

Living with the Trinity

Lesson Plan 2: The Trinity River Watershed

Learning Objective:

Students will begin to understand how all of the living things in and around the Trinity River Watershed affect each other in their daily lives.

Lesson Activities:

Students will use a bed sheet, wads of paper and a few buckets to create an interactive model of the Trinity River Watershed.

Student Performance Objectives:

- The student will learn that a watershed is composed of reservoirs, rivers, streams, lakes, creeks, groundwater, wetlands and bogs.
- The student will use their knowledge of the water cycle to help them understand where water comes from.
- The student will use a map to identify water sources and water flow for the North Texas Trinity River Watershed.
- The student will identify and begin to understand that water use of the population that lives within a particular watershed has an effect on the quality of the water in the local watershed.
- The student will recognize and apply their understanding of pollution as it relates to water quality within the North Texas Trinity River Watershed.

Vocabulary:

watershed, flood, waste water treatment plant, pollution, flood, impervious surface, runoff

Materials

- A flat bed sheet large enough to fit your students around three of its sides (to represent the Trinity River Watershed)
- One sheet of blue paper per student (to represent water)
- About five sheets of brown paper (to represent various pollutants)
- Tape
- Markers
- Paper
- Colored dot stickers (to represent the students' homes)
- Two large buckets or tubs (to catch the "water." One will represent the Trinity River and the second will represent a wastewater treatment plant)
- Three grocery bags (to hold the wads of paper)
- One copy of the *Map of the Trinity River Watershed* for each student (included)
- One copy of the *Visiting the Trinity Activity* sheet for each student (included)
- One copy of the *Trinity River Watershed Scenarios* handout for each student (included)

Before You Start:

Determine whether or not the students know enough about the water cycle to participate successfully in this lesson. If you feel that they are not well versed in the water cycle, consider conducting The Natural Water Cycle/Urban Water Cycle Lesson beforehand.

Once the students have a grasp of the concepts of the water cycle, proceed to:

- Take the five sheets of brown paper and rip them into eighths. Ball up the paper and store them out of site in a grocery bag. These wads will be used later to represent water contaminated by sewage, sediment or other contaminants as described in the scenarios.
- Locate an area inside large enough to accommodate the spread-out sheet and all of your students comfortably. Lay the sheet and materials out before you begin.
- Prepare to watch video from the Internet with your students. If you are unsure how to display a Web site using a projector or other equipment, ask your school computer/technology teacher or librarian for help. Otherwise, you may want to do those portions requiring the group to watch Internet video in a computer lab. Be sure to bookmark the sites ahead of time.

Background Information:

A **watershed** is a land area that drains water to a creek, stream, river or lake within a particular area. Each watershed is determined by connecting the tallest topographic points on a map between two adjacent areas. Each small watershed is considered a part of a larger regional watershed, which is then seen as a part of an even larger watershed, etc., ultimately forming a global watershed. This is so because all the water that has ever been on the planet is still here. The water that the dinosaurs drank millions of years ago is still the same water that repeatedly returns to the earth through the process known as the **hydrologic** or **water cycle**. (If your students are unfamiliar with the water cycle, begin with The Natural Water Cycle/Urban Water Cycle Lesson Plan as a lead in to this lesson.) So as water moves through the water cycle and from one watershed to another, the watershed is refilled by rain, snow, sleet or hail which is **precipitation** that could have come from a watershed millions of miles away. The watershed for the North Texas region is known as the **Trinity River Watershed**. This watershed is shared by nearly nine million Texans and meets the needs of about 40% of the state's 24,500,000 people.

Regardless of where we live, or what watershed we live in, our used water is piped to a wastewater treatment plant so that it can be cleaned and then reused. In urban and suburban areas, wastewater travels through underground sewer pipes to the **wastewater treatment** plant. At this facility, various processes treat the water before it is sent into parts of the watershed including creeks, streams and rivers, and some of it is captured and contained in man-made lakes known as **reservoirs**. Before this same water can be used in our homes or businesses, it will first go to a separate water treatment plant to be further cleaned and purified for drinking.

TEKS (Texas Essential Knowledge and Skills) for:

3rd Grade:

Science: 3.2E; 3.3C; 3.5A, B; 3.8A, B, C, D

Language Arts: 3.20A; 3.23A, B, C

Social Studies: 3.4A, B, D; 3.5D; 3.10C; 3.11A, B; 3.16E, F

4th Grade:

Science: 4.2E; 4.3C; 4.5B; 4.10A

Language Arts: 4.18A; 4.21A, B, C

Social Studies: 4.6A; 4.7B; 4.8D; 4.9A, B, C; 5th Grade:

Science: 5.2E; 5.3C; 5.5B

Language Arts: 5.17; 5.18A; 5.21A, B, C

Social Studies: 5.6A; 5.7B

2010-2011 School Year Science TEKS

3rd Grade: 3.1B; 3.2C, F; 3.3C

4th Grade: 4.1B; 4.2C; 4.3C

5th Grade: 5.2E; 5.3C; 5.5B

Time Needed: One Hour

How to Start:

- Walk the students over to the area where you have the sheet and materials waiting. Say: *Today, we're going to take this sheet and turn it into a model of a river. Who can name a river that is near or in our city?* (Answers may vary) *The major river in our area is the Trinity River.*
- Define "watershed" for the students and allow them to take notes if needed.

Steps

1. Spread the sheet out on the floor. Label the entire sheet the "Trinity River Watershed" using paper and tape to secure the label to the top middle of the sheet. Also, label the sheet with "North," "South," "East" and "West," with "South" being the end where no students are standing and where you place the buckets.
2. Then, choose an area to the right side and label it "Dallas." To help show scale, use an 11.5x17 inch piece of paper or tape two pieces of paper together to represent Dallas.
3. On the Dallas paper, draw a rectangle and label it the name of your school.
4. Give each student a colored dot sticker and ask them to write their initials or first name on it. Let all students put their dots on the Dallas paper around the school rectangle area.
5. Next, add Fort Worth to our model, using two pieces of paper taped together (or 11.5 x 17 inch piece of paper) with the city's name written as the title. Also add the city of Gainesville, Texas which is to the North of Dallas, and also add Galveston, Texas, to our model at the bottom of the sheet where the "water" will flow off. Allow students to add landmarks and dots if time permits. Allow a few volunteers to add colored stickers to represent the houses of people they know who live in each city.
6. Ask the students if they can name any other cities nearby besides the cities named. Write these city names on 8.5 x 11 inch paper and add them to our model. Allow the children to add dots to represent the people they know who live there if time permits.
7. Give every student a sheet of blue construction paper to represent water. Ask them to tear the page in half, then in half again. Then, tear the four pieces in half and wad up each of the eight pieces into balls. Collect all of the wads and store them in something that is easy to carry, like a grocery bag.
8. Next, have the students stand around the top and the sides of the sheet. Explain that they are going to pick up the sheet and work together to show how water moves through our watershed. The object is to keep the blue wads of paper on the sheet until it is time to dump them into the bucket. Label the bucket, "Trinity River."

9. **Trinity River Watershed Simulation:** Tell the students you are going to read some short stories or scenarios. Read a scenario from the Trinity River Watershed Scenarios (Teacher's Version) sheet below. Every time you say, "And then it FLOWS INTO THE TRINITY RIVER AND RETURNS TO THE WATER CYCLE," ask the students to say it with you. Then, they work together to lift up the sides of the sheet so that the blue paper rolls off the sheet (or the watershed) and lands in the bucket labeled "Trinity River."
 - a. The scenarios are ordered in increasing difficulty, so start with number one and then go in numerical order to make sure the students understand the concepts. Feel free to add your own scenarios to customize the experience for your students.
 - b. At the conclusion of each scenario, choose a student or two to help sort the blue wads from the brown and place them back in their bags.
10. Hand each student a copy of the *Trinity River Watershed Scenarios* (Students' Version). Allow students to work together to review the activity and answer the questions. Discuss aloud and answer any remaining questions that arise.
11. Watch the introductory video on the "Living with the Trinity" Web site home page: <http://trinityrivertexas.org/> up to the part where they talk about Leslie Stemmons. Ask students to think about why it would be important for people who live in the Trinity River Watershed to watch this video.
12. **Mapping Activity:** Give each student a copy of the *Map of the Trinity River Watershed* that shows the river and the cities that surround it. Help students find their city, and mark it by drawing a star. Have students trace the flow of the river from upstream to downstream with their finger so they understand how all of the areas affect each other. Use a highlighter to outline the river's flow from their town to the Gulf of Mexico.

Wrap Up:

Ask students to visit or observe part of the Trinity River by locating a nearby creek, lake or stream. The site could be near their home or any place they can easily access. Ask them to complete the *Visit the Trinity* worksheet. If your school is located near the river, a stream, or creek, possibly take students to visit it as a classroom field experience.

Curriculum Extensions:

Science

- Conduct the Water Quality Lesson with your students.
- Ask students to brainstorm ways they can recycle or reuse the wads of paper from this activity. Allow the class to decide which method they will use to responsibly reuse the paper.

Art

Create a collage showing where water comes from and what water is used for.

Language Arts

Invent a Water Protection Superhero and create a comic strip (using speech bubbles) describing a scenario where the Water Protection Superhero swoops in to save the day.

Student Web Activities for Centers or Small Groups:

Trinity River Educational Interactives from the Center for Global Environmental Education
<http://www.trinityrivertexas.org/education/interactives>

Environmental Education for Kids from the Wisconsin Department of Natural Resources
<http://dnr.wi.gov/eeek/>

Floods from FEMA for Kids
<http://www.fema.gov/kids/floods.htm>

Teacher Web Resources:

Water teaching resources from the Environmental Protection Agency
<http://epa.gov/teachers/water.htm>

Trinity River Audubon Center
<http://www.trinityriveraudubon.org/site/PageServer?pagename=Home>

Lesson plan illustrating human usage of water with sponges and water.
http://www.eduref.org/Virtual/Lessons/Science/Environmental_Education/ENV0039.html

Website from the Center for Innovation in Engineering and Science that allows teachers from around the world to submit their students' average water usage through the Down the Drain Project and view the data.
<http://www.ciese.org/curriculum/drainproj/index.html>

City of Dallas Storm Water Management site with experiments, videos and volunteer opportunities:
<http://www.wheredoesitgo.com/index.html>

Online diagram from the Environmental Protection Agency showing how urbanization affects water infiltration
<http://www.waterblogged.org/wp-content/uploads/2008/05/water-cycle-in-an-urban-setting.gif>

Trinity River Watershed Scenarios (Teacher's Version)

Read these scenarios as your students use the bed sheet and the paper wads to simulate the Trinity River Watershed. Use the responses listed below to guide discussion and to check the students' answers to their version of the *Trinity Watershed Scenarios*.

1. Say: *You and your family visit the drive-through of your favorite restaurant. You toss your leftovers and trash out of the window when you're done.*
 [Teacher: Toss about 10 brown paper wads on to the sheet.]
 Say: *It rains really hard in our city*
 [Teacher: Toss on a bag full of blue wads].
 Say: *What do you think happens to your trash? (Allow students to respond). It gets swept up by the water and eventually flows into our creeks and streams and from there it... FLOWS INTO THE TRINITY RIVER!* (If you have already taught about the water cycle, you can have the students include "AND RETURNS TO THE WATER CYCLE" in their statement.)
 [Students: Try to make all of the wads land in the "Trinity River" bucket.]
 Ask: *What happens if we all continue to throw trash on the ground? What happens to our water? What happens to the people who live downstream? What happens if the people upstream from us do the same thing?* Allow students to respond.

2. Say: *It rains really hard in our city.*
 [Teacher: Toss about 20 blue paper wads onto the sheet and let the students roll them around as you read making quiet noises pretending to be the rain].
 Say: *The water flows over bridges, streets and parking lots that are covered with yucky oil from our cars and buses. Surfaces that cannot absorb water are called **impervious surfaces**. Water flowing over impervious surfaces can not be absorbed by the ground. Instead, it flows right to our streams and rivers and is called **runoff**.*
 [Teacher: Toss on about 10 brown wads to show the oil.]
 Say: *The water eventually flows into our creeks and streams and from there it... FLOWS INTO THE TRINITY RIVER AND RETURNS TO THE WATER CYCLE!*
 [Students: Try to make all of the wads land in the "Trinity River" bucket.]

3. Say: *Everybody in our class takes their dog outside for a potty break without cleaning up their dog's waste.*
 [Teacher: Toss on all of the brown wads.]
 Say: *Then, it rains hard in our city.*
 [Teacher: Toss on about 20 blue paper wads and let the students roll them around and make soft rain noises.]
 Say: *The water eventually flows into our creeks and streams and from there it... FLOWS INTO THE TRINITY RIVER AND RETURNS TO THE WATER CYCLE!*
 [Students: Try to make all of the wads land in the "Trinity River" bucket]
 Ask students to look in the bucket. Let students discuss what they could have done instead to keep the water clean.

4. Say: *At home, each of our family members flushes the toilet about three times a day.*
 [Teacher: Toss on about 10 wads of blue paper and 5 wads of brown paper]
 Say: *The waste water goes out of our house. Where do you think it goes? (Students will most likely suggest that it goes through our pipes). Tell them that it leaves our house through the pipes and goes to a waste water treatment plant where they clean the water.*
 [Teacher: Introduce the “Waste Water Treatment Plant” bucket and put it on the ground next to the “Trinity River” bucket. Ask the students to make the water and waste flow to the Waste Water Treatment Plant bucket.]
 Say: *After the water is treated, THEN it...flows into our creeks and streams and from there it... FLOWS INTO THE TRINITY RIVER AND RETURNS TO THE WATER CYCLE!*
 [Teacher: Have a student volunteer remove the brown wads and dump just the blue wads in the “Trinity River” bucket.]

5. Ask: *What was difference between the first, second and third scenarios and this (the fourth) scenario? (Allow the student’s time to think and discuss as a class. Eventually they will say that the difference is the waste water treatment plant).*
 Say: *Right! When things go through our homes, they also go through pipes and in that way are sent to the waste water treatment plant before going into our creeks and streams and eventually into our river! When things are washed away from our streets, like the litter you threw out your window, or the oil that drips onto our driveways and roads or even animal waste that is not picked up . . . all of that ends up directly into our creeks, stream and river without ever being cleaned!*

6. Say: *Just as you do at home, people all over the city use the restroom three to four times a day*
 [Teacher: Toss on all of the brown wads and a bag full of blue wads.]
 Say: *Like in the last scenario, the waste water goes out of our house, through the pipes and to the waste water treatment plant where they clean the water before it flows to the river and returns to the water cycle.*
 [Teacher: Put the “Waste Water Treatment Plant” bucket on the ground next to the “Trinity River” bucket. Ask the students to begin to pour the water and waste into the Waste Water Treatment Plant bucket.
 Say: *BUT! (stop the students before they are able to pour all of the water and waste) before the water can be treated, it rains really hard and floods in our city. Now, I don’t mean a little rain or even a regular Texas rain, I mean a rain that is so hard and fast or one that lasts so long that the ground can’t hold it anymore and neither can the streams, rivers and lakes! A **flood** happens when the ground is saturated, like a sponge, and there just isn’t any place left for the water to go. This type of extreme flooding doesn’t happen very often but if it does, sometimes water gets into the waste water sewer system. What do you think might happen to the water being treated by the Waste Water Treatment Plants? Do you think they would be able to handle all the extra water?*

[Teacher: Pour a bag of blue paper wads into the waste water treatment plant until the bucket overflows.]

Say: *So if the plant can't handle all of the extra water, can it handle all of the waste that needs to be treated? What happens to waste that the Waste Water Treatment Plant can't handle? So, some of the water is treated and some of it is not.*

[Teacher: Dump the contents of the Water Treatment bucket back onto the sheet].

Say: *THEN it...FLOWS INTO THE TRINITY RIVER AND RETURNS TO THE WATER CYCLE!*

Ask: *What do you think happens to the waste from our houses that ends up in the Trinity River? How would that affect the people living downstream in the cities at the bottom of our watershed? If this happens to the town or towns upstream from us, how would it affect us? What could help?*

Allow for responses.

[Students: Have several student volunteers sort the wads].

7. Ask students to create their own scenario describing a different way that people in the area might pollute the Trinity River. Allow a few students to share. Add the appropriate wads of paper as they say their ideas aloud just as you did for the scenarios above.
8. Ask students to discuss what they will do differently in their lives to help keep the Trinity River clean?

Name _____ Date _____

Trinity River Watershed Scenarios (Students' Version)

1. You and your family visit the drive-through of your favorite restaurant. You toss your leftovers and trash out of the window when you're done. It rains really hard in our city. What do you think happens to your trash?

What happens if we all continue to throw trash on the ground? What happens to our water?

What happens to the people who live downstream?

What happens if the people upstream from us do the same thing?

2. It rains really hard in our city. The water flows over bridges, streets and parking lots that are covered with yucky oil from our cars. Then, where does that water go?

Surfaces that cannot absorb water are called **impervious surfaces**. Water that is not absorbed by the ground, but instead flows right to our streams and rivers is called **runoff**.

What do you think would happen if it rains a lot and a city has more streets, bridges and parking lots than it does grass and soil?

3. Everybody in our class takes their dog outside for a potty break without cleaning up their dog's waste. Then, it rains hard in our city. What happens to our water?

What could we do differently to keep the water clean?

4. At home, each of our family members flushes the toilet about three times a day. The waste water goes out of our house. Where do you think it goes?
5. What was different between the scenarios in #1, #2 and #3 and the scenario in #4?
6. Just as you do at home, people all over the city use the restroom three to four times a day. BUT, before the water can be treated, it rains really hard and floods in our city. Now, I don't mean a little rain or even a regular Texas rain, I mean a rain that is so hard and fast or one that lasts so long that the ground can't hold it anymore and neither can the streams, rivers and lakes!

A flood happens when the ground is saturated, like a sponge, and there just isn't any place left for the water to go. This type of extreme flooding doesn't happen very often, but if it does, sometimes water gets into the waste water sewer system. What do you think might happen to the water being treated by the Waste Water Treatment Plants?

If the plant can't handle all of the extra water, can it handle all of the waste that needs to be treated? What happens to waste that the Waste Water Treatment Plant can't handle?

What do you think happens to the waste from our houses that ends up in the Trinity River?

How would that affect the people living downstream in the cities at the bottom of our watershed?

If this happens to the town or towns upstream from us, how would it affect us?

7. Create your own scenario describing a different way that people in the area might pollute the Trinity River.

Name _____ Date _____

Visit the Trinity Activity

Visit or observe part of the Trinity River by finding a nearby creek, lake or stream. It can be near your home or one you ride over on your way to school.

Draw a picture of the river, creek, lake or stream. Do you know the name of the creek, river or stream?

What does it look like?

What does it smell like?

Do you see any animals or fish in or around the water? Do you think this water is a good home for animals and fish? Why or why not?

Name _____ Date _____

Trinity River Watershed Assessment

1. Draw a picture of the Trinity River Watershed on a separate sheet of paper. Label the Trinity River and all of the towns that were on our model.
2. How was our model like the actual Trinity River Watershed? How was it different?

Our City:

3. Surfaces that cannot absorb water are called _____ **surfaces.**
4. Water that is not absorbed by the ground, but instead flows right to our streams and rivers is called _____.
5. What is a flood?
6. When rain falls and gets absorbed by the ground, where do you think that water goes?
7. When the rain falls on a surface that cannot absorb the water, like a bridge, street, parking lot or driveway, where do you think it goes?
8. If a city has a lot of parking lots, streets and driveways and not many yards, parks and fields, what do you think will happen to the water in their rivers?
9. What could be done to help in this situation?

Our Home:

10. List two ways that water can travel from our house and through the pipes?
11. What happens to water that goes through our pipes?
12. What happens to our river when we flush old medicine down the toilet? Or when we throw cooking oil down the drain?
13. What happens to water that does not go through our pipes?
14. What happens to our river when we dump old medicine or cooking oil on our front yard?

Trinity River Watershed Assessment
[POSSIBLE STUDENT ANSWERS]

1. Draw a picture of the Trinity River Watershed. Label the Trinity River and all of the towns that were on our model. **Answers will vary.**
2. How was our model like the actual Trinity River Watershed? How was it different? **Answers will vary. Our model had rain and cities like the actual watershed, but it did not have roads. Also, the real watershed does not move like we moved our sheet.**

Our City:

3. Surfaces that cannot absorb water are called **impervious surfaces**.
4. Water that is not absorbed by the ground, but instead flows right to our streams and rivers is called **runoff**.
5. What is a flood? **Answers will vary. When more precipitation falls than the ground can absorb, causing an overflow of water that covers the land.**
6. When rain falls and gets absorbed by the ground, where do you think that water goes? **Answers will vary. It flows underground and into our streams and creeks.**
7. When the rain falls on a surface that cannot absorb the water, like a bridge, street, parking lot or driveway, where do you think it goes? **Answers will vary. Into our streams, creeks and river.**
8. If a city has a lot of parking lots, streets and driveways and not many yards, parks and fields, what do you think will happen to the water in their rivers? **Answers will vary. There will be too much water in our rivers and it will be dirty from all of the oil and waste in the runoff.**
9. What could be done to help in this situation? **Answers will vary. We can pick up after our pets, ask our parents to keep our cars working properly, pick up trash so that it doesn't flow into our river.**

Our Home:

10. List two ways that water can travel away from our house? **Answers will vary. Through our gutters and through our pipes.**
11. What happens to water that goes through our pipes? **Answers will vary. It gets cleaned, then ends up in our river.**
12. What happens to water that does not go through our pipes? **Answers will vary. It goes straight to our river, streams and creeks.**
13. What happens when we dump old medicine or cooking oil on our front yard? **Answers will vary. Some of it may run off into the gutters and then into the Trinity River.**

Map of the Trinity River Watershed

(From http://upload.wikimedia.org/wikipedia/commons/0/09/Trinity_Watershed.png)

