

STORMWATER



Teacher and Parent Information

Water is a traveler on our planet. It carves monuments from rock, alters boundaries between land and sea and, frozen in the form of glaciers, scours the landscape. Water weaves together all living and nonliving things in an intricate tapestry of color, light and movement.

Storm water is a natural phenomenon. Surface water runoff and storm water are nature's method of changing or altering our landscape and cleansing the land's surface. People's activities have altered the natural course of storm water by increasing the amount of water running off the land and adding many materials or pollutants to the runoff.

When you are asked to list things that move in the water, you may immediately think of crabs scuttling sideways or fish gliding with a flick of their tail. Other things also move in the water. Some are visible, such as bobbing plastic bottles, multicolored oil slicks or clouds of brown mud. Others are invisible, such as disease-causing bacteria, toxic chemicals or fertilizers.

Stormwater pollution can make water supplies unfit for people to use for drinking and bathing, and for growing and preparing food. It can also affect natural biological systems, causing unsafe levels of organic residues and metals to build up in fish and other aquatic life. Pollution can lead to the overfertilization of waters and loss of oxygen needed by aquatic life. Stormwater pollution has many sources — industry, agriculture, logging, mining, cities and towns, drilling and transportation.

Most of the world's coastal areas are polluted. Recent studies have shown that a large proportion of coastal pollution comes from upstream sources. A 1991 study of 85 coastal watersheds in the United States found that upstream sources accounted for about 70 percent of the nitrogen and 60 percent of the phosphorus entering coastal estuaries. The following are types of stormwater pollution.

Pesticides from lawns and gardens, farm fields, spills and misuse. Pesticides injure or kill certain forms of life or pests but they can also injure or kill beneficial animals and plants. Some pesticides mimic hormones that can alter reproductive systems of plants, animals and humans.

Fertilizers from lawns, gardens and farm fields. (Fertilizers are also considered nutrients.) Fertilizers contain nitrogen and phosphorus, two elements that promote growth of plants. Overstimulation of aquatic plants can cause algal blooms and fish kills.

Nutrients and fecal bacteria from mismanaged feed lots, dairies, poultry houses, septic tanks, boats and sewage treatment plants. Animal and human wastes are high in nitrogen and phosphorus too. Storm water containing fecal wastes contains not only excess nutrients, but it can carry bacteria and viruses.

Sediments from erosion of construction sites, unpaved roads, mining, clear cuts or farm fields. Sediments increase turbidity (cloudiness) and siltation. Soil erosion is a natural process, but people's activities have increased the amount of soil being moved. Turbidity reduces the amount of light penetrating the water. Siltation causes seagrass beds and fish spawning sites to become unproductive, and can also clog fish gills.

Heavy metals from industrial sites, old or improperly maintained landfills, illegal dumping, and automobiles and their emissions. They cause health problems in both humans and wildlife. Heavy metals become more harmful the higher they reach in the food chain.

Automobile products from cars, parking lots, highways, gas stations and repair shops. Motor oil, battery acid, gasoline, antifreeze, transmission

and brake fluid, degreasers, rust preventatives, flushers and cleaning fluids are all hazardous to the environment. Just one quart of oil can contaminate two million gallons of drinking water or create an eight-acre oil slick. Used motor oil is the largest single source of oil pollution (more than 40 percent) in our nation's water bodies.

Chemicals or hazardous wastes from household products and industries. Many household products contain toxic materials that are harmful to humans, birds, insects and wildlife.

Watch the rain as it runs off your roof, your street and parking lot. You can see it pick up oil, grease, litter, soil and other materials. Eventually, this runoff is carried to the nearest body of water where these pollutants can kill fish, shellfish, wildlife or plants, and degrade water quality.

Most of us blame pollution and its effect on large industries, municipal treatment plants and corporations. But we are all responsible for stormwater pollution and can do many things to prevent it.

To prevent excess stormwater runoff and pollution, you want to reduce the amount of runoff and keep the water clean. Slowing the water down is a good method to allow the water to be cleaned. Slowing the water gives pollutants time to settle out of the water or to be absorbed by plants.

What YOU can do!

Lawns and Gardens

- Reduce or eliminate use of fertilizers. Apply fertilizers properly, only in amounts needed.
- Use compost as an alternative to fertilizer.
- Choose vegetation that is resistant to pests.
- Use mechanical, biological or cultural controls for insects and weeds when possible. Use chemical pesticides only as a last resort.
- Use groundcovers or mulch to eliminate bare ground.
- Place gravel or hardy vegetation under drip lines from roofs or near downspouts to prevent erosion.
- Do not water or irrigate paved areas.
- Use landscaping to conserve water and habitat.
- Protect the natural slope and shoreline vegetation. Replant or revegetate vulnerable areas.
- Use biodegradable nets of paper or sisal to provide temporary stabilization when planting on steep slopes.
- Use basins, hollows, swales and berms to direct water and beautify your landscape. Contour your garden and landscape to follow the natural contours of the land.

Houses

- Cover small mounds of dirt with a tarp when landscaping, remodeling or building. Surround larger piles of dirt with hay bales or filter cloth to prevent wind and rain erosion.
- Use alternatives, such as bricks (non-mortared), interlocking pavers, large gravel, mulches or precast concrete pavers, instead of impervious surfaces or pavement.
- Maintain your septic systems.

Household Chemicals

- Reduce or eliminate use of hazardous chemicals. Use safe alternatives.
- Use and dispose of household chemicals properly. Use the least toxic product that will effectively do the job. Clean up spills.
- Use all chemicals, fertilizers and pesticides under appropriate weather and ventilation conditions.
- Do not apply chemicals near wells, cisterns or water bodies unless instructions permit such use.
- Never flush chemicals down the drain; never pour on the ground or into storm drains.

Paint and Thinners

- Use water-based paints when possible.
- Rinse brushes in a container and pour rinse water down the sink.
- Give excess paint to a friend or nonprofit group that can use it.
- Dry out unwanted paint by allowing it to evaporate, then dispose of dried solid properly.
- Recycle and reuse paint thinner.

Pets

- Clean up after your pets and either bury or flush down toilet.
- Never allow pet wastes to remain on impervious surfaces.

Pools

- Drain pools onto lawn area, never directly into a waterway or street.
- Do not chlorinate pools for several days before draining.

Automobiles and Boats

- Maintain your car. Fix oil and other fluid leaks.
- Dispose of oil or antifreeze properly when changing these fluids or take them to a recycling center. Never dump these toxic chemicals into storm drains, ditches or onto the soil.
- Use biodegradable, low phosphate soap to wash your car. Wash car over grassed area.
- Buy only minimum amount of automotive products needed to maintain car. Store and dispose of empty containers properly.

- Be careful not to spill fuel or overfill the tank when fueling boat or car.
- Reduce the number of miles you drive; walk, ride a bike, carpool and combine errands into one trip. (Note: Toxins that rub off tires, as well as oil and grease, accumulate on the road surfaces, waiting for a good rain to carry them to our water bodies.)

Don't put anything down a storm drain, in the street, or on the ground that you would not want to swim in or drink. Keep everything out of storm drains except the rainwater they are designed to collect.

The responsibility for preventing pollution must be a collective act, just as pollution is a collective result of our actions. The responsibility for pollution lies with all of us, and must be a part of our everyday activities, our routine behavior. We must begin to instinctively think and act to prevent pollution, practicing three basic principles:

1. Reduce inputs. Don't use what you don't need.
2. Use environmentally friendly products.
3. Change your activities and their timing to reduce the amount of materials that will be washed off.

You can make a difference!

Stormwater Consequences Rules

For 3 to 6 players

Time

From 20 to 30 minutes

Object of the Game

Be the player to reach the estuary with the least amount of pollutants.

Materials Needed

1. Game board poster
2. One dice
3. Player circles
4. Pollutant drops (or use coins.)
5. Paper and pencil

How to Set up the Game

1. Make copies of player circles and pollutant drop pieces. Cut out pieces. These can be colored by students and laminated if desired.
2. Place poster on flat surface with game board facing up.
3. Place pollutant drops in a pile near game board.

How to Play the Game

1. Roll the dice to select which player will go first. Player with the smallest number rolled goes first. Play proceeds to the left.
2. Select one player as recorder. May use same method as above.
3. Place all player circles in the start area at the top of the poster.
4. On a turn, each player will roll the dice. Players move one square for each number rolled. For example, if the dice reads four, move your player circle four squares. Each player has one turn at a time.
5. Frowning water drops: If player circle stops on a frowning water drop, player takes a pollutant drop from main pile and loses the next turn. If player can state a way storm water becomes polluted (examples are found on the game board), the player will not lose a turn. Players may not repeat pollution causes. Recorder will list causes on a piece of paper.

6. Smiling water drops: If player circle stops on a smiling water drop, a pollutant drop is returned to the main pile. If the player can state a way to prevent pollution of storm water (examples are found on the game board), the player will go again. Recorder will list all conservation practices given. Practices may not be repeated. If the player does not have a pollutant drop, he/she just gives a response and wins another turn.
7. Turtle squares: If player circle stops on a square marked with a turtle, the player will move ahead to the next smiling water drop and follow rules for smiling water drops.
8. No swimming squares: If player circle stops on a square marked with a no swimming sign, the player will move back to the last frowning water drop and follow rules for frowning water drops.
9. Word squares: These squares are provided to give players a hint of good and bad water pollution practices. No pollutant pieces are lost or gained on these squares.
10. Two or more players may stop on any square at the same time if their moves happen to land them in that position.
11. When all players have entered the "estuary," count pollution drops for each player. The player with the least amount of pollution is the winner.
12. In cases of ties, the winner to reach the estuary last with the least amount of pollution wins.

Game Variations

Let students experiment and develop additional rules and ways to play this game that will teach them about storm water and pollution. One variation may be to require them to roll the exact number to enter the estuary.

With younger students, you may want to eliminate the penalty and bonus squares. Older or more advanced students may want to develop stormwater questions or cards to be answered from the frowning and smiling water drop squares. A sample card sheet is available from the district upon request.

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Player Circles and Pollutant Drops (Copy-and-cut master)

