



Teacher Resources on Stormwater
Adapted for the Resilient San Carlos Project
May 4, 2022

Links to Resource Topics Below:

[Key Concepts to Understand Prior to Teaching](#)

[Background on Watersheds in the San Carlos Area](#)

[Green Schoolyard America's Suggested Sequence of Stormwater Concepts and Lessons](#)

[Step 1: Freshwater versus Saltwater - Our Focus is Freshwater](#)

[Step 2: Understanding Schoolyard Surfaces - Get Students Curious](#)

[Step 3: Watersheds - Understand the Big Picture](#)

[Step 4: Water Transport of Pollution: Understanding the Problem](#)

[Step 5: Pollution in the Food Chain - Understand the Problem](#)

[Step 6: Solutions - Put it all together](#)

Key Concepts to Understand Prior to Teaching

- **Freshwater versus Saltwater:** When teaching about stormwater, it is important to note that we are talking about freshwater. Teachers can connect content such as "The Water Cycle" and "Freshwater is a precious resource on a planet made mostly of saltwater" to this concept.
- **Stormwater and Runoff:** In order to get into the appropriate mindset for teaching about stormwater, it is helpful to remind yourself about what runoff looks like and where it goes during a rain event.
- **Food Chains:** The concept of a food chain is important to keep in mind as you think about where stormwater, and the pollution that it can carry, goes.

Background on Watersheds in the San Carlos Area

- [Flows to the Bay](#)
- [Flows to the Bay Teacher Resources](#)

- [Resilient San Carlos Project Background](#)
- [Flows to the Bay Watershed Map](#)

Green Schoolyard America's Suggested Sequence of Stormwater Concepts and Lessons

Step 1: Freshwater versus Saltwater - Our Focus is Freshwater

It is important to help students understand that when we're discussing stormwater, we're talking about freshwater. There are many ways to explore this topic. Two ideas are listed here.

- Taste test saltwater and freshwater
- [The Water Cycle](#)

Step 2: Understanding Schoolyard Surfaces - Get Students Curious

Outdoor experiments are an engaging way for students to observe and evaluate a variety of surfaces and slopes in their schoolyard, and for teachers to connect various science and math concepts. Students can investigate water flow patterns as well as the permeability or impermeability of surface materials. Equipped with more knowledge and questions, they will be better prepared to propose solutions and be watershed stewards at their school and in San Francisco Bay.

- [Investigate Different Surfaces and Slopes Outdoors.](#) In these experiments, students test different schoolyard surfaces and different slopes to observe the behavior of water. This activity is from "Science in the Schoolyard" from the Boston Schoolyards Initiative.
- [Rainy Day Investigation \(page 160\).](#) See "Follow the Water" activity on page 160 for an activity from The Trust for Public Land where students go outside when it's raining or just afterwards to map the movement of water in their school, while learning the locations of drain pipes, gutters, and storm drains.
- [Experimenting with Runoff \(PDF page 21, document page 16\).](#) See "When Rain Hits the Land" from the Save the Bay Watershed Curriculum. This is a series of experiments on water runoff and percolation.

Dive Deeper

- [Calculate Surface Runoff Area and Volume.](#) Grade 5-8. This math activity provides guidance on measuring schoolyard surface area and calculating surface runoff based on local rainfall patterns. This activity is called "Follow the Drop" from Earth Partnership for Schools.
- [Measuring Slopes in the Schoolyard \(page 42-45\).](#) Grade 6-8. In this math activity, students measure slope and percent slope in their schoolyard and potentially use it for

planning a rain garden. This activity is from Earth Partnership's Rain Garden Curricular Sampler.

- [Permeability of Materials](#). Grades K-8. Experiments on permeability and volume of water that drains through a surface. These activities are from Teach Engineering.
- [Exploring the Flow of Water through Soils: Infiltration and Absorption \(PDF page 37 and page 31 in document\)](#). Grades 6-8. These experiments use a cut-can infiltrometer to investigate the infiltration of soils in natural school yard areas. This activity is from Earth Partnership's Rain Garden Curricular Sampler.
- [Watershed Walk Worksheets \(page 1-4\)](#). Grades K-5. Guided questions provide more structure, if needed, to investigate where water goes in the schoolyard and environs. This activity is from Arizona State University's Ecology Explorers program.

Step 3: Watersheds - Understand the Big Picture

Make a watershed model in your schoolyard to understand how stormwater runoff from your school ends up in creeks, the Bay, and the ocean. Working outdoors is a much easier place to make a watery mess! These models can be set up in small groups or done as one large demo. Some examples of models are below.

- [PBS Kids](#)
- [Make a Watershed Model from Skidmore](#)
- [Earthlabs/NOAA](#)

Step 4: Water Transport of Pollution: Understanding the Problem

The watershed model can next be used to investigate how pollution is transported by water and into creeks and the Bay. The possible sources of pollution are also important to understand. Food coloring is a good option. Remember not to use polluting materials (such as glitter or other synthetics) outdoors.

- [Video Teacher Guidance from Plum Landing](#). A three-minute video to help teachers visualize set-up for this activity.
- **See, Think, Wonder**. Grades K-8. Two posters that can be used to kick off discussions of urban sources of pollution and to brainstorm solutions.
 - See [Solutions to Pollution PDF](#) at Flows to Bay
 - See [Drain Rangers Elementary Curriculum](#) for the poster on page 21
- [Where is the pollution coming from?](#) Grades K-8. This has a short worksheet for matching pollution to its sources. See Activity 1 by Columbia RiverKeeper.

- [Pollution Soup \(PDF page 52, document page 46\)](#). Grades K-8. Using a jar of clean water, students 'pollute' it with a variety of materials that mimic real-world pollutants so they can see the changes first-hand. Find this activity in the Watershed Stewardship Curriculum from the SF Public Utilities Commission.

Step 5: Pollution in the Food Chain - Understand the Problem

This section addresses the movement of pollution through aquatic food chains to help build an understanding of how different species in the Bay and Ocean may be affected by polluted stormwater. Lesson links include outdoor food chain games as well as resources for researching what species live in San Francisco Bay.

- [Food Web Outdoor Tag \(page 129\)](#). Grades 2-5. In this version of the game of Tag, students act out different trophic levels in an ecosystem. Rounds can be modified to mimic different environmental conditions, including pollution or improved water quality. This activity is from Greening of Detroit.
- [Sea Lion Food Chain Game](#). This version of the game of Tag simulates the food chain of sea lions, anchovies, and plankton in the SF Bay and how it can be affected by a variety of scenarios. See lesson 2 in Aquarium of the Bay's 7th Grade Teacher Resource Guide.
- [Web of Life \(page 110\)](#). Grades K-8. This classic food web activity using a ball of string can be taken outdoors. The activity demonstrates the interconnections between all living things and can be used to model disruptions to the system. This activity is offered here by Green Schools Ireland.
- [Animals of San Francisco Bay \(PDF page 138, page 133 actual document\)](#). Grades K-8. Resource on the common species found in the San Francisco Bay. This resource is from Save the Bay.
- [Wetland Habitat and Food Chain Activities](#). Grades K-8. Guidance on making wetland dioramas and food chains. This activity is from The San Francisco Bay Wildlife Society.
- [Human Impact in the SF Bay Watershed](#). This teacher guide was written for Grade 6, but it has useful background information for teachers of all grade levels looking to dive deeper. This resource is from Aquarium of the Bay.

Step 6: Solutions - Put it all together

Soil and other permeable surfaces in the schoolyard allow stormwater to slow, spread, and percolate down through the schoolyard into groundwater instead of running off into creeks and the San Francisco Bay. In the process, many pollutants are also filtered out. Students can be invited to brainstorm solutions and/or invited to see rain garden design plans.

- [Stormwater Filtration Experiment \(page 169\)](#). Grades K-8. This experiment demonstrates the movement of water through permeable surfaces and the filtration of possible pollutants. The system can be pre-built for younger grades. This activity is from CA State Chico.
- [Water and Erosion in Different Ecosystems \(page 132\)](#). Grades K-8. This experiment with vegetated and unvegetated soils allows students to visualize what happens to water runoff in a variety of situations. Grades K-8. This activity is from Education Outside.
 - [Demo video](#)
- [Student Survey of the Schoolyard \(page 242\)](#). In this activity, students fill out a stormwater 'report card' and give points to a variety of features in their schoolyard as they assess what happens to rainwater runoff. This activity is from Save the Bay.
- [Schoolyard Water Assessment Worksheet \(PDF page 15, document page 13\)](#). This assessment is from Project Learning Tree.
- [Calculate Water filtration in Natural Areas](#). Grades 6-8. In this math activity, students measure the area of a garden or other natural area with permeable surfaces to calculate how much water is filtered by these areas.
- [Role of Plants in Water Filtration - EPA Grade 4-7](#). Experiment with different types of simulated pollution to test soil and plants ability to filter water.
- [Video of Green Stormwater Features](#) from Santa Clara Urban Runoff Pollution Prevention Program

Dive Deeper

- [Removing Nitrogen and Phosphorus Pollution - Experiments \(page 110\)](#). Grade 8. This activity comes from the Drain Rangers Curriculum for Secondary School from Puget Sound Starts Here.
- [Rain Garden Location Planning \(page 17\)](#). Grades 4-8. "Noting Notable Features" guides student teams around the schoolyard. This activity is from Earth Partnership's Rain Garden Curricular Sampler.
- [How Water Works in your Garden](#). Grades K-12. This set of activities is from The Nature Conservancy.

More Resources

Background on Watersheds in the San Carlos Area

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- [Flows to the Bay Teacher Resources](#)
- [Resilient San Carlos Project Background](#)
- [Flows to the Bay Watershed Map](#)

Curriculum

- [SFPUC: K-12 Water Stewardship Curriculum](#)
- [Puget Sound Starts Here: K-5 Drain Ranger Curriculum Guide and 6-8 Engineering Solutions Guide](#)
- [Earth Partnership: K12 Rain Garden curriculum](#)
- [Claremont Soil and Water Conservation District: K12 Rain Garden Activity Guide](#)
- [Groundwater Foundation](#)
- [US EPA: Exploring Your Watershed](#)
- [CA Department of Water Resources: K12 Water Units](#)

Field Trips and School Classroom Visits

- [Kids for the Bay](#)
- [Don Edwards SF Bay National Wildlife Refuge](#)
- [Save the Bay Student Programs](#)

SF Bay

- <https://baykeeper.org/>
- <https://savesfbay.org/>

To Purchase

- [Project Wet: Maps, Educator Guides, and Children's Activity Guides](#)