Storm Drainage in Philadelphia With NBC10

Objectives

- Understand the importance of storm drainage, identify common stormwater pollutants and recognize the role of storm drains in protecting our waterways
- Learn to appreciate the interconnectedness of our communities and their environment

Next Generation Science Standards (NGSS) addressed

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time or cost.
- MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Materials

- Whiteboard or blackboard
- Markers or chalk
- Storm Drainage infographic
- Storm Drainage vocabulary list

Lesson content developed by Ale Gonzales Montoya, Drexel University

Vocabulary List

- **Stormwater runoff:** Water from precipitation that flows across the ground and into storm drains, rather than soaking into the ground
- **Drainage system:** A network of pipes, channels and other structures that collect and transport stormwater runoff to a discharge point, such as a river or ocean
- **Drainage basin:** The area of land where all the water that falls within it drains to a particular river or waterway
- **Pollutants:** Substances, such as chemicals or debris, that can contaminate waterways and harm the environment and wildlife
- **Sediment:** Solid particles, such as dirt, sand and gravel, that can be carried by stormwater runoff and deposited in waterways, potentially causing harm to aquatic life
- **Debris:** Objects such as trash, leaves or twigs that can be carried by stormwater runoff and can clog drainage systems, causing flooding and other issues
- **Nutrients:** Chemical compounds, such as nitrogen and phosphorus, that can be carried by stormwater runoff and can contribute to harmful algal blooms in waterway
- **Bacteria:** Microscopic organisms that can be present in stormwater runoff, potentially posing a health risk to humans and wildlife that come into contact with contaminated water
- **Illicit discharges:** Illegal dumping of materials into storm drains or other parts of the storm drainage system, which can cause pollution and harm to the environment

Introduction (10 minutes)

Begin by asking students if they have ever noticed the storm drains in their neighborhood or school.

Show a diagram or poster of a storm drainage system and explain that it is a network of underground pipes and catch basins that helps prevent flooding and protects our environment by collecting and diverting rainwater to nearby waterways.

Define stormwater runoff and explain how it can carry pollutants from our streets and yards into our waterways.

Main Activity (25 minutes)

Review the vocabulary list and have students share what they know or think about each term. Discuss common pollutants found in stormwater runoff, such as sediment, debris, nutrients, bacteria, oil and grease.

Ask students to identify ways they can help prevent stormwater pollution, such as not littering, properly disposing of pet waste and using environmentally friendly products.

Discuss illicit discharges and explain that these are any substances that are dumped into the storm drainage system that can harm our environment. Ask students to brainstorm examples of illicit discharges and discuss the consequences of these actions.

Assign Challenge (5 minutes)

Observe storm drains in or around the student's neighborhood. An alternate option would be observing storm drains in or near the schoolyard as a group during the challenge week.

Instruct students to write or draw a brief description of each storm drain, noting any visible signs of stormwater, pollution or damage. Remind students to be safe and not enter any storm drains or interfere with them in any way.

Conclusion (10 minutes)

Recap what students have learned about storm drainage and its importance in protecting our environment.

Ask students to reflect on how they can make a difference in preventing stormwater pollution in their communities.

Questions to ask during activity

- What is stormwater runoff and how is it different from other forms of water?
- What is the purpose of a storm drainage system and how does it work to prevent flooding?
- What is a drainage basin and how does it relate to stormwater runoff?
- What are some common pollutants found in stormwater runoff and why are they harmful to the environment?
- What are some ways we can prevent or reduce stormwater pollution in our daily lives?

Level Up: Higher level thinking prompts and questions

- Students can plan a public service announcement video or poster to educate others about storm drainage and preventing stormwater pollution.
- Encourage students to explore the social and environmental justice implications of storm drainage, such as how low-income communities and communities of color may be disproportionately impacted by stormwater runoff and flooding.
- Introduce the concept of green infrastructure and how it can help manage stormwater runoff. This could include exploring topics such as green roofs, rain gardens and bioswales.
- Discuss the impact of climate change on storm drainage and how more frequent or intense storms can affect the system.
- Explore the engineering and considerations that go into designing storm drainage systems, such as determining appropriate pipe size, accounting for peak flow rates and assessing infiltration rates.
- Have students conduct research on local storm drainage systems, including how they are designed and maintained, and identify any issues or areas for improvement.

Background info

1. Storm Drainage System." EPA. United States Environmental Protection Agency, n.d. Web. 15 Feb. 2023. https://www.epa.gov/npdes/storm-drainage-system.
2. "Polluted Runoff (Nonpoint Source Pollution)." EPA. United States Environmental Protection Agency, n.d. Web. 15 Feb. 2023. https://www.epa.gov/nps/polluted-runoff-nonpoint-source-pollution.
3. Drowning in Plastic (nationalgeographic.org)
4. A Guide to Plastic in the Ocean (noaa.gov)
5. www.boomerangalliance.org.au

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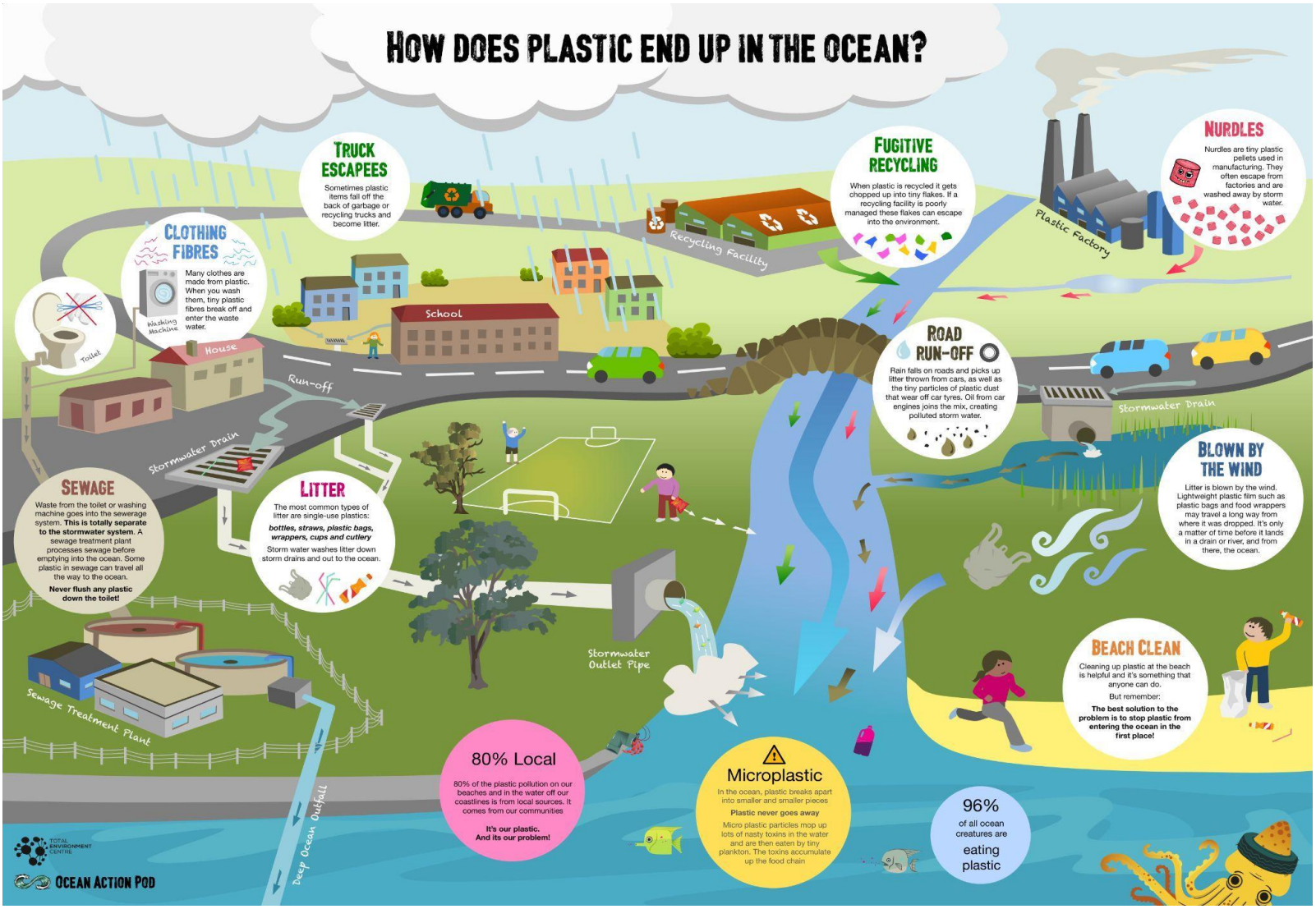
Infographic courtesy of Boomerang Alliance.org



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