

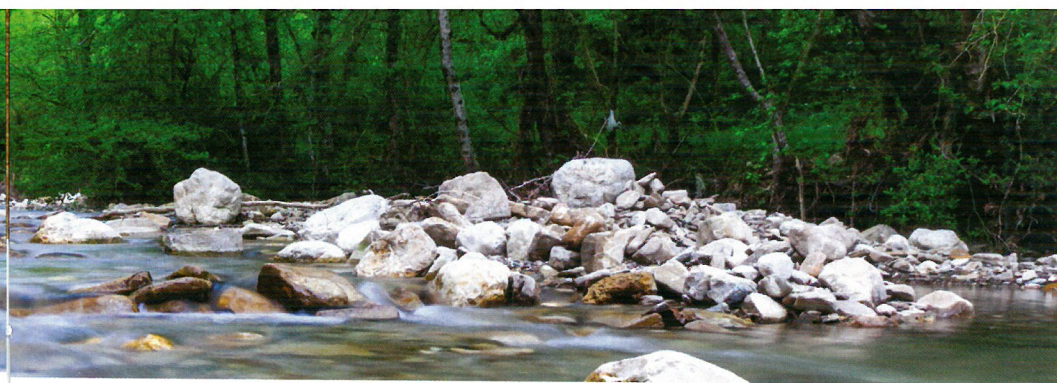
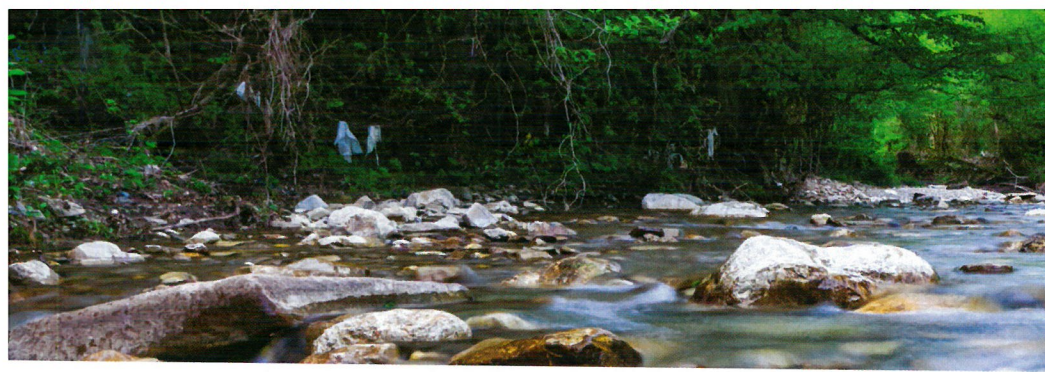


WHAT IS STORMWATER?

If you've ever noticed water cascading over parking lots or rushing down roadside ditches after a rainstorm, you've seen stormwater. Stormwater is exactly what it sounds like—water from precipitation events like rain, freezing rain, sleet, or hail. It also comes from snow and ice melt. Stormwater can be both a great resource and a major problem. As stormwater travels from where it hits the ground to our waterways, it can pick up chemicals and debris that pollute our watersheds. This tips booklet covers actions that each of us can take to keep pollutants out of our stormwater and our watersheds.

Stormwater pollution is a major threat to our nation's waterways. Polluted stormwater can alter and destroy habitats; kill vegetation; and physically disable, choke, or otherwise fatally harm wildlife. It can poison humans, aquatic life, and other forms of life that eat toxin-filled fish and shellfish or use the water for recreation or drinking. Stormwater pollution can cause our rivers, lakes, streams, and oceans to be closed to the public, which means no more fishing, boating, or swimming. Furthermore, when our drinking water is polluted by stormwater, treating it can become more complicated and expensive, if not impossible.





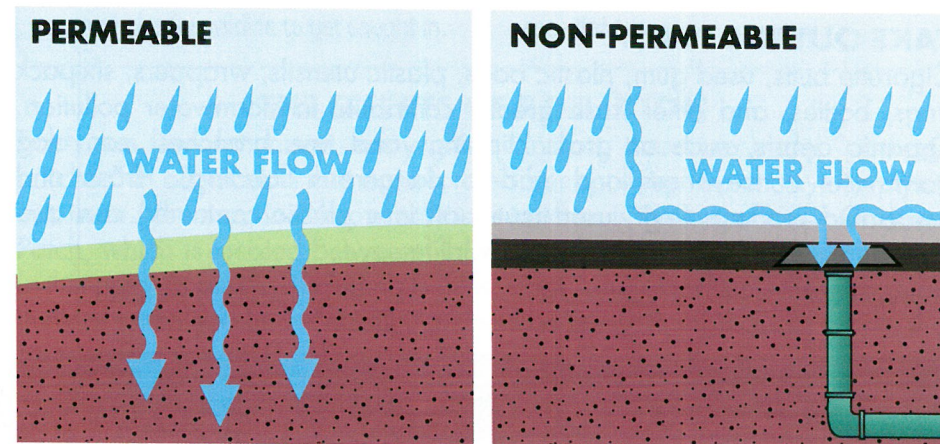
STORMWATER'S MOVEMENT THROUGH A WATERSHED

A watershed, also known as a basin, is an area of land where all water flows to the same body of water. Watersheds can vary in size from relatively small to extraordinarily large. For example, the land area that drains to a small stream may be only a few acres, while a bay watershed, such as that of the Chesapeake Bay, may consist of millions of acres, including many smaller watersheds within its boundaries.

PERMEABLE & PERVIOUS VERSUS NON-PERMEABLE & IMPERVIOUS SURFACES

In forested watersheds, stormwater is intercepted and slowed by plants. It then evaporates back into the atmosphere, becomes runoff and flows gently over the land, or follows gravity to the bottom of the thick layer of organic matter and percolates down through uncompacted soil. The layer of fallen leaves and decaying wood on the forest floor is considered to be a permeable or pervious surface because it is penetrable by water. Other examples of permeable and pervious surfaces are vegetation, gravel, and specialized turf, pervious pavement, or other material specifically designed to let water seep through.

However, many types of pavement, as well as concrete and buildings, are impervious to water. When stormwater can't soak into the driveways, structures, roads, parking lots, and compacted soil on heavily used yards and construction sites, it flows over them. It can combine with more stormwater and quickly gain strength, potentially causing flooding and erosion. During its passage, stormwater can pick up pesticides, organic debris, fertilizers, dirt, trash, oil, and other pollutants that are harmful to living things. The untreated polluted stormwater runoff can then spill into lakes, streams, rivers, wetlands, or coastal waters.



MS4 & CSS SYSTEMS

Most municipalities have either a municipal separate storm sewer system (MS4 for short) or a combined sewer system (CSS) in place to manage stormwater. Both MS4s and CSSs are systems of conveyances that redirect and remove stormwater from non-permeable and impervious surfaces by way of pipes, ditches, and storm drains. Storm drains are the metal grates found on streets and in parking lots. Some storm drains are marked with signage alerting folks that they lead straight to streams. Even if storm drains are unmarked, nothing should ever be dumped into them because they often lead directly to waterways!

These systems are critical to prevent flooding from stormwater. MS4s are the most common type of stormwater system; they route stormwater directly into waterways without it being filtered or treated. CSSs are designed to clean stormwater, transporting it along with sanitary sewage to wastewater treatment facilities before releasing clean water back into local waterways. However, if there is a heavy downpour of rain or other input of water that causes a wastewater treatment facility to become full, water in CSS pipes can overflow directly into streams.

KEEPING STORMWATER CLEAN: PROBLEMS AND SOLUTIONS

Although stormwater pollution is a major problem and a complicated issue, people can be part of the solution by making simple changes to their daily routines and habits. By following the tips listed below, you can help to keep pollutants out of stormwater, manage the amount of stormwater that leaves your property, and possibly save money while creating a healthier home for you, your pets, and your family!

TAKE OUT THE TRASH

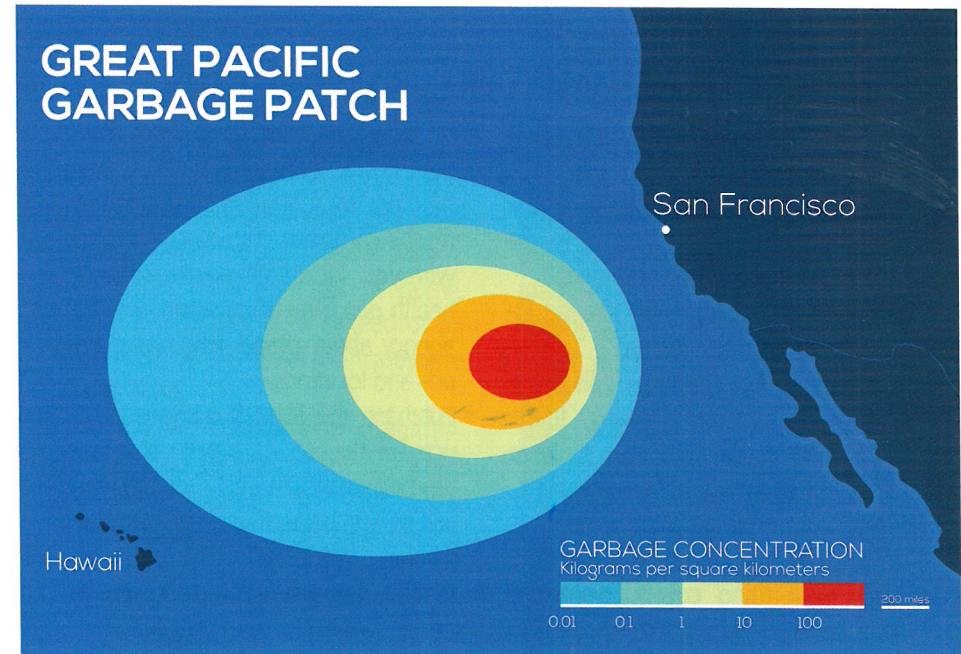
Cigarette butts, used gum, plastic bags, plastic utensils, wrappers, six-pack rings, bottles, and other trash greatly contribute to stormwater pollution. Organic debris, such as grass clippings and tree branches, can clog stormwater conveyances and lead to dangerous flooding. Trash and associated products (e.g., used motor oil in a plastic container) can also choke, injure, poison, and suffocate wildlife.

TIPS FOR KEEPING WATERWAYS FREE OF TRASH AND DEBRIS

- Don't litter!
- Never wash trash and debris off of sidewalks and other paved areas with a hose or buckets of water (this will put it on a fast track to storm drains and local bodies of water).
- Cut six-pack rings apart until there are no holes for wildlife to get caught in.
- Cover trash cans and check for cracks where leaks may occur.
- Keep a trash bag and gloves in your car for your trash and any litter you see during your travels.
- Pick up and sweep up trash around your yard and home.
- Recycle plastics and other recyclables.

THE EFFECTS OF POLLUTION

Trash can flow for many, many miles. In fact, there are many "garbage patches" in our oceans that have formed from polluted waterways emptying into them. The most well-known of these patches is the large Pacific Garbage Patch, which is located between California and Hawaii. Much of the trash in this patch is plastic, including bottles, bags, and other items that you might think of when you hear "plastic," as well as teeny, tiny pieces of plastic that ocean creatures and birds end up ingesting. These garbage patches cannot easily be cleaned up; the best way to help resolve this major problem is to prevent the stormwater pollution that is contributing to them.



HANDLE HOUSEHOLD HAZARDS (SENSIBLY)

Many of the household products that we use on a daily basis are hazardous and can poison or otherwise harm aquatic life if they end up in waterways. Furthermore, humans and other living creatures can be poisoned when they consume the affected fish and shellfish or use the waterway for recreation and drinking water. These products can also change the chemistry of waterways, which can make aquatic environments uninhabitable by certain plants and animals. Some examples of hazardous household products are paints, stains, and sealants; detergents and solvents; drain and oven cleaners; insecticides, pesticides, fungicides, and herbicides; gasoline, kerosene, and propane; personal vehicle, boat, and lawn equipment products like used motor oil, antifreeze, and other auto fluids; batteries; mercury thermometers, thermostats, and fluorescent lights; pool chemicals; and chlorides (de-icing salts).

These toxic substances can be very difficult to remove from waterways; some can remain in the environment and cause problems for many years. Their harmful effects can become even more dangerous when they flow from one waterway to the next, combining with other pollutants along the way.

TIPS TO KEEP HAZARDOUS HOUSEHOLD PRODUCTS OUT OF STORMWATER

- Buy hazardous household products in small quantities so you don't have to manage and store extras at your house.
- Follow directions for use and application; don't overapply.
- Clean up any spills, messes, or equipment promptly, being sure to follow recommendations on containers.
- Keep absorbent materials like cat litter around for spill cleanup.
- Report any large chemical spills to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.
- Store hazardous products inside rigid, durable, and watertight containers with tight-fitting covers, preferably in a covered and contained area to avoid exposure to stormwater.
- Recycle, donate, or properly dispose of hazardous products. Do not pour hazardous products onto the ground or in your trash or dump them down your house drains—instead, dispose of them by following the directions on the container. You can also check with your local solid waste authority, health department, or environmental agency about proper disposal methods and locations.
- Purchase the least hazardous products for the job. As a general rule, a product with "CAUTION" on the label will be less hazardous than a product labeled "WARNING." The most potentially hazardous products are labeled "DANGER" or "POISON."

BE PARTICULAR ABOUT PAINT

- As with other trash and debris, sweep up paint chips—never rinse them or other hazardous waste from pavement with water (this will put it on a fast track to storm drains and local bodies of water).
- Use latex paint instead of oil-based paint. This also eliminates the need for paint thinner.
- Clean water-based paint brushes in the sink, not outdoors.
- Oil-based paints should be cleaned with thinner that can be set aside for paint particles to settle out and then be reused.
- Donate excess paint to local organizations.
- Dispose of extra paint and other hazardous materials through a household hazardous waste collection program.

RELAX RESPONSIBLY (POOL AND SPA MAINTENANCE)

- Buy digital pool thermometers and thermostats instead of those made with mercury.
- Drain your swimming pool only when a test kit does not detect chlorine levels. Chlorine generally dissipates naturally in about 10 days, but verify with a test kit.
- Check with your local government about specific regulations for draining your pool or spa. Many municipalities require that you drain your pool or spa into the sanitary sewer system, but consult them first. Do not drain a pool or spa into your private septic system.

PUT THE BREAKS ON AUTO POLLUTION

- Wash your car at a professional/commercial car wash that recycles water to keep the grease, detergents, and other solvents out of the storm sewer system.
- If you do wash your car at home, do so in a grassy area instead of on pavement so the water infiltrates into the ground.
- Use a low-phosphate or nonphosphate soap to wash your car (read below in "Green Up" Your Lawn about problems that phosphorus can cause in aquatic habitats).
- Use a drip pan under cars while working on them.
- Regularly tune your car and fix leaks.
- Clean up spilled fluids with an absorbent material like cat litter. Remember to properly dispose of the absorbent material. Don't rinse the spills into a nearby storm drain.
- Never dump vehicle fluids on pavement, on the ground, or down the storm drain.
- Dispose of and recycle used batteries, motor oil, and other auto fluids (and old automobiles) at designated drop-off or recycling locations. Ask local service stations about where to recycle.



“GREEN UP” YOUR LAWN

Lawns can be the source of many stormwater pollutants, including debris and hazardous pesticides (both mentioned in previous sections) as well as excess nutrients. Excess nutrients can come from phosphate-filled soaps (used to wash items outdoors or indoors), fertilizers, and organic matter like grass clippings, leaves, and fecal waste. Although nutrients are generally viewed as positive additions in our bodies and on land, excess amounts of nutrients, especially nitrogen and phosphorus, can stimulate algae growth in waterways. When algae die, they sink to the bottom and decompose. The decomposition process removes dissolved oxygen that aquatic plants, animals, and insects cannot live without.

PASS ON THE POISON (WHEN POSSIBLE)

- Properly identify weeds, diseases, or insects before applying a pesticide. Some insects and plants are beneficial and help to keep pests under control naturally without causing harm to humans.
- Use pesticides and herbicides sparingly and only when all else fails. Remember to read labels, use them as directed, store them with care, and dispose of them properly or donate extras to neighbors or a local gardening club.
- Use prescription flea drops (or natural, nontoxic flea treatments) for pets instead of treating a lawn.
- If pesticides are necessary, spot-treat weeds instead of applying to the whole area, because widespread application can kill beneficial insects.
- Do not apply pesticides before heavy rain is forecasted. Not only could you lose the benefit of the product if it's washed away, it may pollute stormwater.
- Use organic mulch, such as pine bark, instead of herbicides to prevent weeds from growing and to help absorb water. You can even create self-mulching areas under trees where leaves can remain as they fall.

BE FRUGAL WITH FERTILIZER

- Test soil for nutrient levels—this will allow you to choose a fertilizer that adds only the nutrients that are needed. Limiting unnecessary and excess fertilizer saves you money, is healthier for the plants (it minimizes the risk of plant roots being chemically burnt), and reduces extra nutrients that might wash off in stormwater. County extension offices often offer a residential soil-testing program and independent laboratories perform soil sampling as well.
- Help fertilize your lawn naturally by mowing only one-third of the total grass height and leaving the clippings on the lawn (mulching mowers and mowers with sharp blades work best).
- If fertilizer is necessary, use, store, and dispose of as directed.
- Choose a fertilizer with a slow-release form of nitrogen to reduce the potential for leaching into groundwater or ending up in stormwater runoff.
- Consider using iron (chelated iron or ferrous sulfate) instead of nitrogen.
- Do not apply fertilizer before heavy rain is forecasted. Not only could you lose the benefit of the product if it's washed away, it may pollute stormwater.
- Sweep up any fertilizer that lands on sidewalks instead of using water to wash it off (as this could send it to a storm drain and local waterway).

ORGANIZE YOUR ORGANICS!

- Compost your organic yard waste (along with kitchen scraps) instead of burning it or throwing it in the trash.
- If you don't compost leaves and other yard debris, bag it for roadside pickup. Don't leave it in the street or sweep it into storm drains or waterways.
- Remember, grass clippings can stay on the lawn. They are a natural fertilizer.
- Use your own pine straw and other clippings for mulch. Share your extra mulch with neighbors or local civic groups.
- Protect landscaping materials from wind and rain by storing them under tarps or in a shed.

GO NATIVE

- Plant native plants since they are adapted to the local area and can survive without extra fertilizers, pesticides, and water.
- Determine how much of a lawn/grass area you need, and plant the rest in low-maintenance or no-mow vegetation.



MANAGE THE MANURE

In addition to adding nutrients to waterways, fecal matter from pets, livestock, and leaking septic systems can carry disease-causing bacteria and viruses that can cause public health and environmental concerns. These pathogens can infect fish and other aquatic life, downstream livestock, wildlife, and humans that drink from the water or use it for recreation. Some pathogens can result in permanent bodily damage, amputations, or even death. A common cat feces pathogen, *Toxoplasmosis gondii*, can have an extremely negative impact on river and sea otter populations if excrement from litter boxes or outside cats enters waterways.

PICK UP PET WASTE

- Clean up after your pet, both in your yard and when walking along trails or roadways.
- Dispose of pet waste properly in waste receptacles or by flushing pet waste (this is the best disposal method). Just make sure not to flush disposal bags or litter with the waste.

LIMIT LIVESTOCK AREAS

- Keep livestock out of streams and away from streambanks by providing water sources elsewhere and creating fenced stream crossings.
- Rotate animal grazing to prevent fields from becoming overgrazed, which can lead to bare soil that can wash off into waterways.
- Store and apply manure away from bodies of water and in accordance with a nutrient management plan.

SUPERVISE SEPTIC SYSTEMS

- Flush responsibly. Flushing household hazardous chemicals can disrupt the biological treatment that takes place in the system, and flushing solid items other than septic-safe products can clog or damage the system.
- Inspect your system every 3 years and pump your tank as necessary, usually every 3 to 5 years.
- Plant only grass over and near the septic drainfield to avoid damage from shrub and tree roots.
- Don't drive or park vehicles on the septic drain field.

CLEAN UP YOUR DIRT

Hazardous pollutants, nutrients, and pathogens can all hitch a ride on soil particles carried into waterways by stormwater. Sediment is generally picked up by stormwater on areas of exposed soil, like construction areas, dirt roads, farm fields, and logging operations. It can also be washed into streams from streambanks that are eroded by high volumes of fast-moving stormwater flowing off of developed areas. Even without its toxic and potentially poisonous hitchhikers, sediment can destroy aquatic life and habitat. It can cloud water and make it difficult or impossible for aquatic plants to grow. It can also smother fish eggs and suffocate other aquatic inhabitants by clogging their gills.

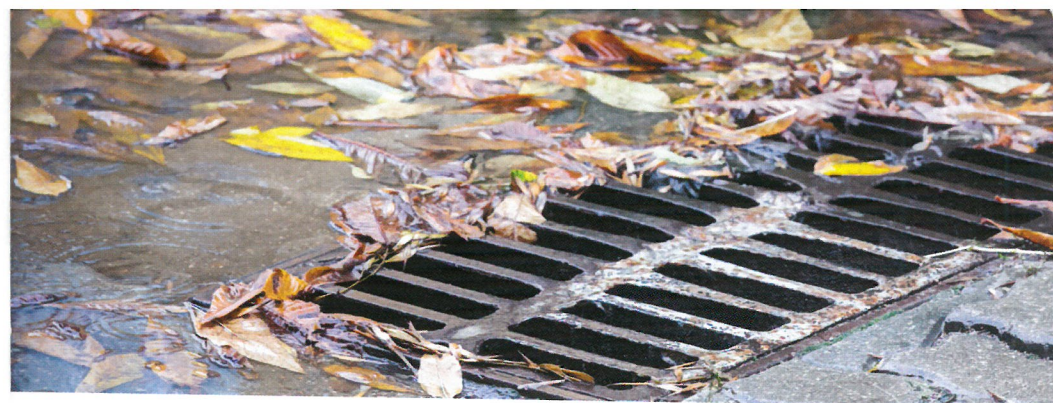
TIPS TO KEEP SOIL ON LAND AND OUT OF WATER:

- Carefully plan any activity that will expose soil. Plan to limit areas of exposed soil by working on small sections, reseeding, and then working on the next section.
- Seed and mulch bare areas of soil as soon as possible.
- Cover piles of dirt (or mulch) being used in landscaping projects.
- When possible, use equipment that limits soil disturbance, such as a no-till drill.
- Don't mow all the way up to streambanks and other areas near waterways (referred to as riparian areas), because grass and other vegetation helps to hold soil in place. It also filters pollutants and provides shade that keeps waterway temperatures cooler (read about thermal pollution in the "Wrangle Your Water" section below).
- Plant trees and shrubs along shoreline that aren't already covered with vegetation.
- Slow and reroute stormwater away from disturbed or exposed areas of soil using water bars (mounded soil that slows water down) and ditches.
- Minimize driving equipment through wet areas or construct stream/wet-area crossings to limit erosion and physical damage to waterways.
- Become familiar with any storm drains, ditches, or bodies of water located on or near your property. Once they are located, you can take measures to protect these waterways from sediment anytime construction or other dirt work is happening on your property. Hay bales can be used as sediment barriers and filters near waterways, and specialized materials, like a product called silt fencing, can also be purchased and installed.

WRANGLE YOUR WATER

(LIMIT THE AMOUNT OF STORMWATER LEAVING YOUR PROPERTY)

When stormwater travels over roads, driveways, and pavement, the surfaces can warm the stormwater, which in turn warms the waterways that it flows into. Removing vegetation and the shade it provides from shoreline or riparian areas can also raise water temperatures. This increase in temperature, called thermal pollution, reduces the amount of dissolved oxygen in the water and can stress or kill aquatic plants and animals that are used to colder water and higher dissolved oxygen levels. Reducing the amount of stormwater runoff that leaves your property can minimize the amount of warm (and potentially polluted) water that enters nearby waterways while also decreasing flooding and erosion hazards.



TIPS TO REDUCE STORMWATER RUNOFF FROM YOUR PROPERTY

- Increase the amount of permeable and pervious surface area on your property. These areas will allow stormwater to soak through, decreasing the amount of runoff leaving your property. Examples of permeable installations are pavers, green (vegetated) roofs, rain gardens, grassy swales, and vegetated filter strips along paved areas and streams. (Vegetation along streams also helps to shade the waterways.)
- Keep your gutters on your home clean of leaves and grass cuttings and direct them toward permeable surfaces or water collection tanks.
- Collect rainwater from rooftops in rain barrels. Make sure the containers are mosquito-proof because standing water can attract mosquitoes that may carry disease.
- Use water collected in rain barrels to water lawns and gardens.
- Water during the cool times of the day, and don't let water run off into the storm drain.
- Consider using a soaker hose instead of a sprinkler system.
- Don't overwater your lawn. Only water when plants and grass show signs of stress.
- Help grass to develop a more drought-resistant root system by setting the blade higher on your lawn mower.
- Help to retain moisture (and increase time between watering) by maintaining a 2-3" layer of organic mulch around plant beds, shrubs, and tree roots. Be sure to leave a 2-inch space between the plant base and the mulch, as mulch that is placed too close to plant and tree stems can cause decay and encourage rodent and insect problems.

SHINE LIGHT ON STORMWATER

One of the worst stormwater problems is the lack of awareness surrounding the issue. Many folks don't know about how stormwater moves through our communities, the pollutants it picks up along the way, the negative impacts it can have on local aquatic environments and our health, or the simple tips that can be followed to protect local water quality. Education is the key to changing people's behavior, so you can have a very positive impact on stormwater pollution simply by talking to people about stormwater and how they can help to keep it clean.

TIPS FOR SHARING STORMWATER INFORMATION

- Report illegal dumping.
- Invite a professional water-quality expert to speak about stormwater at your next civic or organizational meeting.
- Share stormwater pollution prevention information on social media.
- Talk to your neighbors and Homeowners Association, if you have one, about "greening up" yard maintenance regulations.
- Volunteer for or sponsor community stormwater projects (like stream cleanups).
- Talk to family and friends, and encourage them to share the information with others.

Tackling stormwater pollution and cleaning up our waterways will help wildlife, individuals, communities, our nation, and even other countries, as much of our waste ends up in oceans that we share. Think prevention first! An ounce of prevention is worth a pound (or many gallons!) of cure. We all have a hand in polluting stormwater, so we need to work together to keep pollutants out. As the saying goes, "many hands make light work," so make sure to share this stormwater pollution information far and wide, and ask your neighbors, friends, and family members to get involved with you!