's list, and ask the class to consider what they would do if the supply of fossil fuels ran out (or if fossil fuels became too expensive to make that item anymore). Can students think of a substitute product, an alternative energy source, or a way to change their lifestyle so they do not need this product anymore? Discuss these same issues with several other items from students' lists; then have students complete the right column on their worksheets.
6. Select one page from The Times. List all of the items on the page that have used fossil fuels.



# FUEL FROM FOSSILS WORKSHEET

<b>EXAMPLES OF FOSSIL FUELS</b>	<b>TYPES OF FOSSIL FUEL USED</b>	<b>PRODUCT OR ENERGY SUBSTITUTE (OR LIFESTYLE CHANGE)</b>

# RENEWABLE RESOURCES

## INTRODUCTION

Resources that can be used over and over again are called renewable resources. Resources that are consumed when they are used are called non-renewable resources. Examples of renewable energy resources include solar, hydroelectric and wind power. Fossil fuels, on the other hand, are a non-renewable resource.

## OBJECTIVE

Students will distinguish between resources that are renewable and those that are not. Find examples of both in the news, and explore ways to substitute renewable resources for non-renewable resources in their everyday lives.

## MATERIALS

The Times daily eNewspaper, index cards, sheets of paper, Power Supply Replacement Program, and Power Content Label graphs from the Los Angeles Department of Water and Power.

## PROCEDURES

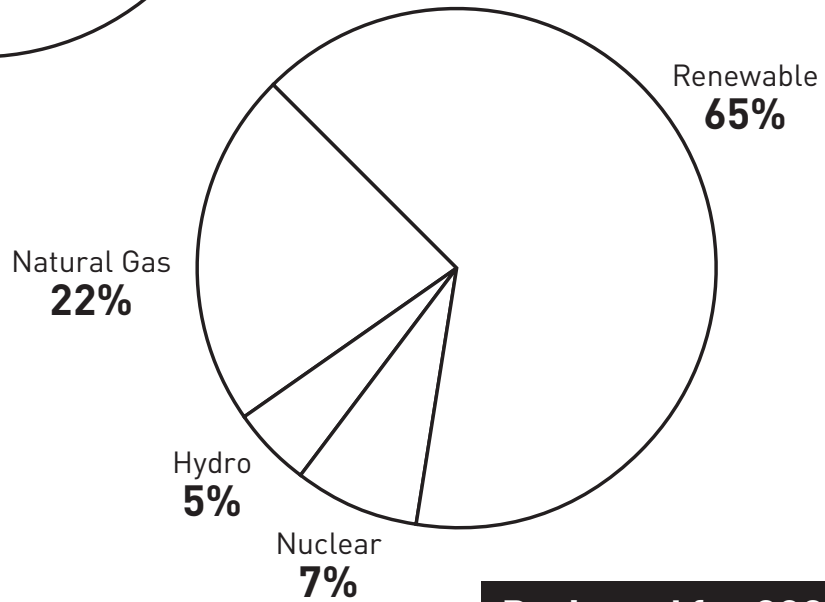
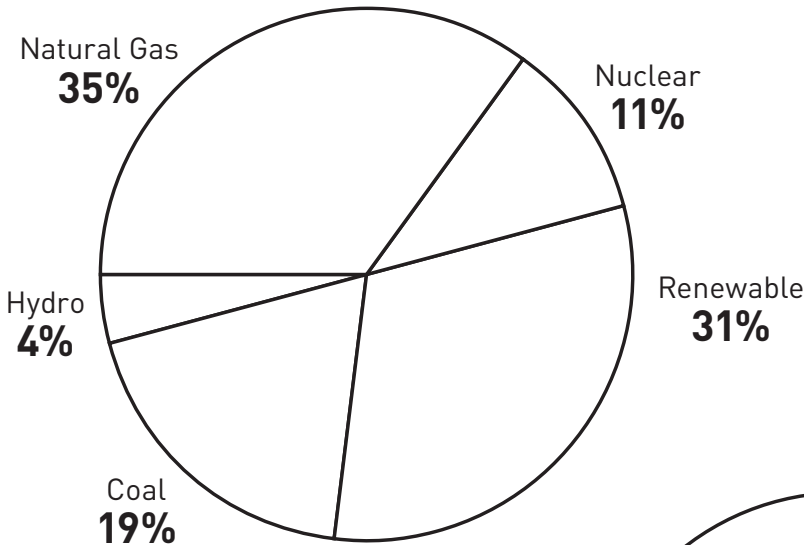
1. Discuss the difference between renewable and non-renewable resources with the class. Ask students to name examples of each kind of resource (the examples do not have to be confined to energy resources).
2. Discuss how the characteristics of a resource can be changed to make it more or less renewable. For example, trees are renewable if they are managed wisely. A tree can be cut down, but its seeds can be planted to grow a new tree. Metals such as aluminum or steel can be made more renewable by recycling them to be used over and over again.
3. Distribute sheets with two circle graphics from the Department of Water and Power, "Power Supply Replacement Program," and Power Content Label. See pages 47 and 48.
4. Discuss how LADWP is planning to reduce the amount of fossil fuels currently provided and increase renewable energy in the future.
5. Instruct students to log on to The Times eNewspaper and save or print out as many news items as they can find which deal with natural resources.
6. Divide the class into small groups. Have each group paste their news items onto index cards, sheets of paper, or into photo editing software. On each card or paper, students should write the following information:
  - a) the name of the resource
  - b) whether the resource is renewable or non-renewable
  - c) conservation measures for this resource
7. Have each group share its findings with the class. Are some resources in danger of being exhausted? Are there simple and easy conservation measures that can be recommended to the class?

## EXTENSION

Have students design a bulletin board displaying the natural resource cards they made for this lesson. The theme of the bulletin board could be conservation, recycling, or a related topic.

# POWER SUPPLY REPLACEMENT PROGRAM

**2017**



**Projected for 2036**

LADWP's power supply was built over the last 100 years and now L.A.'s clean energy future is being built through a complete transformation of our power supply. This includes unprecedented investments in coal transition, energy efficiency, renewable energy, power reliability and electric transportation.

## POWER CONTENT LABEL

### ANNUAL REPORT OF ACTUAL ELECTRICITY PURCHASES FOR LADWP, CALENDAR YEAR 2016

ENERGY RESOURCES	2016 LADWP Power Mix	2016 Green Power for Green LA Power Mix	2016 CA POWER MIX** (for comparison)
<b>Eligible Renewable</b>	<b>29%</b>	<b>100%</b>	<b>25%</b>
-- Biomass & waste	2%	100%	2%
-- Geothermal	5%	0%	4%
-- Small hydroelectric	2%	0%	2%
-- Solar	5%	0%	8%
-- Wind	15%	0%	9%
<b>Coal</b>	<b>19%</b>	<b>0%</b>	<b>4%</b>
<b>Large Hydroelectric</b>	<b>3%</b>	<b>0%</b>	<b>10%</b>
<b>Natural Gas</b>	<b>34%</b>	<b>0%</b>	<b>37%</b>
<b>Nuclear</b>	<b>9%</b>	<b>0%</b>	<b>9%</b>
<b>Other</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>
<b>Unspecified sources of power*</b>	<b>6%</b>	<b>0%</b>	<b>15%</b>
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

\* "Unspecified sources of power" means electricity from transactions that are not traceable to specific generation sources.

\*\* Percentages are estimated annually by the California Energy Commission based on electricity sold to California consumers during the previous year.

The green energy reported under 2016 Power Mix includes green energy sold through the Green Power Program.

For specific information about this electricity product, contact LADWP at 1-800-DIAL-DWP (1-800-342-5397).  
For general information about the Power Content Label, contact the California Energy Commission at 1-844-217-4925 or <http://www.energy.ca.gov/pcl/>.



# ENERGY COSTS AND BENEFITS

## INTRODUCTION

Economists and social scientists use a technique called cost-benefit analysis to evaluate different options and make recommendations. This technique is often employed in making public policy decisions, but it can also be used to evaluate other decisions such as our choice of energy sources.

## OBJECTIVE

Students will use newspaper stories and other research they have gathered in connection with this study unit to compile lists of costs and benefits.

## MATERIALS

The Times daily eNewspaper and copies of Energy Costs and Benefits worksheet.

## PROCEDURES

1. Discuss the concepts of costs and benefits with the class. Model these concepts, and the idea of direct versus indirect costs and benefits, using an example from everyday life. For example, what are the costs and benefits of making a decision not to mow your lawn? The benefits could include not having to work so hard and having more free time. The direct cost is having an ugly yard. But there could also be indirect costs such as having more mice and insects in your house because they thrive in the tall grass or having to walk to the park three blocks away to play Frisbee because your grass is too tall.
2. Explain the economic concept of an “externality” a cost or benefit that is experienced by someone other than the person who caused it. In the example above, possible externalities could include the neighbors having more mice and insects too, or property values decreasing in the neighborhood because of your ugly lawn.
3. Share with students The Times daily eNewspaper. Ask students to skim through the newspaper and look for news items related to energy or the environment.
4. Ask for a volunteer to share an energy news item with the class. Ask the class to name all the costs and benefits associated with the energy source described in the news item. Make a list on the board. Make sure students consider both direct and indirect costs and benefits. Then ask students to think of any externalities resulting from use of this energy source. Does it impact anyone other than the person using it?
5. Distribute worksheets. Have students complete their worksheets using the energy-related news items they found in The Times. Walk around the room and provide assistance as needed.
6. When students have completed their worksheets, lead a class discussion on the costs, benefits, and externalities associated with different energy sources. Are the true costs of fossil fuels reflected in the price we pay at the gas pump (after indirect costs and externalities are considered)? Does renewable energy have fewer indirect costs than other energy sources? What energy source do students think is the cheapest, when all costs, benefits, and externalities are considered?

# ENERGY COSTS AND BENEFITS WORKSHEET

**ENERGY SOURCE:**

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COSTS	BENEFITS	EXTERNALITIES

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# GREEN POWER — RENEWABLE ENERGY

## INTRODUCTION

Green power refers to energy that is produced in an environmentally friendly manner and is renewable. Some examples of green power include solar power, wind power, hydroelectric power, geothermal power and biomass. These power sources produce energy without polluting or consuming non-renewable resources.

## OBJECTIVE

Students will look for examples of different kinds of green power in the news, then discuss the uses and benefits of these energy sources.

## MATERIALS

The Times daily eNewspaper and copies of Green Power worksheet.

## PROCEDURES

1. Explain what the term “green power” means without using any examples. Then ask the class to name types of green power. Write their answers on the board, and make sure the list includes solar, hydroelectric, wind, and geothermal. Discuss the characteristics these energy sources have in common.
2. Share with students The Times daily eNewspaper. Ask students to look through the newspaper and find news stories, photographs, advertisements, or other items in the news that discuss green power or show green power energy sources being used. Have students print out and save the items they find. Repeat this exercise over several days to ensure that students can collect a number of green power news items.
3. Distribute Green Power worksheets. Have students write or paste their green power items in the first column of the worksheet. Then have students fill in the second and third columns of their worksheets by naming the type of green power used and the way in which it was used for each item. For example, if a student’s first item is an ad for a solar-powered calculator, in column two the student should write “solar” and in column three “calculator.” Check students’ worksheets to make sure they are filled in correctly.
4. Lead a class discussion of students’ findings. Have students focus on the benefits of using green power, such as lack of pollution and no consumption of resources. Are there any negative aspects of using green power? Is the cost comparable to fossil fuels for some or all uses? What conclusions can students draw based on the items they selected for their worksheets?

## EXTENSION

Students can research DWP’s Green Power or Renewable Energy Program. (Note the two terms are technically interchangeable but at LADWP Green Power refers to a specific program where customers pay additional money allowing the utility to purchase more renewable energy.) What kinds of green power are they planning to provide? Do they have plans to expand use of green power?

Additional information can be found on [ladwp.com/renewableenergy](http://ladwp.com/renewableenergy).

# GREEN POWER — RENEWABLE ENERGY WORKSHEET

<b>GREEN POWER NEWS ITEM</b>	<b>TYPE OF GREEN POWER USED</b>	<b>WAY GREEN POWER WAS USED</b>

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PART 4

**The Air  
We Breathe**

## CARE ABOUT AIR

### INTRODUCTION

It doesn't require a degree in meteorology to become familiar with concepts of air quality. Students can describe the air and the atmospheric environment with words they find in the newspaper.

### OBJECTIVE

Students will build vocabulary and become conscious of air quality concepts by finding words that describe the air in the pages of The Times.

### MATERIALS

The Times daily eNewspaper, copies of Care About Air worksheet, highlighters or colored pens.

### PROCEDURES

1. Ask students to think of words that describe the air. Write some of the descriptive words they use on the board. Words can be adjectives or nouns, flowery or technical, positive or negative. Examples could include: clean, fresh, breezy, dirty, brown, oxygen, carbon dioxide or ozone.
2. Divide the class into four or five groups, and distribute one Care About Air worksheet to each group. Each group should designate one student as a "scribe" who will complete their worksheet. Have students begin to fill out their worksheets by writing down the words on the board.
3. Share with students The Times daily eNewspaper. Instruct students that they will look for words that describe our air in the newspaper.
4. Give students 30 minutes to look through the eNewspaper, highlighting or circling words that describe our air. Students may wish to begin on the weather page, but all parts of The Times can be used. Encourage students to be creative! Make sure that the scribe for each group writes the words on the worksheet and notes the newspaper section and page number where the word was found.
5. At the end of the 30-minute period, have students stop. Have each group read their list of words aloud, and make a list on the board to tally each group's score.

### EXTENSIONS

Students can make their own air quality glossaries by copying new words they encounter in this lesson (and other lessons in this study unit), then looking up the words in a dictionary, writing the definition, and using each word in a sentence.

Students can cut out the descriptive words they found in this lesson and use them to make a collage or poster about air quality. Make a bulletin board to display your class collages.

# CARE ABOUT AIR WORKSHEET

DESCRIPTIVE WORD	NEWSPAPER SECTION	NEWSPAPER PAGE NUMBER

Use additional pages as necessary

## MAPPING THE AIR

Based on “Mapping Air Quality” from the Los Angeles Department of Water and Power’s Air Quality Los Angeles Science Teacher’s Guide, copyright 1996, used with permission.

### INTRODUCTION

Although it takes only an afternoon to drive from one end of Southern California to the other, the difference in air quality from any one point to another can be extreme. Southern California has unique geography. Mountains, beaches and deserts make up the landscape. Many of our neighborhoods have different levels of air pollution because geography can affect air quality.

### OBJECTIVE

Students will become familiar with Southern California geography and air pollution by making a map depicting the relative concentrations of pollutants in different parts of the Los Angeles Basin.

### MATERIALS

The Times daily eNewspaper, a map of the city of Los Angeles, colored pencils, copies of Mapping the Air worksheet.

### PROCEDURES

1. Explain to students that many factors affect air quality in Southern California. Seasons, temperature, prevailing winds, topography and other factors all affect how much pollution is in the air we breathe.
2. Using a map of Los Angeles, have the class raise their hands to point out different geographic regions. After identifying mountain ranges, coastal regions, high and low deserts, valleys, etc., have students identify some major cities in each area.
3. Draw a model outline map of Los Angeles on a portion of a blackboard and fill in the topographic features as students identify them.
4. Distribute copies of the Mapping the Air worksheet to the class. Instruct students to first draw simple outline maps of the Los Angeles area, using the teacher model on the board or maps from the pages from The Times. Then have students fill in cities and geographic features on their maps.
5. Share with students The Times daily eNewspaper and have them go to the weather page. Then have students fill in the air quality on their maps according to the current day’s findings.

### EXTENSION

Make a list of major Southern California cities beside the chalkboard map grouped by geographic region. Have students also note the air quality next to each city using the Air Quality Key from the weather page.



# MAPPING THE AIR WORKSHEET

Based on “Mapping Air Quality” from the Los Angeles Department of Water and Power’s Air Quality Los Angeles Science Teacher’s Guide, copyright 1996, used with permission.

**DIRECTIONS:** Use the map in The Times, or draw an outline map of the Los Angeles area in the space below. Then fill in major land regions like mountains, valleys and beaches. Using the air quality data from the weather page in The Times, color in your map to show the air quality levels in different parts of Southern California.

Outline map of Southern California



Use your map to answer the following questions:

1. Which cities seem to have the best air quality?
2. Which cities in Southern California have the poorest air quality?
3. In general, among mountains, valleys and beaches, which kind of geographic area has best air quality? Which has the worst?



PART 5

# Careers in Water and Power

## CAREERS IN WATER AND POWER

### INTRODUCTION

We tend to take for granted many of the products and services that we use. This is especially true of common items such as water and electricity. In fact, a lot of hard work by many different people in many different kinds of jobs helps to bring us the products or services that we use.

### OBJECTIVE

Students will identify the many different kinds of jobs, encompassing many different talents and skills, that are needed to bring water and electricity into their homes.

### MATERIALS

The Times daily eNewspaper and copies of the Water and Power Work worksheet.

### PROCEDURES

1. Pick an example that students are familiar with, such as their own school. Obviously, the teachers and the students are important components of any school. But if just the teachers and students showed up at the same place every morning, would that make a functioning school? Ask the class to think about what other people, performing what other jobs, are necessary to create a school and to keep it going.
2. Call on students and make a list on the board of students' ideas about the various tasks and the kinds of workers who perform those tasks, which are needed to build and operate a school. For example, architects and engineers would be needed to design a school. Building a school would require construction workers, plumbers, electricians, landscapers, etc. In addition to teachers, operating a school requires counselors, administrators, gardeners and custodians. Someone needs to order textbooks, furniture, and supplies. Other jobs related to schools include bus drivers, crossing guards, nurses and librarians. How many of these tasks, and how many more, can your class think of?
3. Much like schools, another vital and essential service in our community that we often take for granted is our water supply and power source. And just like building and operating a school, there are many people with many different jobs behind each turn of the faucet and flip of the switch.

## CAREERS IN WATER AND POWER *(continued)*

4. Divide the class into small groups. Using what they know about our water supply system, power supply and electrical system (and what they have learned from other lessons in this guide), ask each group to brainstorm about the different steps involved in bringing water to our taps and energy to our homes. For example, water is collected in reservoirs which are often created behind dams. Water is transported in aqueducts and pipelines. Water is pumped out of the ground. Water must be treated and tested to make sure it is safe for drinking. When water is transported from environmentally sensitive areas, water quality and wildlife populations are monitored.
5. Ask each group to share its ideas with the class. Encourage the exchange of information so that each group has as many ideas to work with as possible.
6. Based on the different tasks that students have identified as important in providing our water supply, ask each group to identify the different job skills that would be needed to perform those tasks. Examples might include engineers, chemists, biologists, electric distribution mechanics, electrical mechanics and steam plant operators, etc. Students may find water and power related job descriptions at the following websites: [ladwp.com/jobs](http://ladwp.com/jobs), [lacity.org/find-jobs](http://lacity.org/find-jobs), [awwa.org](http://awwa.org) and [appa.org](http://appa.org).
7. Distribute Water and Power Work worksheets. After students have read the worksheet instructions, direct them to the Classified section of The Times eNewspaper, [jobs.latimes.com](http://jobs.latimes.com), [ladwp.com/jobs](http://ladwp.com/jobs), [lacity.org/find-jobs](http://lacity.org/find-jobs) or other similar job search websites. They can use the job descriptions and requirements they find in this section as a research source to help complete their worksheets.
8. If necessary to help students complete their worksheets, use some actual job titles at the Los Angeles Department of Water and Power, such as: civil engineer, utility service specialist (works on conservation programs), sheet metal worker, land survey assistant, water treatment operator, water microbiologist, environmental specialist, range and wildlife biologist, mechanical repairer, water works mechanic, water utility operator, public relations specialist and customer service representative, aqueduct and reservoir keeper, hydrographer, electric station operators, electrical repairers, load dispatchers, electrical testers, electrical craft helpers, steam plant assistants and utility pre-craft trainees.

# CAREERS IN WATER AND POWER WORKSHEET

**DIRECTIONS:** As you have discovered, many different people with many different jobs work to bring water and electricity to our city. Your group has been asked to help find the right people for the tasks below. You can reference the Classified section of The Times daily eNewspaper or the [jobs.latimes.com](http://jobs.latimes.com) link on The Times' website to help you to create advertisements for these positions.

1. Finding and securing water sources:

Job title:

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Job description:

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Required education or experience:

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2. Water quality:

Job title:

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Job description:

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Required education or experience:

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# CAREERS IN WATER AND POWER WORKSHEET *(continued)*

### 3. Water distribution:

Job title:

Job description:

Required education or experience:

### 4. Operating and maintaining aqueduct:

Job title:

Job description:

Required education or experience:

# CAREERS IN WATER AND POWER WORKSHEET *(continued)*

## 5. Generating electricity:

Job title:

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Job description:

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Required education or experience:

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## 6. Transmitting and distributing electricity:

Job title:

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Job description:

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Required education or experience:

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# CAREERS IN WATER AND POWER WORKSHEET *(continued)*

7. Controlling and repairing electricity:

Job title:

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Job description:

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Required education or experience:

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