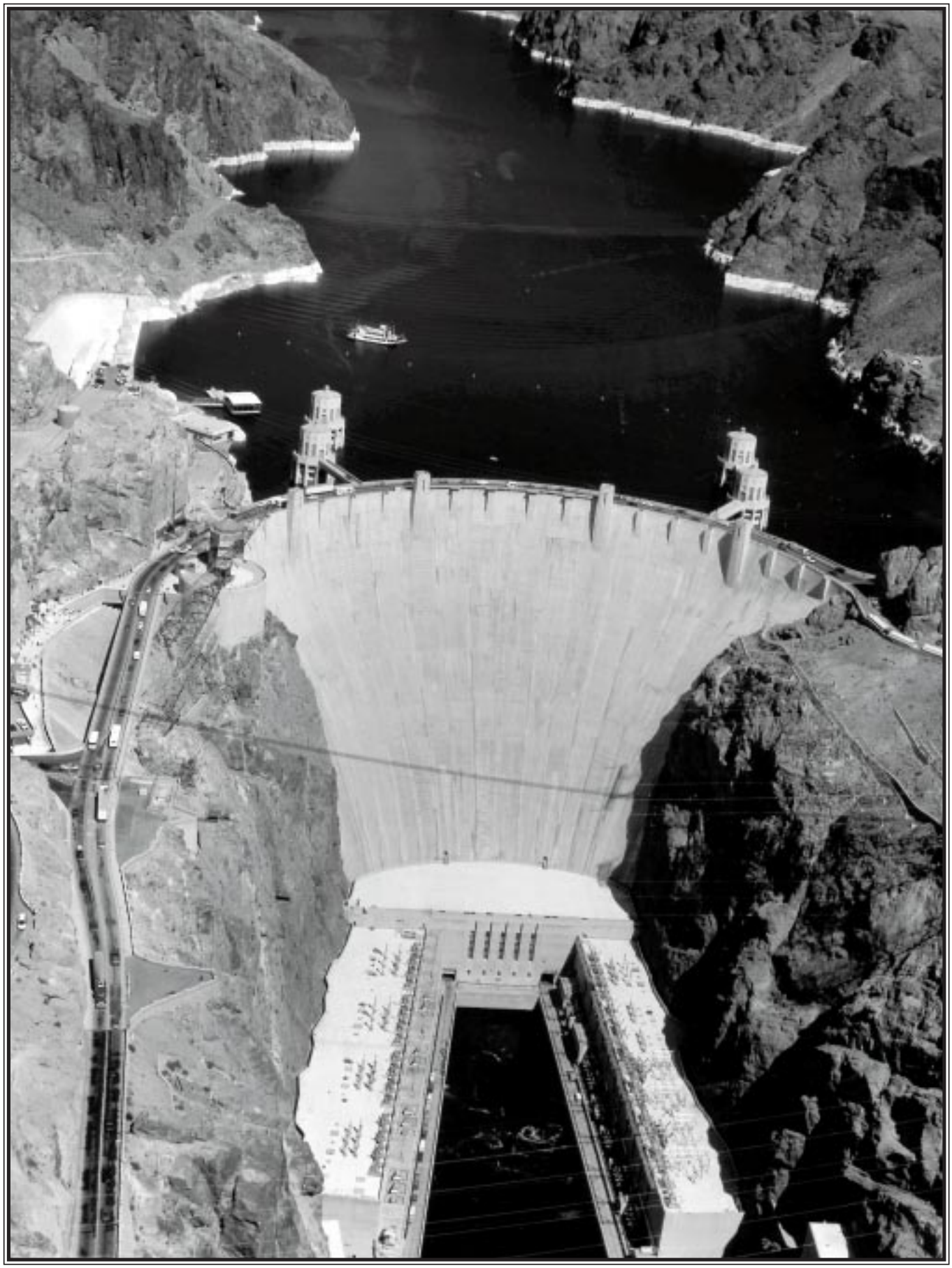

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INTRODUCTION

PURPOSE OF TEACHER/STUDENT LEARNING PACKET:

This packet has been prepared to provide background information about Hoover Dam and the surrounding area. It includes learning activities to promote understanding of Hoover Dam's impact on the environment, and its technical and historical significance for the United States. The student activities may be used either alone or in conjunction with a visit to Hoover Dam. Please feel free to reproduce and share the information in this packet. This information can be accessed through our Internet address: www.*hooverdam.com*

CONTENTS:

The information has been separated into four main sections: History; Wildlife; Water Resources; and Hydroelectricity. Within each section you will find the concepts that are stressed by the material, background information for learners, suggested activities to aid learning and understanding, charts, posters, puzzles, and a bibliography for further resources.

HOOVER DAM — MISSION STATEMENT:

Hoover Dam is a project of the Bureau of Reclamation, U.S. Department of Interior. Reclamation's mission is to manage, develop and protect water and related resources in an environmentally and economically sound manner for the benefit of the American public.

We believe that providing this educational information will further Reclamation's mission goals by helping the students of today understand how the decisions of the past have helped to shape their lives and the future.

ACKNOWLEDGMENTS:

The education team* at Hoover Dam thanks the many people who have so generously shared their knowledge, time and funding. Special thanks to Mary Webb, Tom Shrader, and Bob Walsh of the Bureau of Reclamation Lower Colorado Regional Office. Additional thanks to the National Park Service at Lake Mead NRA, especially Kay Rohde and Leslie Paige. Thanks to Dan Jensen, Marketing and New Products Manager at Hoover Dam, for providing the time and resources to make this packet a reality.

Original Education Team members were—Phil Aurit,

Bob Baron, Carol Ferguson, Dorothy Nolan, Donna Pacileo.

HISTORY

CONCEPTS:

1. **People lived in this area for thousands of years.**
2. **People lived here because the river made it possible to live in this desert.**
3. **The building of Hoover Dam changed the area in large and important ways affecting people.**
4. **People still live in this area because of the river, most in ways very different than before Hoover Dam was built.**
5. **Hoover Dam was a significant accomplishment for human beings.**

INTRODUCTION:

Human beings have lived along or near the Colorado River for thousands of years. The evidence for this is the hundreds of habitation sites found throughout the Las Vegas, Lake Mead, Hoover Dam and Lake Mojave area, many of which have been dated with radiocarbon, argon, or by other measures.

Some of the earliest peoples have been called "desert culture" people, basket makers, or pueblo people. It is important to remember that these names are just a convenience for those who study people and their way of life. These are not names that the people have given themselves.

The descendants of the early peoples we know by more familiar names — Paiutes, Hopi, Mojave, Yuma, Havasupai, Hualapai. These names are the names which the people have given to themselves — for example, Havasupai means "the people of the blue-green water".

The first non-native people in the Colorado River area were Spanish conquerors (conquistadores), who were looking for gold, silver or other wealth. Ulloa was the first to see the mouth of the Colorado in 1539. Cardenas, who traveled with Coronado from Mexico in 1540, was the first to see the Grand Canyon. Some of these Spanish soldiers stayed or returned to live in the area, which is why the Spanish language is so widely used today in California, Arizona, New Mexico and Nevada.

The sharing of languages was not the only effect of contact between Spanish soldiers and native people. Foods, diseases, tools, horses, and a great blending of cultures was the ultimate result of the initial, sometimes unfriendly, contacts.

Some two hundred years after the conquerors came, Spanish priests, such as Fathers Dominguez and Escalante in 1776,

entered and explored parts of the Colorado River basin as they looked for routes of travel between their missions. It was Father Garces, also in 1776, who named the river Rio Colorado or "river colored red."

Jedediah Smith and other trappers came looking for beavers in 1826, gold miners on the way to California followed in 1849, and Mormon settlers arrived in Las Vegas in 1855. Las Vegas, which is Spanish for "the meadows", did not become a town until 1905.

River explorers and mappers first came in January 1858, under the leadership of Lt. Joseph Christmas Ives, who came up the Colorado by steamboat from the Gulf of California. He traveled as far upriver as possible to Black Canyon, the eventual site of Hoover Dam. In 1869, John Wesley Powell and his men floated down the river, starting on the Colorado's main tributary, the Green River. From Green River, Wyoming, he and his men rowed all the way through the Grand Canyon. Powell made a second trip down the Colorado in 1871.

The river explorers were hoping to find that the Colorado could be used as a route of travel and commerce, but because of the wide fluctuations in the amount of water from season to season, and year to year, they concluded that it could not.

The dam builders came in 1931. A handful of men did the planning and designing of the dam. There were another 16,000 workers who did the actual building. Many of these men had families - wives and children - who came with them.

Why would so many people come out to what was, at the time, a raw, undeveloped and dangerous place to live? Essentially, because of the terrible economic times, the Depression, that was then affecting almost every part of the United States. People came from every part of the country to work at Hoover Dam.

The way of life so many people had to endure — camping out in tents or shacks along the Colorado River, some for as long as three years, without clean drinking water, toilets, or protection from the extreme weather — makes these "common" people the real heroes of Hoover Dam.

96 men were killed in on-site industrial accidents while building the dam. Several dozen others passed away later from the heat or carbon monoxide poisoning incurred while on the job. As many as a hundred other people, including wives and children of the workers, died from heat, polluted water or disease.

Because of Hoover Dam, the Colorado River was controlled for the first time in history. Farmers received a dependable supply of water in Nevada, California and Arizona. Los Angeles, San Diego, Phoenix, Las Vegas and a dozen other towns and cities

NOTES

were given an inexpensive source of electricity, permitting population growth and industrial development.

ACTIVITIES:

Grades 1 - 4

1. Make a mural showing all of the different people who have lived in the Lake Mead / Las Vegas area or traveled through.
2. Make a model (clay, paper or cardboard) of an Indian village, an army fort or a dam builder's river camp.
3. Write a story such as: one day in the life of a river explorer; a Native American Indian, or ??? (your choice).
4. Write a poem or song: for example — "We Built the Dam!" or "Life on the River." or (your choice).

Grades 5 - 8

1. Research: Do any descendants of early settlers in the Las Vegas valley live as their ancestors lived? Explain.
2. Write: The lives of many people in the Lake Mead/Las Vegas area are possible because of Hoover Dam. From a population of several thousand in 1930, it has grown to over 1,000,000 today. How can people prepare to meet the challenges that such a growing population brings?
3. Create: A painting of a local scene or person (current or historic); a reproduction of an artifact (Native American or Depression era) in clay, wood, stone or other medium; a song or poem about life today or yesterday on Lake Mead, in the desert, or by the river.
4. Research: Which of your favorite foods were also enjoyed by native people in prehistoric times or by the conquistadores?

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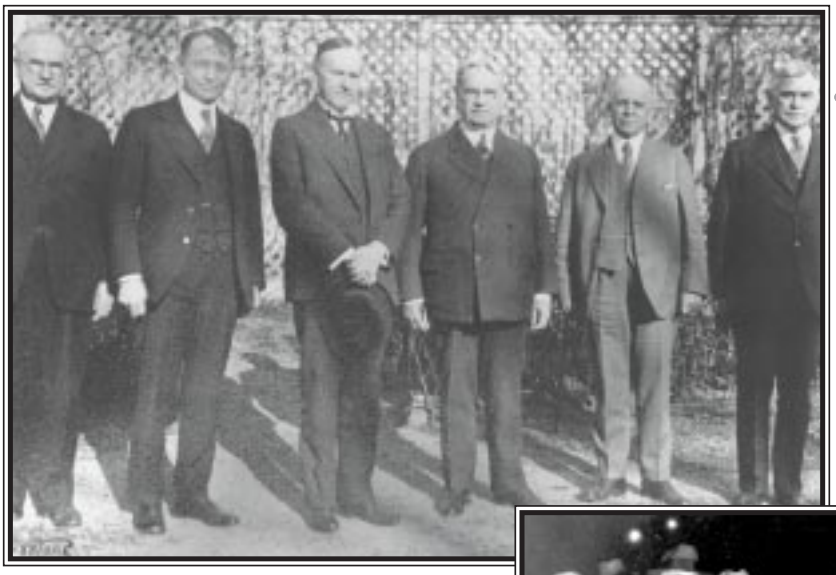
THREE PRESIDENTS AND HOOVER DAM



Calvin Coolidge, president 1923-1929, at signing of Boulder Canyon Project Act 12-21-28

Herbert Hoover, president 1929-1933, on inspection tour at Hoover Dam, 11-12-32

Franklin D. Roosevelt, president 1933-1945, dedicating Hoover Dam on 9-30-35

NOTES

WILDLIFE

CONCEPTS:

1. **Learners will be able to identify several types of local plant and animal life.**
2. **Learners will recognize the "food chain" concept.**
3. **Learners can list the endangered animals of the Black Canyon site.**

LIFE IN THE DESERT:

A quick glance at the desert might give the appearance of a lifeless environment. Yet, the Mojave Desert is alive with plants, animals, insects, fish and reptiles which have all adapted to the desert climate. The desert environment meets their needs for:

FOOD - Each type of animal will only eat certain foods. Some plants provide more nutritional value than others. Both the quantity and quality of the food are important.

WATER - All wildlife needs water. There are many water sources such as rain, dew, snow and moisture in food.

SHELTER - All wildlife needs cover for protection while feeding, sleeping, playing, traveling, etc. Cover can come in many forms, for example: vegetation, burrows, and rocks.

SPACE - Overcrowding leads to competition among animals for food, water, and shelter. For this reason, only a set number of animals can live in an area.

The desert is a delicate land of plant and animal life dependent on each other for their survival. The following pages identify and describe some of the most commonly found plants and animals in the desert area surrounding Hoover Dam.

OUR ENDANGERED WILDLIFE:

Small changes created by man can disrupt the delicate balance of nature in the desert. The tortoise, bonytail chub, and razorback sucker are examples of life endangered by man's intrusion in the environment.

Desert tortoises are easily recognized by their thick, elephant - like legs. Their front legs are larger than their rear legs in order to dig burrows. This is an important activity in the life of a tortoise because burrows protect them on hot summer days. They also hibernate in these burrows during the winter. The desert tortoise is a herbivore, meaning it eats only plants, such as grasses, blossoms, and cactus. It can be found grazing in the mornings and late afternoons to avoid the heat of the summer sun. Desert tortoises can live to be 100 years old. Female tortoises normally lay four to six eggs during the month

of June. The eggs are deposited in a shallow hole and covered with dirt. The eggs take several months to hatch.

Bonytail chubs and razorback suckers are endangered species which should be reported to the National Park Service, U.S. Fish & Wildlife Service or Nevada Division of Wildlife, and placed back into the water if caught.

ANIMALS OF THE AREA:

BIGHORN SHEEP

Nevada's most famous animal is the bighorn sheep. It is the official state animal. You can often see these magnificent animals near Hoover Dam. Adult males, called rams, weigh from 150 to 200 pounds. Females, called ewes, are somewhat smaller. Baby sheep are called lambs and are normally born in May or June. Bighorn sheep are surefooted animals that can swiftly climb the mountains in which they live. They use their speed to escape from predators, such as mountain lions. Bighorns are brown to grayish-brown with white rumps. Rams have large, curled horns. Ewes have smaller, straight horns.

Bighorns normally travel in herds, led by the oldest ewe. Rams separate from the herd during the summer months. The males return to join the ewes and lambs in the fall. All bighorn sheep have horns that grow throughout the animal's life. As the sheep grow older their horns grow distinct rings, one for each year. Counting these growth rings will tell you the bighorn sheep's age. Bighorn sheep can live as long as 14 years. Telling the age of a ram is easier than determining the age of a ewe. This is because the horns of a ram are larger than a ewe's and have more growth during the year. Therefore, the rings on a ram's horns are larger and more distinct.

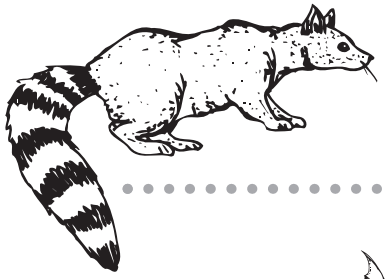
COYOTE

Coyotes are carnivores, or meat eaters. Coyotes are gray or rusty gray with white throats and bellies. Adult coyotes weigh between 20 and 50 pounds. They are fast runners and can easily outrun any human. When running, the coyote holds its tail between its hind legs.

In southern Nevada, the coyotes usually eat rodents, rabbits, lizards and birds. Coyotes will eat berries if there is no other food available. They will also eat animals that have been killed by automobiles and whatever food they can find in garbage dumps.

ANTELOPE GROUND SQUIRREL

You can identify the antelope ground squirrel by the white lines running down each side of its gray body. Its cousin, the chipmunk, lives at Mount Charleston. Antelope ground squirrels are well adapted to southern Nevada's desert climate. They are able to let their body temperatures rise to high levels. Because of this, they are often the only living creatures you will see in the desert during hot summer days. These squirrels dig burrows



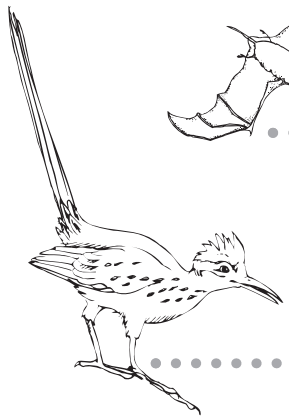
where they go to cool off. They will also hibernate in their burrows if forced to by harsh weather. Their favorite foods are green plants and insects. Their predators include hawks, falcons, and coyotes.

RINGTAIL CAT

This animal averages in length from 24 to 31 inches long. The body is catlike and the face is fox-like. The cat has a long, bushy tail with black and white bands around it. The ringtail cat is found in rocky canyon areas like where Hoover Dam is located.

LITTLE BROWN BAT

The bats most frequently found in the area of Hoover Dam are greyish to dark brown in color and average in length from 3 3/4 to 3 5/8 inches. They live in the tunnels and caves in the surrounding canyons. The bats help pollinate desert plants and they eat small insects.

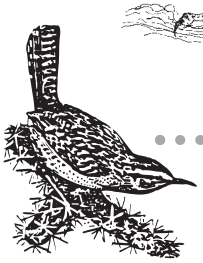


GREATER ROADRUNNER

Roadrunners are very common to Southern Nevada. The greater roadrunner is a big bird with a long tail and bill. It has a bushy crest on its head. Greater roadrunners are fast runners who seldom fly. A roadrunner is often seen running with its neck outstretched and its tail held out flat. They are ground dwellers that hunt lizards, snakes, birds, and invertebrates.

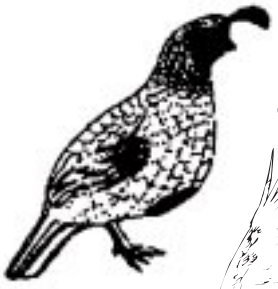
GOLDEN EAGLE

This large graceful bird can be seen soaring at great heights above southern Nevada. Adults measure up to three feet long. They are brown with a white tail band and feathered legs. Eagles usually build their nests on suitable cliff ledges or, less frequently, in trees. Their prey includes rabbits, mice, and injured water birds.



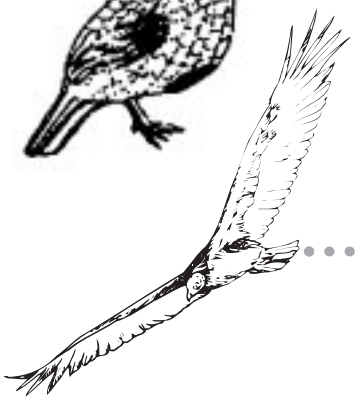
CANYON WREN

Everyone who lives in Southern Nevada has seen this bird, but few know its name. The bird has a beautiful song that can be heard when it echoes off canyon walls. The adult wren is about 3-4 inches long. It has a white throat and breast and a brown belly. The little wren eats gnats and seeds of desert plants.



GAMBEL'S QUAIL

This is one of four types of quail found in Nevada. The others are the California quail, mountain quail and scaled quail. Gambel's quail are easily identified by tufts of feathers, called topknots, on their heads. They can often be seen in vacant lots around the Las Vegas Valley. Their food consists mostly of seeds and fruit.



TURKEY VULTURE

The turkey vulture varies in length from 26 to 32 inches with a wingspan of 72 inches. Its color is brown-black all over with an

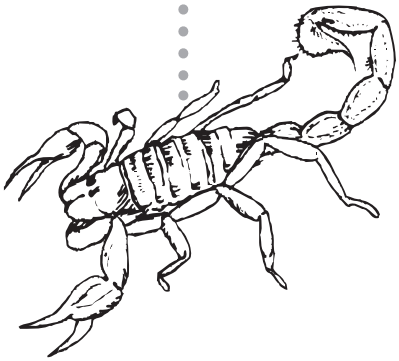
unfeathered head. Sometimes this bird is referred to as a "buzzard". They serve as scavengers of the desert by eating carcasses of dead animals.

RAVEN

This bird is all black and ranges in sizes from 19 to 21 inches. The raven has a heavy bill, wedged shape tail and long throat feathers. The bird is found in areas of mesquite and it needs trees or power lines for nesting.

SCORPIONS

Scorpions are found all over the world, but most like to live in warm, dry climates such as the desert. Scorpions have pincers and a long tail with a stinger at its tip. Though they have many eyes, they do not see well. When running, they hold their pincers out. Males have broader pincers and longer tails than females. Like wolf spiders, scorpions feed at night on insects. The mother carries her babies on her back until they shed their first skins. Scorpions sting to defend themselves. Never touch or play with a scorpion!

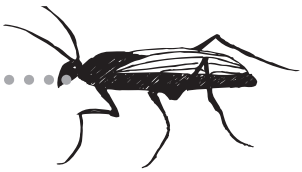


DESERT TARANTULA

Desert tarantulas can get as large as four inches long. They have brownish black, hairy bodies and legs. Female tarantulas may live for 20 years. In the day, tarantulas hide in holes or under stones. In the dim light of sunset or near dawn, tarantulas come out to hunt food. They eat insects, lizards and other small animals. Tarantulas do not like to attack humans. Usually their bite is no more poisonous than a bee sting.

TARANTULA HAWK

The Tarantula Hawk is a velvety black wasp with orange wings. It depends on the tarantula for its survival. Here's how: The female tarantula hawk paralyzes the spider with its stinger. Then she quickly digs a large hole. Next, she drags the spider inside, lays an egg, then covers the hole. When the egg hatches, the larva feeds on the spider. When it is full grown, the tarantula hawk feeds on plant nectar.

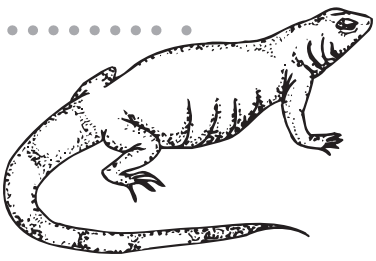


MOJAVE RATTLESNAKE

This snake varies in size from 24 to 51 inches. It has uniform white scales surrounding brown diamonds on its back from the midline to its tail. The upper half is greenish brown to olive green. You may find this snake in areas where mesquite, creosote and cacti are prominent. Its venom is extremely toxic. Keep your distance!

CHUCKWALLA LIZARD

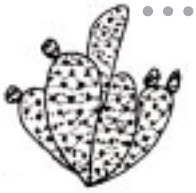
The average length of this lizard is 11 to 16 1/2 inches in length and it is very obviously potbellied. Its skin is loose and floppy. These lizards are seen around large boulders or rocky areas and live strictly on leaves, flowers, buds, and fruit.



PLANTS OF THE AREA

BARREL CACTUS

Perhaps the most recognized cactus in Las Vegas is the barrel cactus. It is not hollow, as many believe, but has a spongy pulp inside. When growing, most barrel cactus lean to the South. It is also known as the bisnaga, red barrel, fire barrel, solitary barrel and compass barrel cactus.



BEAVERTAIL CACTUS

This cactus has flat, greenish jointed stems with rose or lavender flowers from March to June. The height is 6 to 12 inches and frequently is found in dry, rocky, desert flats or slopes. The beavertail cactus looks like the prickly pear, but does not have long spines. It has tiny hair-like spines instead.

CHOLLA CACTUS

The cholla (pronounced "cho-yah") cactus has jointed stems that are tubular. These joints can break off and take root in the ground to grow a whole new cholla cactus. After the plant dies, a skeleton of "ventilated wood" remains in the desert. There are many different kinds of cholla in the Mojave Desert.

CREOSOTE BUSH

This large shrub has small, round leaves which look and feel oily or sticky. This coating called "lac", helps to keep water from being lost to the dry air. Indians used lac as glue. Mexicans called this plant, "little stinker".

DESERT MALLOW

The mallow is common to roadsides and vacant lots. This plant has orange flowers and fuzzy leaves. The star-shaped hairs may get in your eyes if you handle the plant. That is why it is called the "sore-eye poppy".

DESERT MARIGOLD

This common plant has inch wide yellow flowers. These flowers look like small sunflowers on tall stalks. The marigold's fuzzy leaves grow at its base.

INDIAN PAINT-BRUSH

The flowers of this small colorful plant are barely visible. A "brush" of bright orange or red surrounds the tiny flowers. The top of the plant looks as if it has been dipped in paint.

PRICKLY PEAR CACTUS

There are many kinds of prickly pear cactus (nearly every state has a native species). Most can be recognized by flattened stems, called pads, that grow from joints. Indians would carefully scrape or burn off the spines and cook the pads for food. The egg-shaped fruits, called "tunas", can still be found in some grocery stores.

ROCK NETTLE

This plant is found in dry, rocky places or on canyon walls in the desert. A rounded, bushy plant with stinging hairs and flowers, blooms from April to June. The flowers are cream or pale yellow in color. Do not pick the flowers — the stinging hairs are vicious!

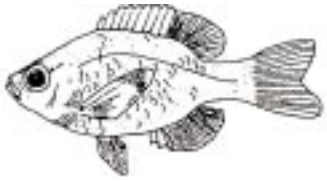
SACRED DATURA

This plant is unusual for the desert. The datura is vine-like with large, grey-green leaves. The flowers look like large white trumpets, several inches long. It is sometimes called the "moon-lily" because the flowers open at night. This is when the Giant Sphinx Moth pollinates the flowers. It is also known as "jimson-weed" or "thornapple" because of its round, spiny seed pod. All parts of this plant are poisonous.

FISHING IN LAKE MEAD AND ON THE COLORADO RIVER

STRIPED BASS

Bait: anchovies, shad, and lures at different depths (seasonal). It is found in the Overton Arm, Las Vegas Bay, and Temple Bar.



BLUEGILL

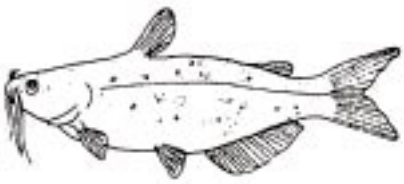
Bait: minnows, worms, insects, crayfish, flies (wet or dry), and popping bugs. The "big ones" live near the canyon walls.

RAINBOW TROUT

Bait: cheese and marshmallows. This trout likes deeper levels and cold water.

LARGEMOUTH BASS

Bait: night crawlers, minnows, and lures. Largemouth bass are more active at dawn and dusk and prefer weedy areas and shoreline.

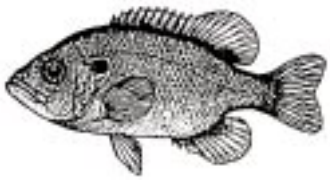


CHANNEL CATFISH

Bait: natural or prepared stink baits. They can be identified easily by their large whiskers. Bottom fishing is best at day or night.

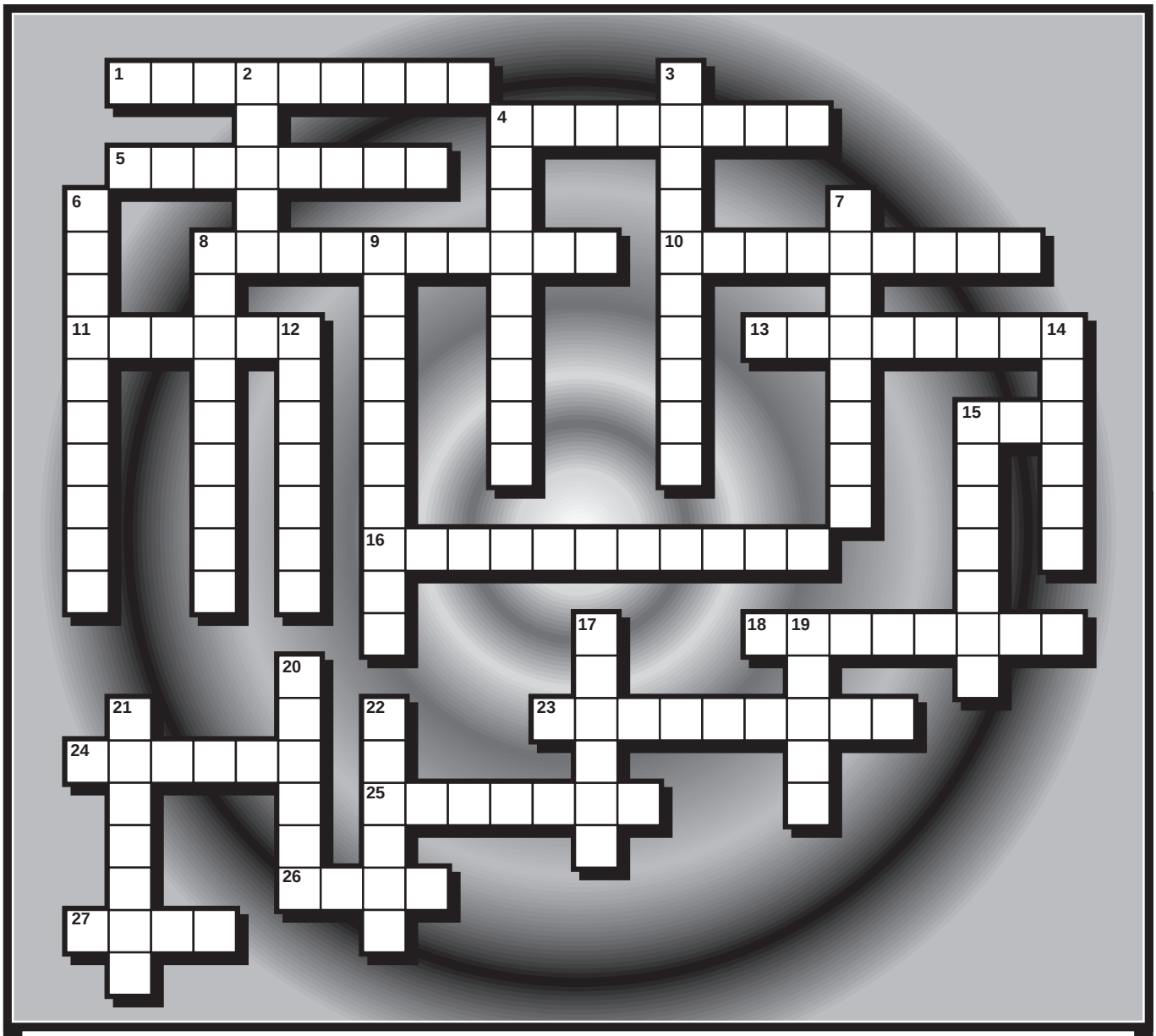
THREADFIN SHAD

It is usually found in pools along the edges, usually around mud, sand, and debris. This small fish is used for bait.



SUNFISH

Its body is short, stocky and narrow. It lives in vegetated lakes and muddy rivers. Bait: night crawlers, red worms and small lures.



Across:

1. Development changes in the life of an organism.
4. Herbivore found in the desert, very slow moving.
5. Cat-like animal with a striped tail.
8. Cactus with flat, jointed stems.
10. An endangered fish in the Colorado River.
11. Carnivore, related to the dog.
13. Arthopod that looks like a tan lobster with a curved tail.
15. Small mammal that flies.
16. Reptile with a noisemaker at its tail.
18. Small, bushy tailed mammal.
23. Who eats who.
24. Warm blooded, live-bearing creature.
25. Cold blooded, egg-laying vertebrate.
26. Small bird found in canyons, beautiful song echoing off the canyon walls.

Down:

2. Our national bird.
3. Bird with long tail, often seen running.
4. Big, black, eight-legged, furry creature.
6. Large lizard with loose, floppy skin.
7. Shrub with leaves that look and feel oily or sticky.
8. A person who studies living things.
9. Animals who are getting scarce.
12. The study of connections between living things and their environment.
14. "Velcro plant" that grows on canyon walls.
15. Mountain climbing animal with horns.
17. Cactus with jointed, and tubular prickly stems.
19. Bird with tufts of feathers on its head.
20. Plant with orange flowers and fuzzy leaves.
21. The place where an organism is most frequently found.
22. Type of cactus that is named for its shape.

Word List:

barrel • bass • bat • beavertail • bighorn • biologist • cholla • chuckwalla • coyote • creosote • eagle • ecology endangered • food-chain • habitat • lifecycle • mallow • mammal • nettle • quail • rattlesnake • razorback • reptile • ringtail • roadrunner • scorpion • squirrel • tarantula • tortoise • wren

ACTIVITIES

ART:

Bring into class a dried branch, common to the Lake Mead Recreational Area. (Choose a large, interesting branch.) This branch should be hung on a bulletin board or planted in a container. The student will draw, color and cut out a bird found in this region. A report on their habitat might be presented orally to the class.

To incorporate plants and wildlife into the above project, create a model desert scene from materials available to students (such as clay, plaster of paris, leaves, branches, paper, Styrofoam, etc.). Include reptiles, birds, and mammals in as many habitats as possible.

MATH:

Desert tortoises may drink up to 40% of their weight in water per day. Select some desert plants and weigh them while they are fresh to determine how much water is in the plant. Dry the plant and re-weigh. You may now calculate how much water weight is in the plant.

Weigh a desert tortoise and calculate how much water he might consume in a day and how much he must eat to provide sufficient water for survival.

SCIENCE:

Discuss the concept of the "food web". Follow up this study by collecting pictures of native animals. Collect smaller pictures of plants, insects, and other animals and create a display of how the food chain works for a specific animal.

Create mobiles of food chains for various species. This activity can be done independently or with a small group. Cut plants and animals from magazines and post on cardboard, or the students may do original artwork. Each mobile must follow a food chain for a single animal.

LANGUAGE ARTS:

Use pictures (animals, reptiles, fish, birds) to introduce wildlife specific to the area. Groups of students are to select two animals to investigate and tell about:

1. **The survival rate of each animal.**
2. **What may have contributed to this animal's success or failure;**

Each group may present their findings to the class by means of skits, debates, discussions, puppet shows, or reports.

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WATER RESOURCES

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CONCEPTS:

The purpose of this unit is to give the student a general overview of water; how it relates to the earth and more specifically the Nevada-Arizona-California area. This will be achieved by:

1. **A summary view of the Colorado River watershed and the purpose of Hoover Dam and other Reclamation projects.**
2. **Activities designed to introduce the student to water quality, water quantity, water related vocabulary, and conservation of water resources.**
3. **A water poster which will describe how water is used and the sources of a water supply.**
4. **A brochure describing the hydrologic cycle with pertinent information about water quantities.**

The water poster has activities on the back which can be copied for the class to use. The Hydrologic Cycle brochure is usable on its own or as a supplement to the poster and H2O on the Go. The two activity sheets, H2O on the Go and Sedimentation: the Nitty Gritty, can be utilized as individual science units.

INTRODUCTION - WATER IN THE DESERT:

One glance at Hoover Dam will reveal a most obvious fact - there's a lot of water behind the dam. You might think that there is enough water for thousands of years. Actually, there is enough to supply 29 million households for one year. In regions of the Southwest where people are water wise, Lake Mead could supply twice this many families with water for one year.

The Colorado River is more than 1400 miles in length, making it the third longest river in the United States. The watershed covers more than 244,000 square miles, 1/12 of the area of the lower 48 states. Although the river begins in the Rocky Mountains, most of its length drains the arid Southwest region.

This river is an important source of water to seven western states - Colorado, Wyoming, New Mexico, Utah, Arizona, Nevada, and California, as well as a portion of Mexico. Along the way it is used for irrigation, domestic water, recreation, and hydroelectric power production. These uses would not be possible if not for the series of dams along the Colorado river and its tributaries.

Just after the turn of the century a succession of floods broke through levees just above the border with Mexico. The resulting

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flood waters created the Salton Sea in southern California and inundated much of the Imperial Valley. On the other hand, drought years reduced the river to a trickle. In order to supply water to the arid Southwest, a series of dams along the Colorado River was devised. These dams would act as flood control, silt control, and water storage units.

Hoover Dam was the first of the large reclamation projects along the Colorado River. The dam backs up the waters of the river to form Lake Mead. Lake Mead is the largest man-made lake (reservoir) in the United States, holding almost 29 million acre feet of water. An acre-foot of water is the amount of water that will cover an acre, one foot in depth. This water is stored behind Hoover Dam and is used throughout the Southwest. The dam also helps to settle out silt and reduce the amount of sediment sent down the river.

Water is a top priority at Hoover Dam. Without water, life in the desert would be impossible. Hoover Dam, as well as other dams along the Colorado River, make the storage of this precious water possible.

ACTIVITY #1 - H20 ON THE GO

Water is all around us, in many forms. Even in the middle of the Mojave desert, it may seem dry and forbidding, but if you know where to look, the water is there. It can be held in the

clouds or fog, in the form of vapor. It can fall from the clouds as a liquid, like rain, or be a solid like hail and snow. Once it has fallen, it can lay in a lake, flow in a stream, sit in a snowpack, or travel through the soil (percolate) to an underground reservoir called an aquifer. The water on the surface may be evaporated (turned back into vapor), form a cloud and continue on its journey. This continuous recycling of water is known as the Hydrologic Cycle.

You can create your own Hydrologic Cycle. For this you'll need:

- 2 liter clear plastic soda bottle
- sand to fill bottle to about 1/4 full
- plastic wrap (about 1 foot square)
- rubber band

Cut the top off of the soda bottle, below the narrow neck. Pour the sand into the bottle, create your own hills, valley, and lake, you can even put in a small plant, if you like. Give your ecosystem a drink of water, about 1 cup. Next, cover the top of the bottle with the sheet of plastic wrap and keep it in place with the rubber band. Set your mini-earth in a sunny window and observe what happens.

It won't take long, especially if the day is warm, for things to start happening. Do you observe any water collecting on the underside of the plastic wrap? This is called condensation and is a result of water molecules warming up enough to evaporate and become vapor.

The vapor will naturally rise until it meets with the plastic wrap at the top of the bottle where the air is cooler. In the Earth system, this vapor will rise until it meets the impermeable layer in the stratosphere. Since the vapor can't move through the plastic it condenses or changes back to it's liquid form. When enough collects, it will drop back down to the sand, much as rain would. You may even see small lakes or streams form where the water drops back to your mini-earth.

There is as much water in the earth's system today as there was when the earth was formed. At any given time, more water may be locked up in icepacks or caught up in weather systems. That is why we have cycles of drought and flooding. During the last ice age, large quantities of water were contained in icepacks, which reduced the amount of water available to the oceans. Ocean levels dropped and more shoreline became exposed. When earth's temperatures increased by a few degrees and the icepacks melted, more water was freed up and the water levels in the ocean again rose. The water levels at Lake Mead can also be altered due to climatic changes.

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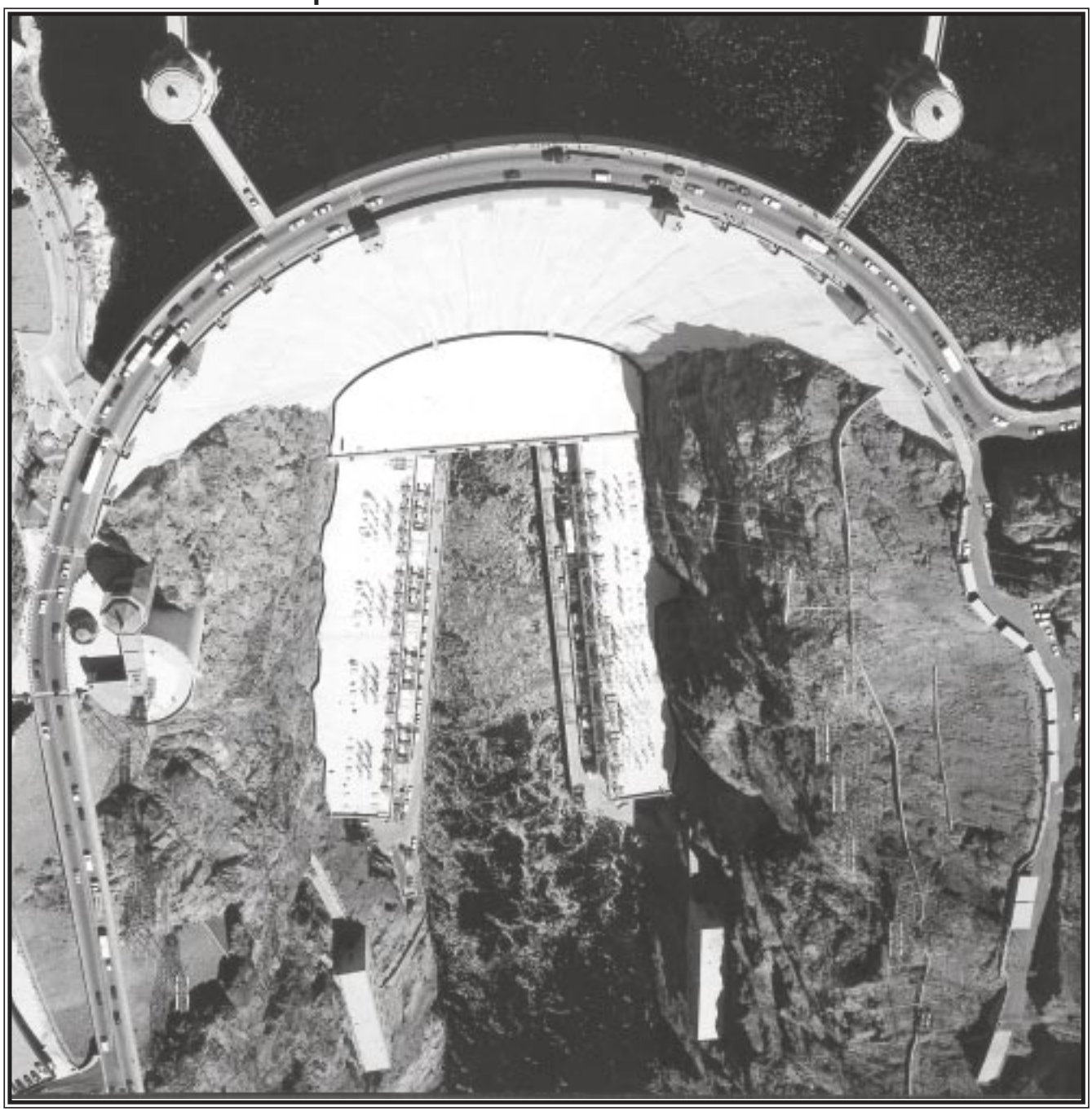
At times there seems to be more water than we can use. At other times we can't seem to find a drop. But, as we found out, there is always some out there somewhere!

ACTIVITY #2 - SEDIMENTATION: THE NITTY GRITTY

Before Hoover Dam the Colorado River was a much different river than we see today. In the place of the warm, silt-laden stream of pre-dam days now lies a cool, clear river. In its journey down from the Rocky Mountains, through the arid



southwest region, it would pick up a tremendous load of sand, silt and other debris, called sediment. This sediment load would then be carried down stream, only to be dropped out (deposited) when the water slowed down. This sediment would usually end up in the bottom of the river or along the sides.

To examine how this process, called sedimentation, works you'll need a few simple supplies:

- 1 or 2 liter plastic soda bottle, with cap
- water to fill the bottle 2/3 full
- a couple of hand fulls of dirt (or 1 to 2 cups) from your schoolyard or backyard

Pour the water into the bottle. Carefully pour the dirt into the bottle, put on the cap, then shake it up! Wait a while for the dirt to settle. It might take about 5 to 15 minutes. Now, take a close look and examine what you see in the bottom of the bottle.

As long as the water kept moving, the dirt stayed mixed with the water (in suspension). As the water slows down, it is no longer strong enough to hold the dirt up and the dirt will settle to the bottom.

Depending on the type of dirt that you used, you will see various layers. These layers are comprised of the many types of soil particles which make up dirt or soil. The heaviest of particles, like rocks, will drop out first. Sand may be next, since it's grains are lighter than rocks, but heavier than most other soil. The lightest fragments, such as clay and small pieces of leaves and twigs, will stay in suspension longer and therefore be on top.

This is like how the river works. The river usually flows, or moves, fast enough that it can keep the dirt it picks up along the way in suspension. If the river slows down, as it's going around a bend or coming into a lake, then that sediment will settle to the bottom, much like it did in your bottle.

At Lake Mead, the sediment will usually drop out where the lake starts to form at the west end of the Grand Canyon. If the water coming through the canyon is moving fast enough, like after a heavy rain, then the sediment will be carried farther into the lake before it settles to the bottom. It is estimated that 60 to 90 feet of sediment (or silt) now lies behind Hoover Dam. Eventually, enough of this sediment may come down the river to fill up the whole lake, but we don't expect that to happen for hundreds of years.

For now, the dam does it's job of slowing down the river so water can be stored in Lake Mead. As we've seen, this also "cleans" the water by allowing the dirt to settle to the bottom of the lake.

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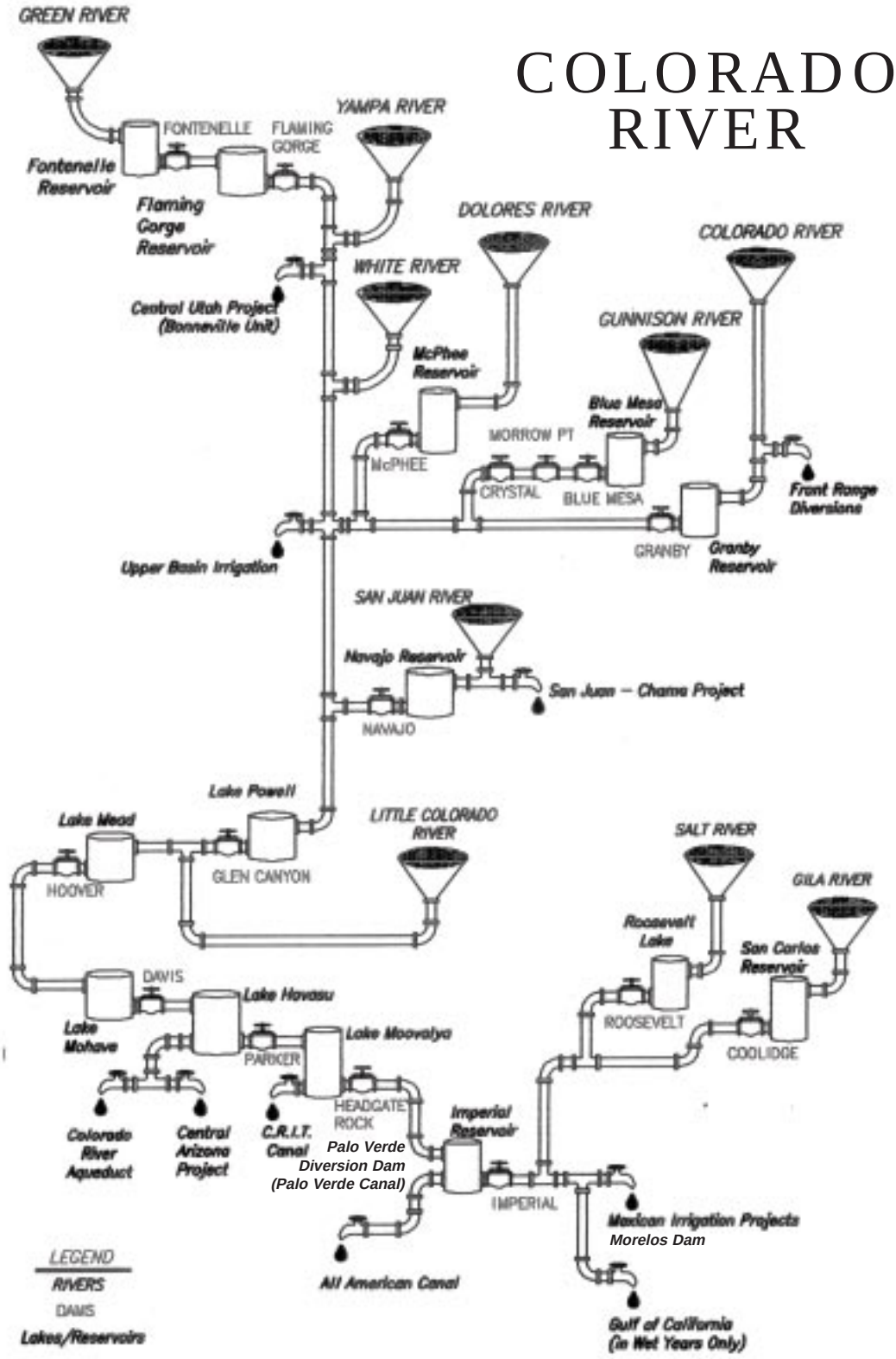
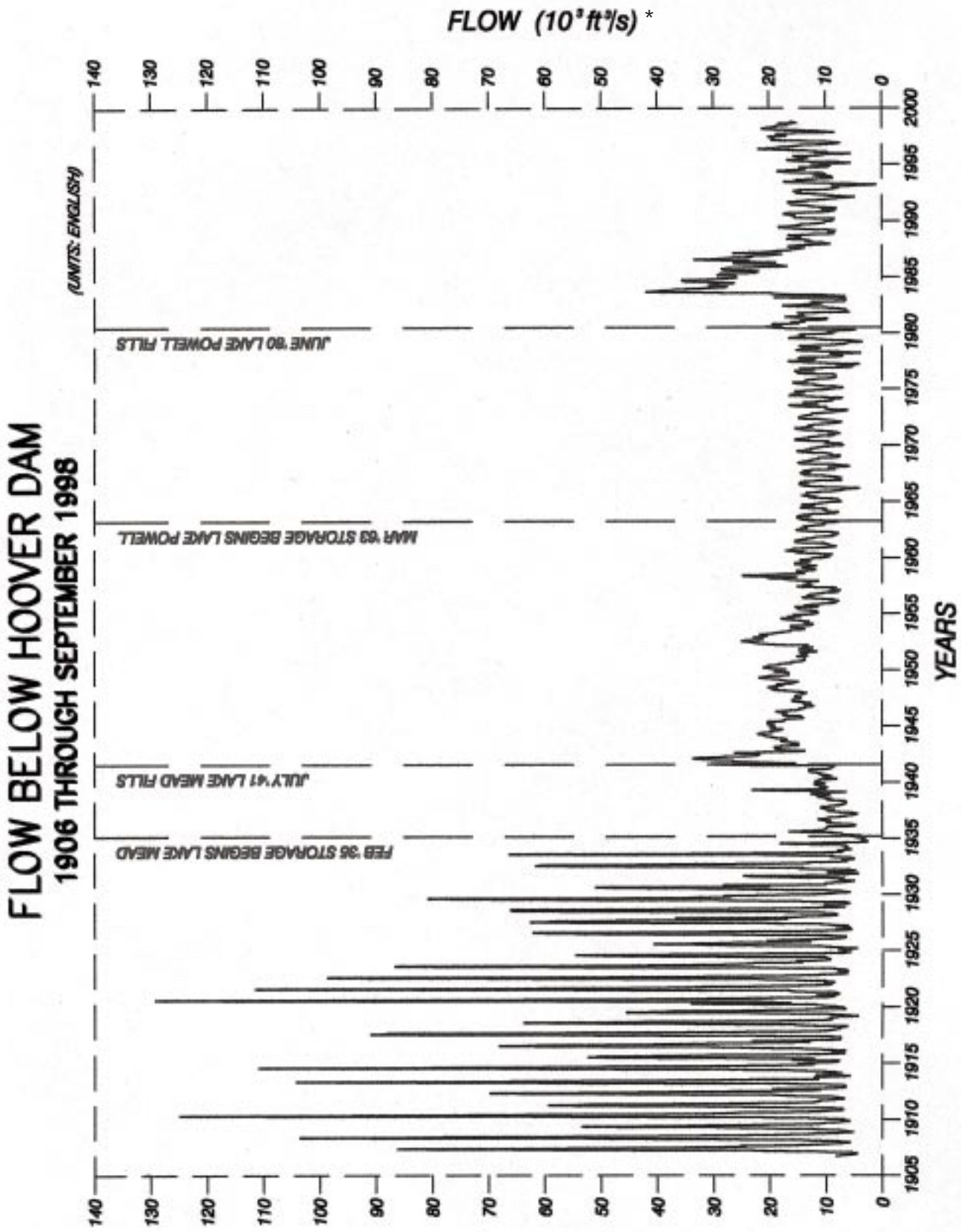
COLORADO RIVER



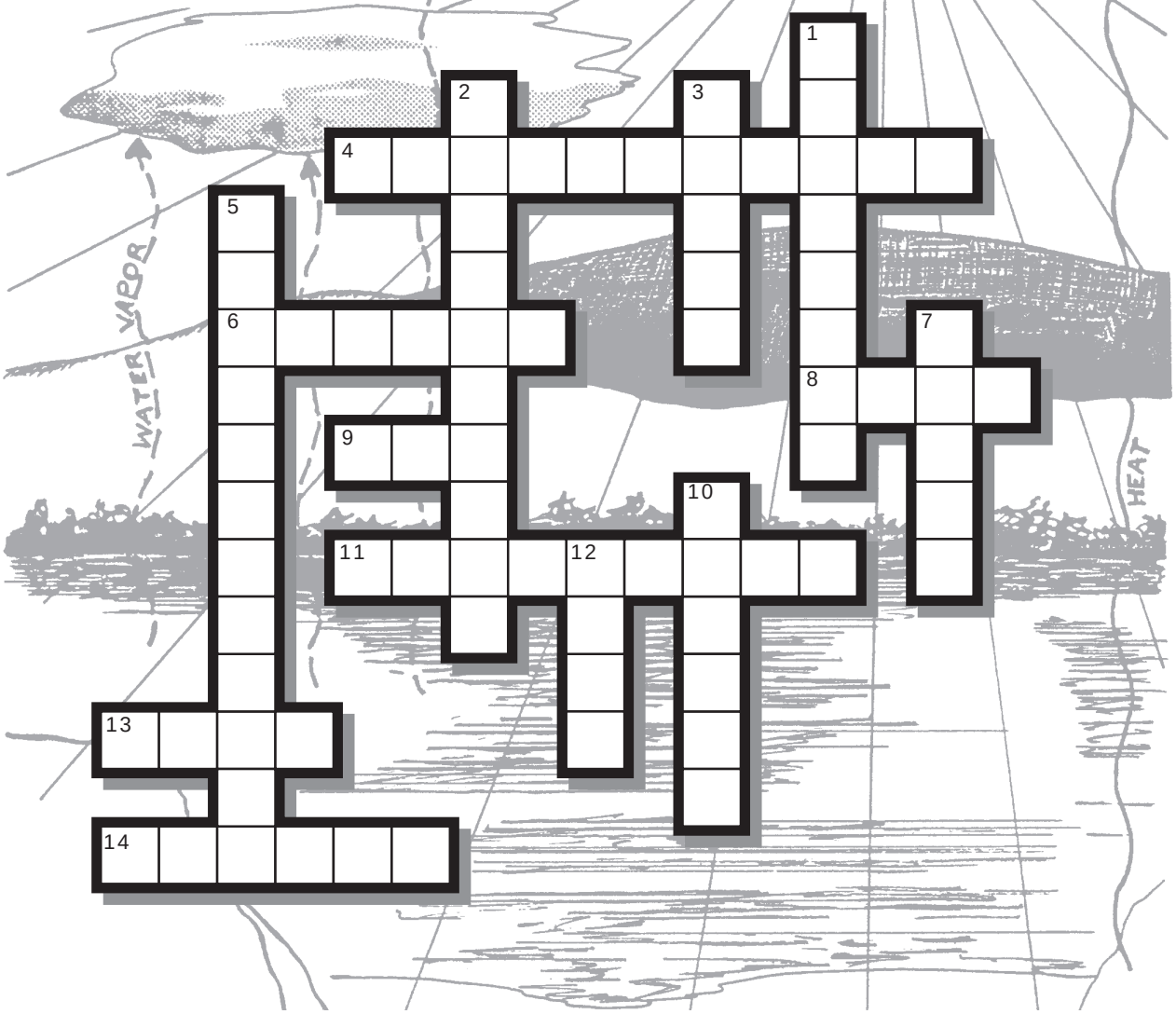


*1,000 cubic feet per second

NATURE'S WATER CYCLE

WORDS TO CHOOSE FROM:

VAPOR	**CONDENSATION**
DAY	**RAIN**
COLD	**RIVER**
EVAPORATION	**WATER CYCLE**
MOLECULES	**NATURE**
MOISTURE	**WINDOW**
SOIL	**CLOUDS**



ACROSS:

4. The process of liquid water changing to vapor is called _____.
6. The water cycle of _____ is very important.
8. Precipitation.
9. Opposite of night.
11. Very small particles.
13. Top layer on our planets surface.
14. An opening in a wall that allows air or light in.

DOWN:

1. Dampness
2. The constant movement of water between earth and our atmosphere.
3. The gaseous state of water.
5. The process of water vapor changing to liquid water is called _____.
7. A large stream of water.
10. Millions of condensed water droplets floating in the sky.
12. The opposite of hot.

NOTES

HYDROELECTRICITY

CONCEPTS:

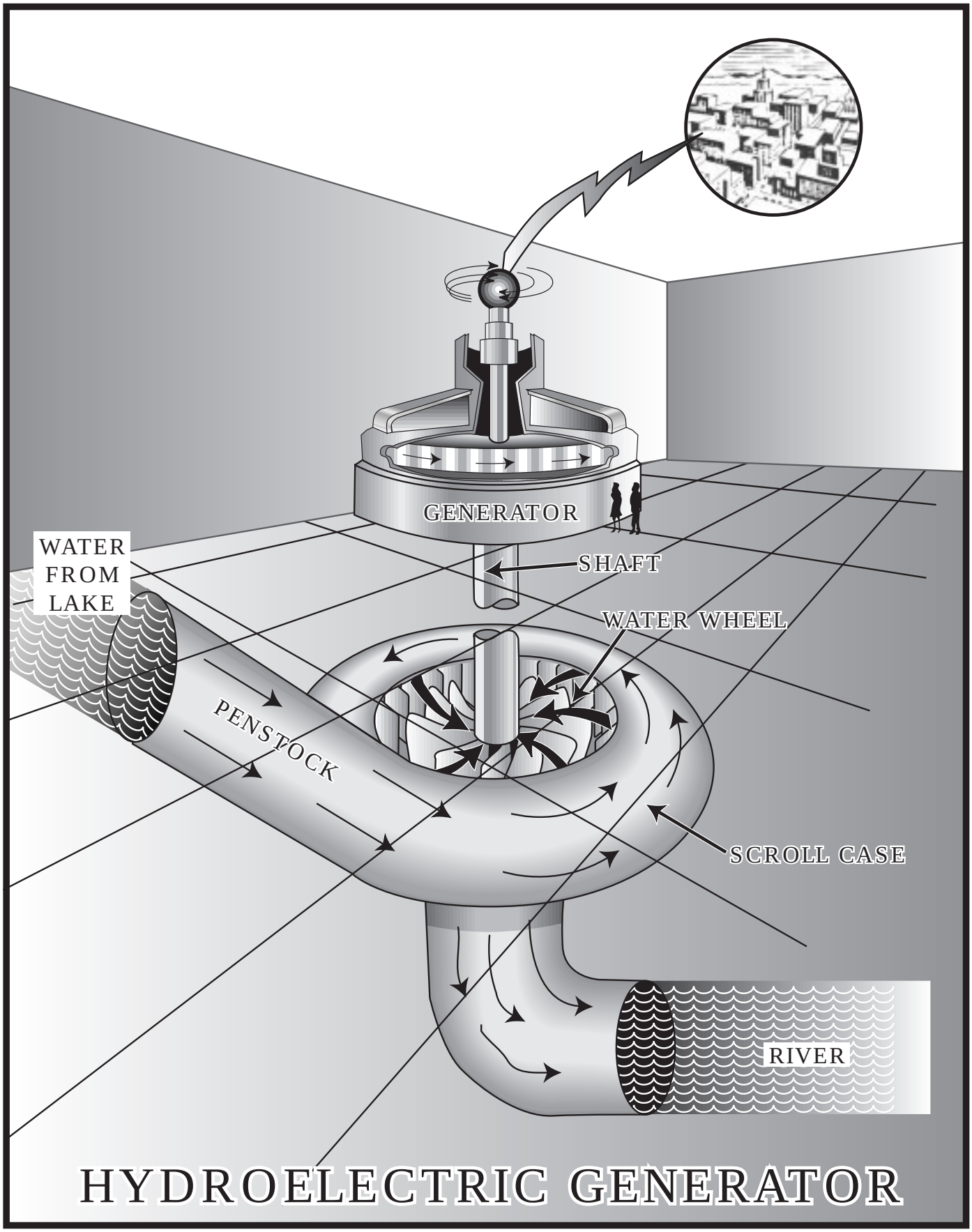
1. **Hoover Dam created Lake Mead.**
2. **Water flowing from Lake Mead is used to make electricity.**
3. **Turbines and generators are used to change water from mechanical energy into electrical energy.**
4. **Water in the Colorado River is used over and over again.**

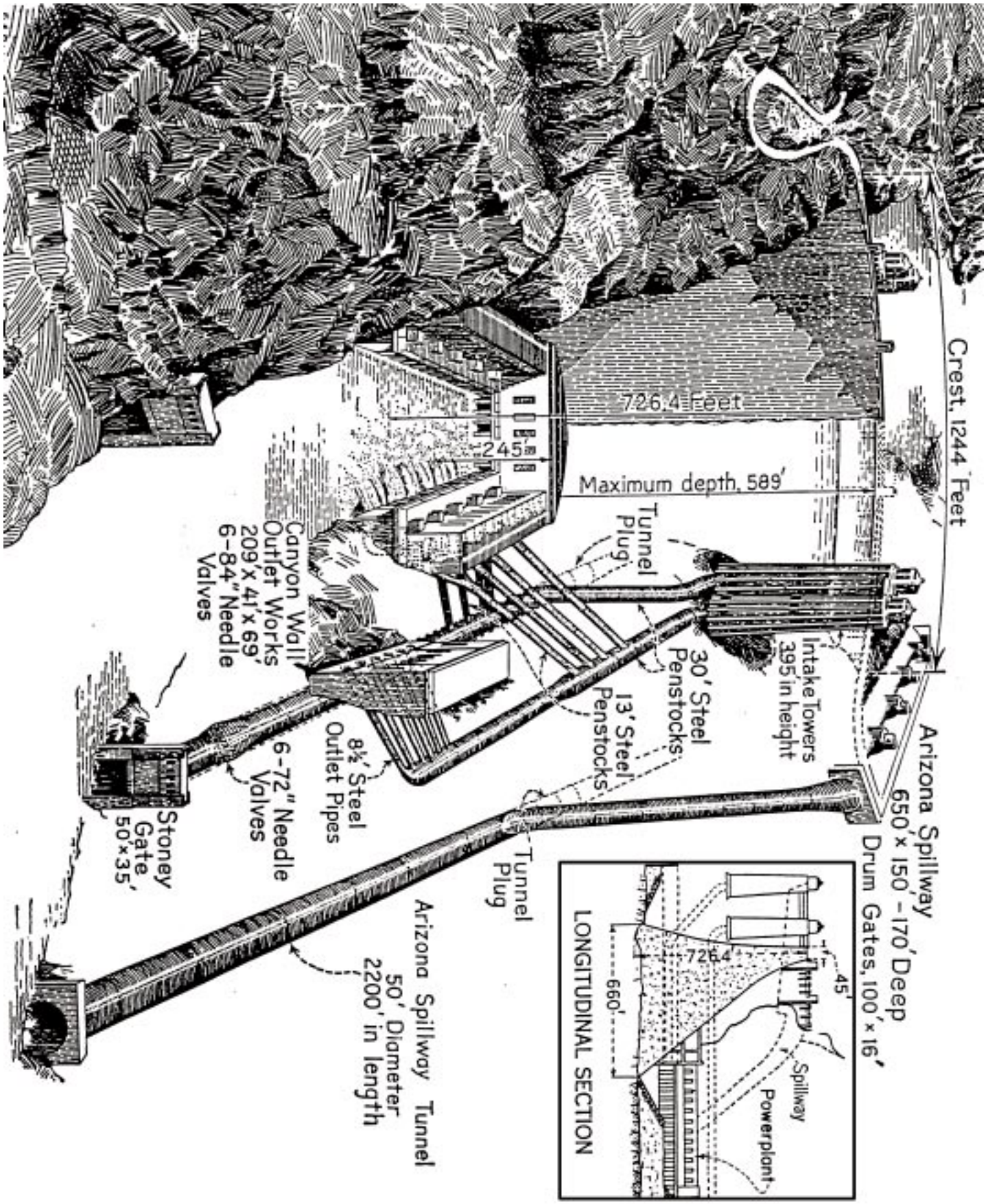
Generators can be powered by many sources. The most common sources are — the wind; atomic fuels like uranium; gasoline or diesel engines; steam from fuels like oil, coal, or natural gas; and last but not least, water. Energy from water is created by the force of water flowing from a higher elevation — usually from a reservoir or lake — to a lower elevation, through a large pipe (penstock). When the flowing water reaches the end of the penstock it funnels into the scroll case where it hits and spins a water wheel (turbine).

A water turbine is a wheel with fins on it, somewhat like a windmill, except it uses water instead of air. Water hits and rotates the turbine, the turbine rotates the connecting shaft, which then turns the generator. Magnets spinning inside wire coils in the generator make the electricity. In this way the generator and turbine change mechanical energy into electrical energy. The electricity then flows by wires (transmission lines) to cities and homes where it is used.

After having done its job of turning the water turbines to generate electricity, the water flows downstream. There it can be stored behind dams and used again. Hoover Dam was built to make Lake Mead, to keep water from flowing down the Colorado River. There are three other major storage dams on the main stem of the Colorado River. The dam 370 miles upriver from Lake Mead and north of the Grand Canyon is Glen Canyon Dam/Lake Powell. 67 miles south of Hoover Dam is Davis Dam/Lake Mohave. And 155 miles south of Hoover is Parker Dam/Lake Havasu.

There are over 53 dams on the Colorado River and its tributaries. All these dams use much of the same water and work together to control floods, irrigate crops, supply drinking water, make places for recreation, create habitat for wildlife, and of course — generate electricity.


GENERATOR
SHAFT
WATER FROM LAKE
WATER WHEEL
PENSTOCK
SCROLL CASE
RIVER
HYDROELECTRIC GENERATOR


Crest, 1244 Feet
Arizona Spillway
650' × 150' - 170' Deep
Drum Gates, 100' × 16'
Intake Towers
395' in height
726.4 Feet
1245
Maximum depth, 589'
Tunnel
Plug
30' Steel
Penstocks
13' Steel
Penstocks
Canyon Wall
Outlet Works
209' x 41' x 69'
6-84" Needle
Valves
8½' Steel
Outlet Pipes
6-72" Needle
Valves
Stoney
Gate
50' × 35'
Tunnel
Plug
Arizona Spillway Tunnel
50' Diameter
2200' in length
45'
Spillway
Powerplant
726.4
660'
LONGITUDINAL SECTION

HYDROELECTRICITY

E	Z	A	N	B	L	T	Y	P	W	A	M	E	G	A	W	A	T	T
N	E	E	D	L	E	V	A	L	V	E	Z	L	P	T	O	A	U	Q
E	W	L	B	A	A	Z	L	W	P	B	R	T	U	O	Q	L	R	K
R	A	E	T	D	R	U	M	G	A	T	E	T	O	X	C	M	B	B
G	S	C	A	E	P	H	A	C	X	N	Q	W	Z	Y	C	O	I	L
Y	I	T	F	S	Q	W	G	E	N	E	R	A	T	O	R	E	N	R
R	T	R	Y	U	D	I	N	O	P	A	S	T	D	F	E	G	E	H
J	K	I	L	W	A	T	E	R	W	H	E	E	L	Z	S	X	C	V
V	B	C	N	M	M	Q	T	W	E	R	T	R	Y	S	T	E	E	L
U	I	I	O	P	A	S	D	F	G	H	J	K	K	L	L	Z	X	C
C	V	T	R	A	N	S	M	I	S	S	I	O	N	L	I	N	E	V
V	B	Y	N	M	W	C	E	R	F	G	G	J	G	M	C	C	A	O
Z	U	N	B	W	T	R	A	N	S	F	O	R	M	E	R	U	I	D
A	G	B	C	I	M	O	X	U	T	V	E	U	N	A	L	X	N	Z
O	P	X	R	N	H	L	Q	P	O	W	E	R	P	L	A	N	T	Z
Y	N	B	X	W	A	L	I	O	N	T	G	O	B	H	Y	X	A	P
A	S	F	V	N	K	C	V	P	E	N	S	T	O	C	K	X	K	U
S	P	I	L	L	W	A	Y	U	Y	C	A	A	S	F	T	B	E	S
H	X	C	V	R	Y	S	A	D	G	F	V	T	A	G	Y	I	K	M
A	A	C	Z	Y	J	E	N	M	A	C	T	E	E	Y	X	V	B	Q
F	Z	X	E	V	B	N	M	P	T	E	Q	W	T	N	M	V	U	I
T	Z	A	W	D	O	U	T	L	E	T	B	I	M	P	L	Z	W	F

BLADES
COIL
CREST
DAM
DRUM GATE
ELECTRICITY
ENERGY
GENERATOR
INTAKE
MAGNET
MEGAWATT
NEEDLE VALVE
OUTLET
PENSTOCK
POWER PLANT
ROTATE
SCROLL CASE
SHAFT
SPILLWAY
STEEL
STONEY GATE
TRANSFORMER
TRANSMISSION LINE
TURBINE
WATER
WATER WHEEL

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COMMUNITY RESOURCES

Area Code (702)

Boulder City Chamber of Commerce	**293-8906**
Boulder City Historical Society and Museum	**294-1988**
Bureau of Land Management, Red Rock Visitors Center	**647-5000**
Bureau of Reclamation, Regional Office	**293-8000**
Clark County Heritage Museum	**455-7955**
Colorado River Commission	**486-2670**
Environment Protection Facility	**486-2850**
Hoover Dam, Visitors Center	**293-4521**
Las Vegas Valley Water District	**870-2011**
National Park Service at Lake Mead, Alan Bible Visitors Center	**293-8906**
Nevada Desert Tortoise HCP Study	**486-5127**
Nevada Power Company	**367-5676**
Nevada Wildlife Department, Fish Hatchery	**486-6738**
Project WET (Water Education for Teachers)	**293-7425**
United States Department of Agriculture, Forest Service	**870-0355**
Water Treatment Plant at Lake Mead	**897-7177**

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ELEMENTARY SCHOOL LEARNING GOALS
Curriculum Focus

MATH:

- **Develop and use strategies to solve problems, build models, conduct experiments, make lists, tables, and graphs to reason logically.**
- **Create and solve math problems from real life, relevant situations.**
- **Observe, compare, and order by measurable attributes, including temperature, linear, capacity, weight/mass, and volume.**
- **Estimate measurables to describe and compare real life situations.**

SCIENCE:

- **Explore the interactions of magnets.**
- **Explore rocks and minerals and their properties.**
- **Investigate the effects of natural forces on the earth's surface.**

LANGUAGE ARTS:

- **Summarize information from printed materials.**
- **Identify important details from presented materials.**
- **Organize ideas to show relationships.**
- **Ask questions to clarify and develop unclear ideas.**

SOCIAL SCIENCES:

- **Describe the functions of the federal government.**
- **Describe the factors of production.**
- **Explain how government provides public goods and services.**
- **Define earth as being made up of land and water.**
- **Relate important historic events in Nevada to the development of American History.**
- **Recognize famous explorers in Nevada's history.**

THE ARTS:

- **View memorials and monuments which artists have created to remember important people and events in the past.**
- **Examine architectural structures and their functions.**
- **Construct an architectural form applying the appropriate principles.**
- **Model with clay.**
- **Explore the music of other cultures.**

COMPUTERS:

- **Use a computer to collect data.**
- **Demonstrate the use of computer-based technologies as a tool.**

MIDDLE SCHOOL LEARNING GOALS
Curriculum Focus

MATH:

- **Read appropriate standard measuring devices, such as century, decade, km., mi., L., kg., ton...**
- **Estimates measurements to describe and compare nonstandard appropriate units to real life situations.**
- **Design a strategy for collecting data to solve a problem.**
- **Analyze data from a chart.**

SCIENCE:

- **Apply the steps of the scientific method.**
- **Exhibit skills in observation through use of the senses and laboratory techniques.**
- **Use various library and professional resources to develop information on a given topic.**

LANGUAGE ARTS:

- **Interact verbally in informal situations.**
- **Identify important details from presented materials.**
- **Relate prior knowledge to new information.**
- **Classify information (people, places, things, ideas).**
- **Expand vocabulary.**
- **Demonstrate note-taking skills.**
- **Maintain a journal or log.**

SOCIAL SCIENCE:

- **Analyze the effects of climate on human populations and regions.**
- **Analyze the impact of the Great Depression on American society.**
- **Research the importance of federally developed projects in Nevada.**

THE ARTS:

- **Relate networks to proper historic and cultural context.**
- **Construct three-dimensional forms with paper, tagboard, and other assorted materials.**
- **Explore the music of many cultures including style, instruments, and traditions through listening.**

COMPUTERS:

- **React with multiple methods of communication, such as videos and computers.**
- **Employ computer skills acquired previously.**

NOTES

HOOVER DAM

learning packet

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

150
U.S. Department of the Interior
1849-1999

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Visitor Services, Educ.
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