

WHAT IS STORMWATER?

LESSON 2

GRADE LEVEL(s):

2nd, 3rd, and 4th grade

MAIN CONTENT AREA FOCUS:

Science and Social Studies

SKILLS:

Discussion, Critical Thinking

LESSON DURATION:

50 minutes

GROUP SIZE:

Small groups of two to three students

PROGRAM DEVELOPED BY

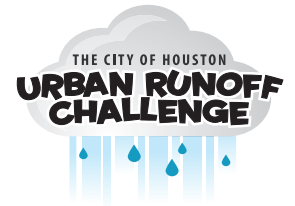
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LEARNING OBJECTIVES

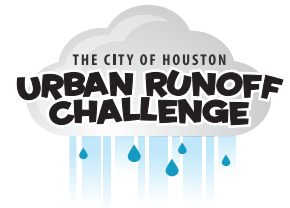
- THE STUDENTS WILL...**
- 1 Understand what stormwater is by watching a video and listing five questions to understand or explore the topic further.
 - 2 Understand the effects of polluted stormwater by viewing a demonstration and answering facilitation questions.
 - 3 Discuss and list strategies to prevent stormwater pollution in their local community.
 - 4 Create an informational flyer to remind their community of basic techniques to help prevent polluted stormwater from draining into local storm drains.

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TEKS OBJECTIVES

2ND, 3RD, 4TH GRADE:

§112.13. Science, Grade 2, (b) Knowledge and skills.

- (2) **Scientific investigation and reasoning.** The student develops abilities necessary to do scientific inquiry in classroom and outdoor investigations. The student is expected to: (A) ask questions about organisms, objects, and events during observations and investigations; (B) plan and conduct descriptive investigations such as how organisms grow; (D) record and organize data using pictures, numbers, and words; (E) communicate observations and justify explanations using student-generated data from simple descriptive investigations; and (F) compare results of investigations with what students and scientists know about the world.
- (3) **Scientific investigation and reasoning.** The student knows that information and critical thinking, scientific problem solving, and the contributions of scientists are used in making decisions. The student is expected to: (A) identify and explain a problem in his/her own words and propose a task and solution for the problem such as lack of water in a habitat; (B) make predictions based on observable patterns
- (9) **Organisms and environments.** The student knows that living organisms have basic needs that must be met for them to survive within their environment. The student is expected to: (A) identify the basic needs of plants and animals; (C) compare and give examples of the ways living organisms depend on each other and on their environments such as food chains within a garden, park, beach, lake, and wooded area.

§112.14. Science, Grade 3, (b) Knowledge and skills.

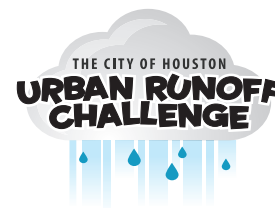
- (9) **Organisms and environments.** The student knows that organisms have characteristics that help them survive and can describe patterns, cycles, systems, and relationships within the environments. The student is expected to: (A) observe and describe the physical characteristics of environments and how they support populations and communities within an ecosystem; (C) describe environmental changes such as floods and droughts where some organisms thrive and others perish or move to new locations.
- (10) **Organisms and environments.** The student knows that organisms undergo similar life processes and have structures that help them survive within their environments. The student is expected to: (A) explore how structures and functions of plants and animals allow them to survive in a particular environment.

§112.15. Science, Grade 4, (b) Knowledge and skills.

- (1) **Scientific investigation and reasoning.** The student conducts classroom and outdoor investigations, following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to: (B) make informed choices in the use and conservation of natural resources and reusing and recycling of materials such as paper, aluminum, glass, cans, and plastic.
- (2) **Scientific investigation and reasoning.** The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to: (A) plan and implement descriptive investigations, including asking well-defined questions, making inferences, and selecting and using appropriate equipment or technology to answer his/her questions. (F) communicate valid, oral, and written results supported by data.

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TEKS OBJECTIVES

2ND, 3RD, 4TH GRADE:

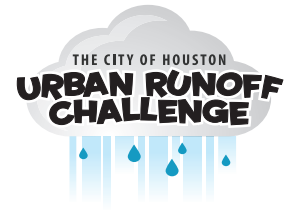
- (3) **Scientific investigation and reasoning.** The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to: (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
- (7) **Earth and space.** The students know that Earth consists of useful resources and its surface is constantly changing. The student is expected to: (C) identify and classify Earth's renewable resources, including air, plants, water, and animals; and nonrenewable resources, including coal, oil, and natural gas; and the importance of conservation.

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KEY VOCABULARY

AQUATIC ANIMAL

An aquatic animal is an animal, either vertebrate or invertebrate, which lives in water for most or all of its life.

[HTTP://EN.WIKIPEDIA.ORG/WIKI/AQUATIC_ANIMAL](http://en.wikipedia.org/wiki/Aquatic_animal)

DECOMPOSITION

(or rotting) The process by which organic material is broken down into simpler forms of matter.

[HTTP://EN.WIKIPEDIA.ORG/WIKI/DECOMPOSITION](http://en.wikipedia.org/wiki/Decomposition)

IMPERVIOUS SURFACES

Artificial structures such as pavements (roads, sidewalks, driveways and parking lots) that are covered by impenetrable materials such as asphalt, concrete, brick, and stone--and rooftops. Soils compacted by urban development are also highly impervious. [HTTP://EN.WIKIPEDIA.ORG/WIKI/IMPERVIOUS_SURFACE](http://en.wikipedia.org/wiki/Impervious_surface)

STORM DRAIN

(or storm sewer) Designed to drain excess rain and ground water from paved streets, parking lots, sidewalks, and roofs. Many storm drainage systems are designed to drain the stormwater, untreated, into rivers or streams.

[HTTP://EN.WIKIPEDIA.ORG/WIKI/STORM_DRAIN](http://en.wikipedia.org/wiki/Storm_drain)

STORMWATER

Water that originates during precipitation events. Stormwater that does not soak into the ground comes surface runoff, which either flows directly into surface waterways or is channeled into storm sewers, which eventually discharge to surface waters. [HTTP://EN.WIKIPEDIA.ORG/WIKI/STORM_WATER](http://en.wikipedia.org/wiki/Storm_water)

SURFACE RUNOFF

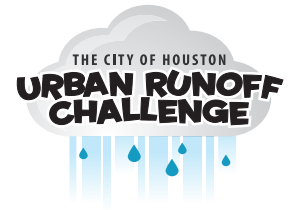
Water flow that occurs when the soil is infiltrated to full capacity and excess water from rain, meltwater, or other sources flows over the land. http://en.wikipedia.org/wiki/Surface_runoff

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MATERIALS

- [KWL Chart](#) (PDF)
- [Stormwater solutions](#) PDF
- [Collaborative Work Skills Rubric](#) (PDF)
- [Informational Flyer Rubric](#) (PDF)
- Mixing spoon
- Rubber gloves
- 1 gallon tall clear container
- 2 quarts of water
- 1 cup cooking oil
- 1/2 cup grass
- 1/2 cup paper cut small pieces
- 1/4 cup dark colored paint
- 2 table spoons of glitter
- Rubber duck
- White feathers or white feather boa
- Hot Glue sticks
- Hot Glue gun
- MS Word (OPTIONAL)
- MS PowerPoint (OPTIONAL)
- MS Publisher (OPTIONAL)
- Glogster (OPTIONAL - [LINK](#))
- Digital camera (OPTIONAL)
- Paper
- Magazines
- Glue
- Scissors
- Crayons
- Map Pencils
- Markers
- Stormwater Runoff (JPG)

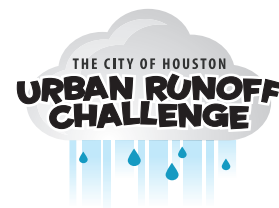
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LESSON PLAN

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

ENGAGE

Initiates the learning task. The activity should make connections between past and present learning experiences, and anticipate activities and organize students' thinking toward the learning outcomes of current activities.

OBJECTIVE

Students will understand what stormwater is by watching a video and listing five questions to understand or explore the topic further.

MATERIALS:

- [KWL Chart.PDF](#)

VIDEO(S):

- [Stormwater Runoff 101 \(YouTube\)](#)
- [Stormwater runoff \(JPG\)](#)

Teaching Strategies: Create interest; Raise questions and problems; Elicits responses that uncover students' current knowledge about the concept/topic.

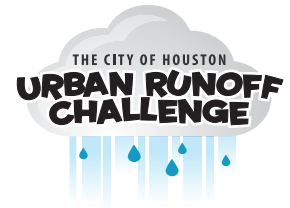
1. Create a **KWL chart** on the board.
2. Ask the class the following question: "What types of trash/waste has been seen around your neighborhood or city?" The list can include (but is not limited to): debris, oil, garbage, grass clippings, plastic bags, paint, bottles, six-pack rings, cigarette butts, grease, aluminum cans, or paper.
3. Ask the class: "What happens to that trash/waste when it rains? Where does it all go?" Write student responses within in the "K" portion of the chart.
4. Show students a video introducing the definition of "Stormwater Runoff 101." Watch the Stormwater Runoff video from 00:00 seconds to 00:50 seconds. Stop the video. Review with the class how Stormwater is created. Ask the class: "What do you want to know regarding Stormwater?" Write student responses within in the "W" portion of the chart. Responses may include: How does it happen? How can we prevent it? How can we reduce waste? How do we stop debris going down the storm drain? How is the city helping local communities to prevent Stormwater runoff? Does the polluted runoff affect our drinking water? What happens to the wildlife that is in the polluted runoff water?
5. Show the **stormwater runoff image** to the class. Ask student to review and explain the diagram.

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LESSON PLAN

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

EXPLORE

Provide students with a common base of experiences within which current concepts, processes, and skills are identified and developed.

OBJECTIVE

Students will understand the effects of polluted stormwater by viewing a demonstration and answering facilitation questions.

Teaching Strategies: Create interest; Raise questions and problems; Elicits responses that uncover students' current knowledge about the concept/topic.

PREPARE THE FOLLOWING AHEAD OF TIME: HOT GLUE WHITE FEATHERS ALL OVER A RUBBER DUCK OR WRAP A WHITE FEATHER BOA AROUND A RUBBER DUCK.

MATERIALS:

- Rubber duck
- White feathers or white feather boa Hot Glue sticks
- Hot Glue gun Mixing spoon Rubber gloves
- 1 gallon tall clear container
- 2 quarts of water
- 1 cup cooking oil
- 1/2 cup grass
- 1/2 cup paper cut small pieces
- 1/4 cup dark colored paint
- 2 table spoons of glitter

1. Demonstrate the following to the class:

- a. Pour 1 quart of water in a one gallon tall clear container. Tell students that the water represents rain.
- b. Ask a student volunteer to place a handful of paper into the water. Tell students that the paper represents a person throwing trash on an impervious surface (such as a road or driveway) and not picking it up. Tell students that when it rains the paper slides down the impervious surface and goes down the storm drain.

TIP: *Trash can release toxic chemicals into the water as it decays. Fish and aquatic animals sometimes become sick or die from eating trash floating in the water. Trash can also clog the waterways where fish and other animals live.*
- c. Ask a different student volunteer to place a handful of grass into the water. Tell students that the grass represents a person mowing the yard and not picking up the clippings. The grass slides down the impervious surface into the storm drain and flow into the local city lake.

TIP: *When grass clippings or leaf litter decay in water, the process takes oxygen away from fish and other aquatic animals. Fish and other aquatic animals need oxygen to live.*
- d. Ask a different student volunteer to pour a 1/2 cup of paint into the water. Tell students that the paint represents a person spilling paint on the driveway (which is an impervious surface), when it rains it drains into the storm drain. Ask students: "What do you think the word 'impervious' means?"
- e. Ask a different student volunteer to pour 1 cup of oil into the water. Tell students that the oil represents a car leaking oil/grease on an impervious driveway. Ask students: "When it rains, where does the oil go?"

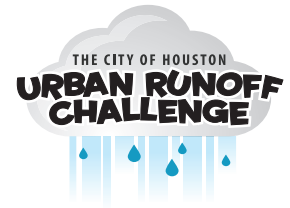
TIP: *Fluids used in cars can be poisonous to fish and other aquatic creatures. The fluids may saturate feathers or scales of aquatic life causing breathing issues / problems.*

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LESSON PLAN

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

EXPLORE CONTINUED

Provide students with a common base of experiences within which current concepts, processes, and skills are identified and developed.

f. Ask a different student volunteer to pour 2 table spoons of glitter into the water. Tell students that the glitter represents chemicals (such as pesticides, fertilizers, or pet waste) being washed down the storm drain.

TIP: *Animal waste in water can be a source of germs and disease and can lead to beaches being closed. Fertilizers in waterways can lead to excess plant growth. When these plants die and decay, the process uses up the oxygen that fish and other aquatic animals depend on. Pesticides in water can harm fish and other aquatic animals. People can also be harmed by pesticides in the water that they drink.*

g. Pour an additional 1 quart of water. Tell students that the additional water represents more rain. Use a mixing spoon to really mix up the “toxic stew.”

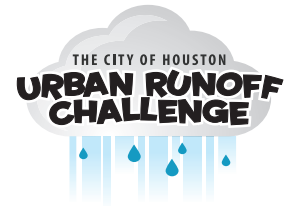
2. Ask the class: “Do you think a person would get sick if they swam in the water all day?” Ask students to elaborate further if they answered “yes” or “no.”
3. Put on rubber gloves and show the rubber duck (glued with feathers) to the class. Inform the class that the rubber duck represents a real duck with feathers. Ask: “What would happen if a duck swam in this water?” After receiving a few responses, submerge the rubber duck into the “toxic stew.” Allow the rubber duck to slowly float back to the top of the water line. The rubber duck is now covered in toxic materials. Allow students to see the effects of the “toxic stew” close up. Ask students: “Do the duck’s feathers look okay?” “What do you notice about the feathers?” “Is this a healthy and safe environment for the duck?” “Can the duck breathe fully?” “Would the duck get sick? Why?” Encourage class discussion.

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LESSON PLAN

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

EXPLAIN

Focus students' attention on a particular aspect of their engagement and exploration experiences, and provide opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to introduce a concept, process, or skill.

OBJECTIVE

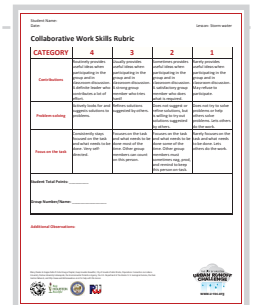
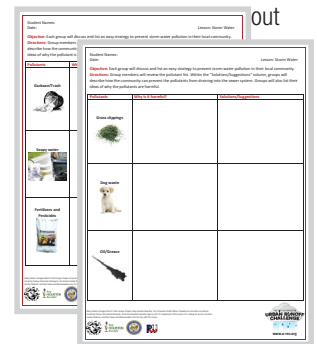
Students will discuss and list strategies to prevent stormwater pollution in their local community.

MATERIALS

- Stormwater solutions (PDF)
- Collaborative Work Skills Rubric (PDF)

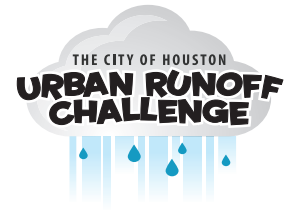
Teaching Strategies: Encourage students to explain concepts and definitions in their own words; Asks for justification (evidence) and clarification from students; Formally provides definitions, explanations, and new vocabulary; Uses students' previous experiences as the basis for explaining concepts.

1. Divide students into partners (two to three students per group). Pass one page of the “Stormwater Solutions” activity sheet to each group. Ask groups to discuss strategies to prevent polluted stormwater runoff from happening in their local neighborhood/city. Groups will focus on the following question: “What can be done to prevent polluted stormwater when it rains?” Groups will write their ideas on the provided activity sheet.
2. Visit each group to evaluate (using the Collaborative Work Skills Rubric) their progress and participation of each student. Ask groups to explain their strategies. Provide guidance if needed.
3. After the groups have completed the activity sheet, ask each group to present one of their solutions to the class. Through class discussion ask groups to edit their document if corrections are needed or if they would like to expand on their notes.



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LESSON PLAN

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

ELABORATE

Challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills.

OBJECTIVE

Students will create a draft flyer to remind their community of basic techniques to help prevent polluted stormwater from draining into local storm drains.

MATERIALS

- Paper
- Pencil

VIDEO

- *Your Stormwater Dollars* (YouTube)
- *Stormwater Runoff 101* (YouTube)

Teaching Strategies: Expects students to use vocabulary, definitions, and explanations provided previously in new context; Encourages students to apply the concepts and skills in new situations; Reminds and refers students of alternative explanations.

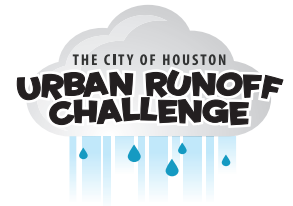
1. Show students the "Your Stormwater Dollars" video from 01:00 minutes to 4:58 minutes. Another video option is "Stormwater Runoff 101" from 00:50 seconds to 3:07 minutes.
2. Ask students: "Have you seen the additional solutions in your local neighborhood?" "How can we help inform the public of your ideas to help prevent polluted stormwater?" List students' ideas on the board. (Suggest creating a flyer as an option).
3. Ask students: "What would you place on the flyer?"
4. Discuss the basic components of an informational flyer.
 - a. Catchy title
 - b. Creative layout
 - c. Content specific pictures
 - d. Accurate content and vocabulary that describes useful strategies
5. Provide each student a blank sheet of paper. Instruct students to create a rough layout of their flyer. Encourage groups to provide peer assistance.
6. Walk around the classroom and evaluate the progress of each student's work. Provide suggestions if needed.

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LESSON PLAN

INQUIRY-BASED 5E INSTRUCTIONAL MODEL

EVALUATE

Encourage students to assess their understanding and abilities and provide opportunities for teachers to evaluate student progress.

OBJECTIVE

Students will create an informational flyer to remind their community of basic techniques to help prevent polluted stormwater from draining into local storm drains.

MATERIALS

- Informational Flyer Rubric (PDF)

Teaching Strategies: Observes students as they apply new concepts and skills; Assess student's knowledge and/or skills; Allows students to assess their learning and groups process skills; Asks open-ended questions such as, What evidence do you have? What do you know about the problem? How would you answer the question?

1. Review with the class what has been learned in today's lesson. Write statements within the "L" portion of the KWL chart. Ask student to elaborate their statements if needed.

2. Students will work individually to finalize their informational flyer. The flyer will showcase basic techniques to prevent polluted stormwater from draining into local storm drain systems. The flyer can be created as home work. Students have the option to create the flyer using:

- MS Word,
- MS PowerPoint,
- MS Publisher,
- Glogster, or
- Basic art materials (such as paper, magazines, glue, scissors, crayons, map pencils, markers, feathers, glitter, etc.)

Student Name: _____ Date: _____		Lesson: Storm water			
Informational Flyer Rubric					
CATEGORY	4	3	2	1	
Content	All facts in the flyer are accurate.	90-95% of the facts in the flyer are accurate.	80-85% of the facts in the flyer are accurate.	fewer than 80% of the facts in the flyer are accurate.	
Vocabulary	The student correctly uses major vocabulary words that may be unfamiliar to the reader.	The student correctly uses five vocabulary words and defines words that may be unfamiliar to the reader.	The student uses to use some vocabulary words, but may use 2 words incorrectly.	The student does not incorporate new vocabulary.	
Mechanics	Spelling and punctuation are correct throughout the flyer.	Spelling and punctuation are correct throughout the flyer after feedback from the teacher.	There are 3-2 spelling and punctuation errors in the flyer even after feedback from the teacher.	There are several spelling and punctuation errors in the flyer even after feedback from the teacher.	
Grammar	There are no grammatical mistakes in the flyer.	There are no grammatical mistakes in the flyer even after feedback from the teacher.	There are 2 grammatical mistakes in the flyer even after feedback from the teacher.	There are several grammatical mistakes in the flyer even after feedback from the teacher.	
Design	Graphics go well with the text and enhance the flyer.	Graphics go well with the text, but there are some things that distract from the text.	Graphics go well with the text, but there are some things that distract from the text.	Graphics do not go well with the text. The overall design may appear to be unprofessional.	
Student Total Points: _____					
Additional Observations: _____					

3. Encourage students to be creative with the flyer.

4. After completion, ask for student volunteers to share their flyer to the class. Ask volunteers to explain their flyer and the information presented on it.

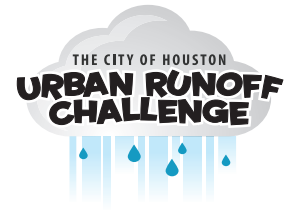
5. Evaluate student flyers by using the provided Informational Flyer rubric.

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ADDITIONAL RESOURCES:

EVENTS

Water Works Educational Center

Green Houston Calendar of Events

INFORMATIONAL SITES

City of Houston Public Works and Engineering

City of Houston Solid Waste Management Department

City of Houston Trash Facts (PDF)

Waste Collection Services

KWL Chart

Glogster for Educators

YOUTUBE VIDEOS

Your Stormwater Dollars

Stormwater Runoff 101

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Many thanks to Kappa Delta Pi Zeta Omega Chapter, Keep Houston Beautiful, City of Houston Public Works, Populations Connection via Indiana University Purdue University Indianapolis, the Environmental Protection Agency, the U.S. Department of the Interior U.S. Geological Service, the Rain Garden Network, and <http://www.worldofrenewables.com/> for help with this lesson.

