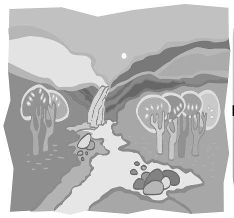

Karst Watering Holes

Karst and Water

Adapted for LBJWC Family Garden

<u>TEKS</u> Science: 5.1(B), 5.2(B,C,D,F), 5.3(A,D), 5.7(A,B), 5.8(A,D), 5.10(A)
<u>Social Studies</u>: 5.7(B), 9(B)
<u>Reading</u>: Students learn academic vocabulary in meaningful context, 5.27(A), 5.28, 5.29

<u>AISD Essential Science Vocabulary</u>
Basin (watershed), channel, weathering, chemical weathering, physical weathering, erosion, deposition, environment, drought, pollution, wind energy, flow, results, experiment, groundwater, extinct, adaptation, climate, weather

<u>Concept</u>
Hydrology of a Karst Aquifer

<u>Objective</u> - Students will:

- Describe native plant adaptations in a karstic landscape.
- Describe the chemical weathering process that creates karstic limestone.
- Investigate flow paths through karstic limestone by pouring water on different examples of karstic rock in the Watering Holes area and observing the flow path through the rock.
- Use the Dye Trace Map and Karst Model to trace the path of water from the karstic area (Recharge) to the aquifer and the springs.
- Describe ways pollutants get into the aquifer and personal actions each individual can take to protect water quality.

<u>Time</u> 50 minutes

<u>Site Access</u>: You will need access to the LBJWC Family Garden pavilion and karst rock area to complete this activity.

<u>Materials</u>: Karst Model. Dye Trace Map. Plant root model. Photos of: 1) stormdrain in a neighborhood, 2) disappearing stream with pollution, 3) clean creek with whirlpool of water entering the aquifer, 4) Lady Bird Lake after a rainstorm, 5) aerial of Barton Springs, 6) Barton Springs Salamander, and 7) 10 ft. plant root.

Safety Considerations:
Slippery Surface

Directions: First group follows the order in this lesson.
The second group goes to 1) Windmill, 2) Karst Watering Holes, 3) Family Pavilion, and 4) Raintower and skips the Recharge Creek and Karst Boulder on the Path to the Family Garden since they covered that on the way to the cave.

KARST AND WATER LESSON

SITE: RAINTOWER at the rain barrel, which is halfway up.

RAINWATER HARVESTING: Look into the rainbarrel and ask students, "What are we looking at? (water) Where did the water come from?"
EXPLORE: "Find where the rainwater outside is being channeled into the barrel." (off the roof)
EXPLAIN: "Catching rainwater from the roof prevents flooding on the land below and saves the water for use on the gardens during drought."

SITE: RAINTOWER at the top

RECHARGE ZONE: Tell students, "Make a watershed out of your hands, then spread your fingers to represent holes and cracks in the land. This watershed is full of holes and cracks that recharge water to the Edwards Aquifer." Explain recharge (filling up).
EXPLORE: Ask students to look at the landscape towards the cave and ask, "Can you see the holes and cracks that recharge water underground?" (No)
EXPLAIN:
"Even though the watershed in the Edwards Aquifer Recharge Zone is rocky and full of holes, it is covered by native plants that are adapted to the dry, rocky soil so we can't easily see the holes in the ground. We need to investigate the land more closely to find the openings."

SITE: KARST BOULDER ON PATH TO THE FAMILY GARDEN

WEATHERING: "What formed the holes in this piece of limestone, weathering or erosion?" (Weathering.)
EXPLANATION: "Water sits on the rock after a rain and slowly dissolves the limestone over hundreds and thousands of years. This is chemical weathering, because the limestone and rainwater chemically react and dissolve. Physical weathering would be the pounding of water on the rock to form holes. This is NOT the type of weathering that forms karstic limestone. Weathering is the decomposition of a rock. Erosion would be when the rock is picked up by water and moved."
KARST: "If we described this rock as holey, what could be a confusion about the meaning of holey?" (People might think you mean holy).

EXPLANATION: "Scientists use the word **"karst"** to describe holey rock or land so that the meaning is clear, that the holes are physical openings. The Edward's Aquifer is made of karstic limestone. The holes are the paths through which the groundwater flows. When the holes are at the surface, like this rock example we are looking at, then water can **recharge**, or fill up, the underground aquifer."

SITE: BRIDGE OVER RECHARGE CREEK

RECHARGE CREEK: Tell students, "Follow the slope of the land with your hands until your hands come together in a watershed. "What should be flowing at the bottom of this watershed basin where the channel for the creek is located? (water) Where did it go? (underground)
EXPLAIN: There are holes in this creek bottom so water recharges, or fills up, the aquifer rather than staying on the surface. Most of the larger recharge holes are covered by roots or gravel so they are not easy to identify except when water is flowing into them."

SITE: WINDMILL

DRINKING WATER SOURCE: "This is an old windmill from when this land was a cattle ranch. What are windmills used for now?" (generate electricity – wind energy) What do you think this windmill was used for back when this was a ranch and was far, far away from City services?" (The energy from the windmill was used to pump water from underground.)
EXPLAIN: "The only place someone can get water naturally in a karst recharge area is underground. No water stays on the surface in creeks because of all the holes. In present time the City of Austin has pipes that run from the Co. River out to the LBJWC so the water in the faucets is from the Co. River. The well is no longer in use."
EVALUATE: "Where does the water in your faucet come from?" (Co. River)"

POLLUTION: "Since the rancher did not have City services, he used the cave we will enter today as a trashcan. What was he doing to his well water? (polluting it) That is like drinking water from the bottom of a trashcan! Do you think the rancher understood that when he put trash in his cave that he was polluting his water? (probably not) Do people in the City of Austin do things that could pollute our water? (yes) Whenever anyone throws trash on the ground, it ends up in the Colorado River and that is our drinking water! The City has work crews that clean out the litter, otherwise it would be the same problem as the rancher, with water coming from the bottom of a trashcan. If everyone picked up 3 pieces of litter a day, would Austin be cleaner? (yes) Is it difficult to pick up 3 pieces of litter a day? (not really) Let's all commit to doing that so we have clean water!"

SITE: KARST WATERING HOLES in the LBJWC Family Garden.

Directions: Direct students to pair with a partner, pick a karst rock to investigate and stand by it.
ENGAGE: "How do you think water travels through these limestone boulders?" (through the holes)

EXPLORE: Demonstrate the investigation while explaining directions: Fill a watering can with water and ask a student to pour it on the surface of the karst rock (recharge), while you observe the bottom of the rock to find the discharge. Students should trade places and repeat. Spend about 10-15 minutes allowing students to explore.

SITE: FAMILY PAVILION (Return to the pavilion to use the karst model, dye trace map and photos.)

Questions to help students connect their exploration to the concept under investigation:

- What happened to the water you poured on the karst rock? (it flowed through the rock into the stream). The place where the water flowed out of the rock is called a spring.
- How does water flow underground through the rock? (through big holes)
- Were the flow paths in the rock you tested all the same or were there different paths? (Different paths - You cannot really see the path, just the recharge and discharge, which allows you to infer the path the water took.)
- Does the water flow quickly or slowly through the karst rock? (quickly)

EXPLAIN

(Dye trace poster) "City hydrogeologists used colored dye to do an experiment similar to the one you just did: they poured colored water into large cave openings and checked to see if it came out at Barton Springs. The cave at LBJWC was tested and the results showed the water in the cave did discharge at Barton Springs!"

(Photo: Barton Springs pool) "How many of you have been to Barton Springs? That water you swim in came from this area and it only took approximately 1 week to travel through the caves to Barton Springs! Is 1 week enough time for anything to break down completely? (no) That means if pollution gets in the groundwater in the recharge zone, there is not enough travel time for it to break down, and there is nothing in the large passages of the aquifer to filter, so the pollution will end up at Barton Springs."

(Photo: Barton Springs salamander) "The Barton Springs salamander is a unique species that is endangered because it could become extinct, or disappear forever, if pollution in the aquifer killed it. It would also contaminate Barton Springs where Austinites like to swim. Also, there are people in Sunset Valley, Buda and Kyle that still get their drinking water from the Barton Springs Edwards Aquifer."

RESPONSIBILITY AND PERSONAL ACTIONS:

(Photo: stormdrain) "Did you locate the stormdrain that was near your house? The homes out here on the recharge zone also have stormdrains on their streets. Just like the drain on your street, it goes to a creek, but the creek here is on the recharge zone, which means it has holes that drain water into the aquifer."

(Photo: dirty creek disappearing into sinkhole) "The creeks in the recharge zone go underground, along with any pollution that is in the water.

How could this creek get cleaned up? (The neighborhoods could learn to do the things we have learned at Earth Camp: pick up litter, scoop the poop.)"

BENEFITS OF NATIVE PLANTS TO WATER QUALITY:

"Can plants in a yard help keep the water clean? (yes, they act as a filter)

EXPLORE: Let's look at different kinds of plants to determine which would grow and filter the water best over the aquifer." **(Demo plant root model)** Pick different students to pull out the roots of the 1) non-native grass; 2) native grass; 3) wildflower.

EXPLAIN: "Austin's climate is mostly drought/flood/freeze/hot, however, the weather, is what is happening today. The long periods of heat and drought can make it hard for a plant to survive since it needs water. Which part of the native plant has adapted in a way that enables the plant to get water even during long dry periods? (the roots) Why are the roots longer? (because there is groundwater deep underground)"

(Photo: Little Bluestem Grass root) "Native plants have changed and adapted over thousands of years to survive in the harsh climate of Austin. Physical adaptations take many lifetimes to change, so you cannot buy a non-native plant with short roots, plant it in your Austin garden and expect it to adapt and survive."

Non-native plants and chemical use: "What kinds of chemicals do people sometimes use to try and get non-native plants to survive in Austin? (fertilizers, extra water, pesticides)"

Look at native grass lawn behind the pavilion. "Native plants do not need any chemicals or extra water to survive. The native lawn is surviving because it has roots going deep to the water table. The LBJWC does not add any chemicals to the lawn. This is best for the groundwater because the water stays chemical-free, and the roots channel water underground where it gets better filtration as it travels along the deep roots of the plants."

EVALUATE: "What kind of plants will grow in this rocky area of the recharge area? (native plants). Is planting a native plant in your yard or garden an action you can take to help the watershed, creeks and springs stay healthy? (yes)"