Colorado Department
of Public Health
and Environment

Teacher Resources for Introducing Urban Stormwater Quality Concepts to the Classroom

Including Example Lesson Plans meeting Colorado Standards for Science, Geography and Civics

Source: USFWS

Driven by new regulations, scientific studies, and public interest in preserving our urban waterways, the study of urban stormwater pollution and its solutions has become increasingly important. Beyond increasing awareness and promoting citizen behaviors that improve the quality of urban waters, stormwater quality is now an important part of the overall study of our environment and related fields. Scientists who study the impacts of nutrients on ecosystems, city managers who create and manage programs to control erosion at construction sites, engineers who design constructed wetlands to reduce pollution from new housing developments, small business owners who must get permits for stormwater discharges, and even firefighters responding to material spills, all need to have knowledge of stormwater runoff issues, and be able to apply that knowledge in their jobs.

The enclosed materials are intended to introduce teachers to some of the concepts of urban stormwater pollution, and provide resources to be used in the classroom as part of a school's current curriculum.

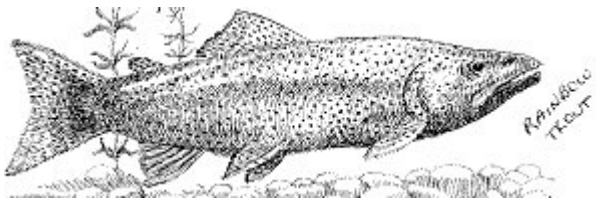
Index

8/2004

Teacher Information Resource Sheet

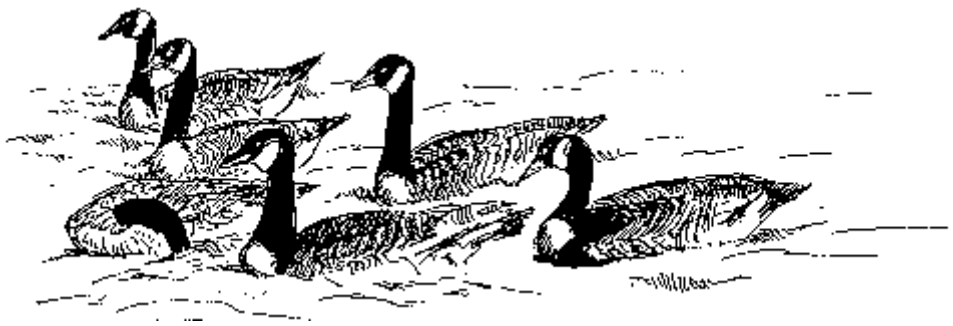
1. **Why is Urban Stormwater Such a Big Issue?**
   - Urban stormwater pollution is pollution that runs off urban landscapes and into storm drains as a result of rainfall and snowmelt events. Stormwater pollution differs from more conventional pollution sources that are discharged from a discrete source (such as a treatment plant or factory) and are more easily identified for control measures. Although not actually composed of stormwater runoff, other sources of urban pollution from diffuse sources, such as dumping of used oil into stormwater drains or waterways, are often included in urban stormwater education and control programs.
   - In Colorado, nearly all stormwater pollution runs directly into surface waters, including lakes and streams, without any treatment. This runoff causes harmful effects on drinking water supplies, recreation, fisheries and wildlife.
   - Contaminated stormwater runoff is arguably the primary cause of water pollution throughout the United States today. Stormwater runoff from urban areas is the number one cause of environmental degradation of the nation's rivers and streams, and the third leading cause of environmental degradation in the nation's lakes.
2. **What are the Sources of Stormwater Pollution?**
   - Stormwater pollution may include sediment (eroded soil); litter; bacteria (e.g., E. coli and fecal coliform, from pet wastes and sewage/septic systems); nutrients and toxic organic chemicals (such as fertilizers, soaps, pesticides, oil, grease, gas, and antifreeze); toxic inorganic chemicals (heavy metals such as lead, zinc, copper and cadmium); salts; acidic and alkaline chemicals (such as bleach and battery acids); and other contaminants.

   - Population growth and development have increased the amount of land covered by hard or paved surfaces in urban areas. Large volumes of storm runoff alter or increase the frequency and duration of peak flow events. This can cause erosion and flooding.
3. **How Does Stormwater Pollution Affect Streams and Lakes?**
   - Stormwater pollution and flows may cause erosion/sedimentation; turbidity; eutrophication; diseases; lethal and sublethal toxic effects (which may be acute or chronic); increased salinity; physical impairment (altered temperature and flow regimes); disruption of habitat structure (changing stream beds, vegetation); and stream bank and channel instability that adversely affects living organisms.
   - **Eutrophication** (of lakes and reservoirs) is a state of high nutrient (nitrogen and phosphorus) enrichment that promotes excessive algae growth. When the algae dies and decomposes, it depletes the water of oxygen needed by fish and other aquatic organisms.



Source: USFWS

4. **Stormwater Regulations.**
   - The Colorado Water Quality Control Division regulates stormwater pollution by issuing permits for stormwater discharges from industry, construction sites, and some government entities ("municipalities") located in urban areas that are responsible for stormwater drainage. In addition to cities, counties, municipal districts, and other similar entities, most urban school districts are considered "municipalities," and are issued permits because they are responsible for the storm drainage from their properties. These permits require: (1) public education and outreach on stormwater impacts, (2) public involvement/participation, (3) illicit discharge detection and elimination, (4) construction site stormwater runoff control, (5) post-construction stormwater management in new development and redevelopment, and (6) pollution prevention/good housekeeping for municipal operations. Regulations require the use of BMPs to reduce or eliminate sources of stormwater pollution. For addition information on the stormwater regulations, contact the Colorado Department of Public Health and Environment's Stormwater program at (303) 692-3517 or cdphe.wqstorm@state.co.us, or visit www.cdphe.state.co.us/wq/PermitsUnit.
5. **Stormwater Best Management Practices: Solving the Problem!**
   - **Best Management Practices (BMPs)** are pollution controls that we can perform or install to prevent or reduce water pollution originating from human activity. BMPs consist of both structural and non-structural BMPs.
   - **Structural BMPs** include, but are not limited to, detention ponds, infiltration basins, construction site silt fences, porous pavement, stream setbacks, stream bank stabilization, sand filters, grass strip biofilters, wetlands, and reducing impervious area.
   - **Nonstructural BMPs** include, but are not limited to, education, maintenance practices (street sweeping and pavement repair), recycling (toxic chemicals), signage, and pollution prevention methods.
6. **Point Source vs. Non-Point Source.**
   - All sources of stormwater pollution were traditionally defined as "Non-Point Source Pollution." "Point Source" pollution was defined as discharges from a discrete point, such as a pipe at a factory. Many references will therefore refer to urban stormwater pollution as urban non-point source pollution. However, since the early 1990s, state and federal regulations have defined certain sources of stormwater runoff as point sources requiring point source discharge permits. Therefore, urban stormwater will often be referred to as both a non-point source, because of the diffuse nature of the pollution sources, and as a point source, because it is regulated as a point source and discharge permits are issued.



Source: USFWS

Urban Stormwater Quality
Lesson Plans

Introduction (For all Lessons)

Our drinking water supplies, fishing and recreational waters are fouled by uncontrolled pollution when rainwater and snowmelt wash over city streets, parking lots, and suburban lawns and pick up toxic chemicals, disease-causing organisms (from pet waste), and dirt and trash. This problem is called urban stormwater pollution. Recent studies have found that urban stormwater rivals and in some cases exceeds sewage plants and large factories as a source of damaging pollutants. Two hundred years of unregulated, unmanaged urban stormwater have contributed to many severe public health problems and expensive natural resource losses in the United States.

Help Colorado's Stormwater Program improve urban stormwater education in Colorado!
If you use any of these lesson plans in your classroom, or as a resource for developing your own plans, please contact us at cdphe.wqstorm@state.co.us and let us know. Any comment and/or suggestions for improvements would also be appreciated. This information is valuable to us in developing future guidance and resources for stormwater education.

Activity 1.
Modeling a Watershed: Erosion, Pollution and Prevention

Subjects: Science and Geography
Grade Level: 6-12

Colorado Model Content Standards:
Geography: 1.3, 2.1, 3.1, 4.4, 5.1, 5.3, 6.2
Science: 1,3.1, 3.2, 4.1, 4.3, 5, 6

Purpose: This activity could be used as a classroom demonstration or a traditional lab for students. Students will learn (1) how water from rain and snow storms becomes runoff and flows down watersheds through storm drains in cities and neighborhoods, (2) how this stormwater runoff causes erosion and picks up pollution, and (3) how to reduce or prevent urban stormwater pollution.

Objectives:
(1) Student will be able to describe the transition of precipitation to runoff.
(2) Student will be able to state the definition of a watershed.
(3) Student will be able to diagram runoff and watershed patterns for a local neighborhood.
(4) Student will be able to demonstrate the effects of stormwater on pollution using a 3-D model.
(5) Student will be able to state three ways to reduce and/or prevent urban stormwater pollution.

Materials: large aluminum pan or plastic container, aluminum foil, dirt, silt, sand, gravel, paper towels, scrap felt, scrap carpet, sponge, food coloring, powdered dyes, spray bottle, water, crushed ice

Vocabulary: erosion, erosion control barriers, fertilizers, buffer, gravel, landscape, pesticides, quantity, runoff, septic systems, slope, soil textures, urban stormwater pollution, water quality, watershed, wetlands

Activity:
(1) Fill one third of large aluminum pan or plastic container with dirt in an irregular manner to mimic the Earth's surface.
(2) Press a layer of aluminum foil over the dirt surface.
(3) Using a spray bottle, spray small amounts of water on the foil and notice how it flows downhill in watersheds. Students record what they observe; e.g., direction of flow, pooling, etc.
(4) Cover the majority of the foil with a layer of dirt, silt, sand and gravel (in any pattern you like until the pan or container is two thirds full) to simulate various soil textures. Leave areas of the model (at various elevations) with the foil still exposed to simulate paved portions of the watershed.
(5) Using the scientific method, have students predict the effects new soil textures and patterns will have on water flow, and effects of the water on the soil.
(6) Spray water in increasing amounts onto soil. Students record observations. Does the water move certain "soils" more than others? Does this depend on the slope of the watershed or the quantity of water? Does more water flow from the foil (paved) area than the soil area?
(7) Place small amounts of different colors of powdered dyes around your landscape model to represent solid pollutant sources (e.g., animal waste, fertilizers, and pesticides). Place a few drops of food colorings at other places to represent liquid pollutant sources (e.g., soap from a car wash, oil from a leaky car, and sewage from a damaged septic system).

(8) Place various materials downhill from some of the pollutant sources to approximate structural water quality controls (also called Best Management Practices or BMPs). Examples of controls that could be modeled include:
   - ◊ Grass Buffer Strip: Place a small strip of carpet below pollutants placed on pavement (i.e., directly on the foil) to model a strip of vegetation that will slow runoff and pick up pollutants such as oils and solids.
   - ◊ Wetland: Form a small depression in the soil and place a piece of felt or sponge in it to model a small wetland. The "wetland" can be placed below an area approximating a farm field with fertilizer and pesticide or a factory with various industrial pollutants.
   - ◊ Erosion Control Barrier: Erosion control barriers such as fiber blankets or crimped straw are placed on disturbed soil at construction sites to minimize erosion of bare soil before final vegetation or pavement is in place. Place a strip of paper towel (i.e., an "erosion control barrier") over an area of loose soil to minimize the erosion caused by the "rain" from the spray bottle as it hits the soil and runs downhill.

   Students can brainstorm additional ideas for pollutant controls that could be modeled as well, such as ponds, terraces, straw bales, berms, vegetated swales, etc.
(9) Using the scientific method, have students predict how the various pollutants will be transported through the watersheds.
(10) Spray small amounts of water on your "pollutants" and observe results. Does the water pick up the substances and transport them as stormwater pollution (colored water)? Does sandy soil filter out some pollutants, while gravel did not? Did your erosion control barriers, buffer strips or wetlands slow or stop the flow of stormwater pollution? Does more of the pollutant run off of the paved areas than the soil areas?

Questions for Review, Discussion, Assignment, or Conclusion:

(1) What is urban stormwater pollution?
(2) What does erosion have to do with urban stormwater pollution? During a rainstorm, does more water flow off the grass or the streets? Is there more grass or pavement in the city? In your neighborhood?
(3) What is a watershed and why do we care? Do watersheds tell us where the pollution will flow?
(4) Can you think of any other pollutants that flow through your neighborhood? What are their sources?
(5) Did any of your treatments (paper towel, cloth or carpet) affect the flow of the polluted runoff? What else might you try to slow or stop the flow of pollution?
(6) Is it easier to prevent the release of pollution or clean it up afterwards? Why?

Additional Resources:

(1) As an alternative to creating your own model, commercial models such as the EnviroScape® model (www.enviroscapes.com) are available for purchase.
(2) Many urban cities and counties have staff in charge of organizing the local stormwater quality program. These people may be a good resource for finding out information about actual stormwater concerns and controls that may exist in the school district's watershed that could be discussed or visited by the class.

Activity 2.
Where Does My Waste Flow? Getting the Word Out!

Subjects: Science
Grade Level: 6-12

Colorado Model Content Standards:
Science: 3.1, 3.2, 4.3

Purpose: This activity will provide students with a knowledge and appreciation of the watershed they live in and how they impact it. Students will (1) understand where water flows in their neighborhood, (2) understand the causes and effects of urban stormwater pollution in their community, and (3) share with the community information about stormwater pollution prevention.

Objectives:
(1) Student will be able to identify the direction of water flow in his or her neighborhood after visual observation.
(2) Student will be able to state sources of urban stormwater pollution in his or her community.
(3) Student will be able to state three effects of urban stormwater pollution in his or her community.
(4) Student will be able to create public service materials to effectively educate members of the community about urban stormwater pollution.

Materials: tag board, paint, paper, pen, and scissors

Vocabulary: algae, buffer, decompose, erosion, soil, stencil, storm drain, urban stormwater pollution, water quality, vegetation, watershed

Activity:
(1) Walk with your students around the school grounds and observe the lay of the land. While walking, observe and discuss with students the features of the watershed. When it rains, where would the water flow? Follow the path that water would take. This is your watershed. Where would the water end up going? Would it flow into a storm drain, stream or lake? If the water would go into a storm drain, research the surface water that the water would ultimately reach. Are there any controls in place to treat the water in any way before it reaches the receiving water? Observe this receiving water (e.g., pond, creek, wetland, etc.) if possible. Is the receiving water clear or cloudy/colored? Is it cold or warm? Do you see living things in the receiving water? Do nearby plants look healthy, or is there just bare, eroded soil? What do you smell at the receiving water: blooming flowers and green vegetation, or decomposing algae and pet waste?
(2) Back in the classroom, have students discuss their observations, and then lead a discussion on the causes and effects of urban stormwater pollution.
(3) Have the students walk around their own neighborhood and record their observations. You may want to assign specific observations for the students to report on, for example:
   ◊ "Where does the stormwater runoff from your home flow?"
   ◊ "List three pollutant sources you observed in your neighborhood."
   ◊ "Did you observe any water quality controls (e.g., signs saying not to dump waste into drains, grass swales instead of pipes, wetlands, ponds, etc.)?

(4) In class the next day, have the students discuss what they observed in their neighborhoods. Did they find sources or signs of pollution? Do they have storm drains in the street that direct the runoff into pipes, or does the water just run down the gutter or into a ditch?

(5) Have the students brainstorm (individually or in groups) for brief sayings and artwork that will foster a "don't pollute" awareness among their neighbors. Examples:

- ◊ "No Dumping, Drains to Creek"
- ◊ "Leaves don't belong in the storm drain"
- ◊ "Junk in the gutter makes us sputter"
- ◊ "Please don't pour, that's our front door"

(6) Create-a-Stencil or Poster: Have each student or group draw their design on a piece of tag board and cut out a stencil for marking storm drains in their neighborhood with their message and/or design a poster to place in public areas in the neighborhood (e.g., recreation centers, park bulletin boards, retail stores)…after getting permission from the city/county or private property owner!

Activity 3.
Stormwater Pollution: Its Physical, Chemical and Biological Impacts

Subjects: Science
(Biology, Ecology, and Chemistry)
Grade Level: 9-12

Colorado Model Content Standards:
Science: 1, 2.1, 3.1, 4.2, 4.3, 6

Purpose: This activity is a framework for science class lab work (although the "Additional Resources" section has information on obtaining the data for this lesson plan from the internet). Students will use physical, chemical and biological science methods to identify stormwater pollutants in local surface waters and assess the effects of urban stormwater pollution.

Objectives:
(1) Student will be able to identify stormwater pollutants in local surface waters using various testing measures.
(2) Student will be able to assess the quality of local surface water using data collected from pollutant tests.
(3) Students will be able to describe environmental impacts from the identified pollutants.

Materials: aquatic invertebrates, dichotomous key, dissolved oxygen meter, kick screen or net, pH meter, spectrophotometer, thermometer, water quality test kit

Vocabulary: bioassessment, chlorophyll *a*, colorimetry, dichotomous key, dissolved oxygen, eutrophication, facultative, intolerant, invertebrates, kick screen/net, nitrate, parameter, pH, phosphate, spectrophotometer, titration, tolerant, toxic, turbidity, urban stormwater pollution, water quality

Activity:
(1) During class, explain the causes and effects of urban stormwater pollution. Discuss local observations on potential pollution problems.
(2) Select the physical and chemical parameters you're going to assess and tests you're going to perform, depending on local observations and availability of equipment/materials. For example, if you are concerned about eutrophication, you might assess nitrate, phosphate, chlorophyll *a* and dissolved oxygen. Students will need to look up normal ranges and/or toxic levels for these parameters in order to understand the results. Examples:
    ◊ temperature (using thermometer)
    ◊ pH (using colorimetry or electronic meter)
    ◊ dissolved oxygen (by titration or electronic meter)
    ◊ nitrates (by colorimetry)
    ◊ phosphates (by titration or colorimetry)
    ◊ chlorophyll *a* (absorbance using spectrophotometer)
    ◊ turbidity (in NTUs using spectrophotometer)
(3) Bioassessment will involve the collection and identification of aquatic invertebrate species using a kick screen or net. Kick screens or nets capture organisms by filtering them from the water column after disturbing the substrate ("kicking" the stream or lake bed). Flowing waters (in streams) deliver the organisms to the screen/net, and lakes can be sampled by sweeping the water

column. A kick screen can be made from household window screen and wood. Certain organisms (such as mayfly, stonefly and caddis fly larvae) are intolerant of pollution and are indicators of good water quality. Dragonfly and damselfly nymphs are facultative or intermediate in pollution tolerance. Pollution tolerant organisms (such as midge larvae, black fly larvae and leeches) are indicators of poor water quality.

(4) Take a field trip to collect (1) a sample of aquatic invertebrates using kick screens or nets (www.people.virginia.edu/~sos-iwla/Stream-Study/StreamStudyHomePage/StreamStudy.HTML is a good online resource for identifying aquatic macroinvertebrates) and (2) a water sample at a local surface water body near the school grounds. Demonstrate (for class) how to perform the tests for each selected physical and chemical parameter. Show the class how to use a dichotomous key to identify aquatic invertebrates.

(5) Have each student collect a sample of aquatic invertebrates and water (volume will depend on tests being performed) from a surface water body (stream or lake) in their neighborhood.

(6) Students will perform tests, identify organisms, report results, and discuss/interpret findings.

Additional Resources:

(1) Hach® Water Quality Test Kits – *Self Contained Test Kits*
www.hach.com
1-800-227-4224

A source of basic, self-contained test kits, such as test strip and titration kits, for analyzing water quality parameters. An affordable and less equipment-intensive way to test for many water quality pollutants and indicators, although not as accurate as many laboratory procedures. Multi parameter kits with curriculum information, designed for grade school classrooms, are also available (e.g., the Ponds and Streams Kit, Product # 2787700). The company has phone support that can help you find kits for the parameters you are interested in.

(2) STORET – *Water Quality Database*
www.epa.gov/storet

STORET is EPA's main repository of water quality monitoring data. It contains water quality information from a variety of organizations across the country, from small volunteer watershed groups to State and Federal environmental agencies. This data can be downloaded from the internet and used for classroom discussion in place of data collected and analyzed by students. There is a training exercise that provides a step-by-step guide for first-time users at: www.epa.gov/storet/storet_download.pdf

Activity 4.
Stormwater Pollution: Integrating Science and Civics

Subjects: Science and Civics
Grade Level: 9-12

Colorado Model Content Standards:
Science: 1, 4.1, 4.2, 4.3, 5, 6
Civics: 1.1, 1.5, 2.1, 2.4, 4.4

Purpose: This exercise will expose students to the ways in which stormwater pollution affects different members of our society. Science will be integrated with government and policy through the exploration of an environmental problem.

Objectives:
(1) Students will be able to state at least 3 types of people stormwater pollution can affect.
(2) Students will demonstrate knowledge of stormwater pollution issues through small group discussion.
(3) Students will be able to write a professional-style letter expressing appropriate interest in stormwater pollution issues.

Materials: index cards

Vocabulary: erosion, fertilizers, runoff, urban stormwater pollution, water quality, watershed

Activity:
(1) Explain the causes and effects of urban stormwater pollution and initiate a classroom discussion about possible local pollution issues.
(2) Create a stack of environmental problem playing cards. Each card should have a different environmental problem related to stormwater pollution written on it. The following list provides a few examples of stormwater pollution issues.
   - ◊ Mr. Johnson changes the oil in his truck every few months on the street in front of his house and disposes of the oil in the storm drain.
   - ◊ Ms. Paige uses industrial strength soap to wash her car every Sunday on her driveway.
   - ◊ Walter uses twice the recommended amount of fertilizer on his lawn just before a big rainstorm.
   - ◊ Prairie Flower Development Inc. is building an apartment building on the side of a creek and has no controls in place to keep soil from eroding into the creek.
   - ◊ Acme Widgets Company is storing materials in a way that is resulting in oils and metal shavings being washed into a nearby storm drain when it rains.
(3) Break class into groups of 4 students. Have one student from each group come and draw one of the environmental playing cards. This card will give each group in the class a different issue.
(4) Assign each member of the groups one of the following roles:
   - ◊ State Stormwater Program Manager
   - ◊ Responsible Party (person or company responsible for the stormwater pollution)
   - ◊ Biologist/Environmental Scientist
   - ◊ Everyday Concerned Citizen
(5) Depending on available time, choose one of the following methods for having students learn about their roles.
   - ◊ Have each student spend time on the internet researching the role he or she is assigned.
   - ◊ Provide students with brief descriptions of the roles that have been assigned.

(6) Have students in each group engage in a discussion about the effects their stormwater pollution issue might have on the different roles they are taking.
(7) Have students playing the Responsible Party, Scientist, and Citizen write a letter to the Stormwater Program Manager, and have the student playing the Stormwater Program Manager write a letter to the Responsible Party. The letters should address the situation from the letter writer's perspective and propose solutions.

Alternative/Expanded Role-Playing Activities:

A teacher may expand this activity to include a broader range of roles and role-playing scenarios.

Examples of roles include:

- ◊ Pollutant
- ◊ Aquatic organism (e.g., fish)
- ◊ Biologist
- ◊ Environmental group
- ◊ Everyday concerned citizen
- ◊ Environmental Engineer
- ◊ Residential developer
- ◊ City official
- ◊ State Stormwater Program Manager
- ◊ EPA (Federal) Stormwater Program Manager
- ◊ Federal Judge
- ◊ Congressional Representative

The teacher can guide the class through whatever scenario he/she chooses. For example, the role playing might begin with the pollutant(s) telling us who they are, and where they came from. The aquatic organism may respond adversely and be noticed by the biologist or everyday citizen. They bring it to the attention of the city official. Meanwhile, the engineer and developer are also in the ear of the city official. The city official consults the State Stormwater Program Manager who, subsequently, requires a new best management practice as part of their municipal permit. If this fails to resolve the pollution problem, the EPA Project Manager may intervene. Other options may include the concerned citizen riling up their favorite environmental group to sue local governments for failure to resolve the situation…in steps the judge. If no solution is found, the congressman might have to draft a new bill that will set new policy for the EPA Project Manager to implement through the Executive Branch.

This activity could involve verbal classroom presentations and discussion, or be conducted in a journal passed between classmates. This activity is also a great opportunity to integrate the content areas of science and civics as the early scientific/factual "steps" in the process leading to government policy development and implementation. This activity could also be a lead-in to your school's mock-trial exercise.

Individual Action Checklist

What can I do…?

Pet and Human Waste

- ❑ Clean up after pets and other large animals to keep feces from polluting water. Carry and use a pooper scooper and plastic bag to dispose of waste in the trash.
- ❑ Keep animals out of lakes and streams.
- ❑ Inspect and pump septic systems regularly. Chemicals can damage septic systems, so select them carefully and use care in pouring or flushing them into septic systems.

Yard and Garden

- ❑ Landscape with fewer hard-paved surfaces to reduce volume of stormwater runoff.
- ❑ Prevent the erosion and runoff of soil by vegetating bare soil. When storing soil, do not store it on or near paved areas where it can easily be carried to storm drains.
- ❑ Landscape with vegetation (such as greenbelts, buffer zones or grass filter strips) between hard paved surfaces and storm drains and/or surface waters (e.g., lakes and streams). Design drainage systems to direct stormwater runoff into grassy or well-vegetated areas rather than paved surfaces.
- ❑ Minimize soil compaction by core aerating your yard.
- ❑ Manually operate sprinklers and use drip/trickle irrigation systems to water only as needed. Keep water off paved surfaces to avoid excessive runoff. If rain is expected, water another day.
- ❑ Replace high-maintenance lawns with drought-resistant grass strains and select native plants that require less water, fertilizer and pesticides.
- ❑ Raise lawn mower to its highest level. Grass requires less water when longer and shaded.
- ❑ Compost (or leave on your lawn) grass clippings and other lawn waste that will safely decompose. Do not dump such items in storm drains or ditches since they can clog drainage systems and add unwanted nutrients to runoff.
- ❑ Reduce pesticide use by planting pest-resistant plant species or those that attract beneficial insects for biological pest control.
- ❑ Store all fertilizers and pesticides in proper containers and keep dry.
- ❑ Use slow-release or natural fertilizers such as compost and bone meal.
- ❑ Follow manufacturer's instructions for application of fertilizers and pesticides to avoid overuse and excessive runoff into storm drains. Sweep excess product from sidewalks and driveway back onto yard so it doesn't wash easily/directly down gutters.
- ❑ Never over-water after application of fertilizers and pesticides. If rain is expected, then apply chemicals another day.

Auto and Household Maintenance

- ❑ Store all automotive chemicals (such as antifreeze, oil, gas and grease) and household chemicals (such as cleaners, solvents, thinners and paints) in proper containers and keep dry.
- ❑ Do not pour these chemicals onto soil.
- ❑ To clean up accidental spills, use absorbents (such as kitty litter and sawdust) and then sweep. Don't rinse with water!
- ❑ Never use storm drains or gutters to dispose of chemical waste.
- ❑ Properly handle and dispose of such wastes by recycling or taking them to a treatment facility. Did you know that 60% of household hazardous wastes can be recycled?

- When washing your car consider: (1) using commercial car washes where wastewater is treated, (2) washing car over lawn, gravel or other permeable surface to reduce runoff, and (3) only using the hose for final rinse.
- Keep your vehicle well-maintained and repair any leaking systems immediately. Watch for drips!

Around Your Neighborhood

- Report any sources of stormwater pollution that are resulting in discharges into storm drains or surface waters (such as construction sites with unmanaged soil erosion, and businesses or individuals dumping materials into drains) to local government officials.
- Do not litter. Litter can be carried into local streams and lakes where it can negatively affect wildlife habitat and water quality.

Share your pollution prevention behaviors and practices with your family, friends, and neighbors.

Internet Resources

QUALITY INFORMATION RESOURCES FOR STUDENTS AND EDUCATORS

1. **Project WET (Water Education for Teachers)**
   www.projectwet.org
   A non-profit water education program and publisher for educators and young people ages 5-18. Program development resources, test kits, outreach materials and more. This program is already being implemented in several Colorado school districts.

2. **Educating Young People About Water - Water Curricula Database**
   http://www.uwex.edu/erc/eypaw
   A searchable database of water curricula that has been reviewed and approved by a national review team. Includes urban stormwater quality curricula, and other curriculum

3. **Colorado Water Protection Project**
   www.ourwater.org
   A public education program (by the League of Women Voters of Colorado) that includes great fact sheets and background information on the causes and effects of urban stormwater pollution; suggestions for citizen action; and many internet links to programs of local municipalities, non-profits, state and federal government.

RELATED COLORADO PROGRAMS

4. **Colorado River Watch**
   wildlife.state.co.us/riverwatch
   Colorado Division of Wildlife program that links environmental protection with education in a meaningful, hands-on project for Colorado residents. Participants currently are made up of middle and high school students, their teachers, watershed management groups and stakeholders.

5. **Colorado Recycles**
   www.colorado-recycles.org
   The whats, wheres and hows of recycling anything in Colorado.

6. **Xeriscape Colorado!, Inc.**
   www.xeriscape.org
   Learn how to landscape with plants that are locally adapted and require less water, fertilizers, and pesticides.

TECHNICAL/PROFESSIONAL RESOURCES

7. **National Menu of Best Management Practices**
   cfpub.epa.gov/npdes/stormwater/menuofbmps/menu.cfm
   EPA's comprehensive menu of stormwater best management practices. Including everything from education on topics such as pet waste and litter, to technical fact sheets on retention ponds.

8. **Center for Watershed Protection**
   www.cwp.org
   A non-profit corporation that provides great multi-disciplinary technical tools for protecting surface waters, including books and online slide shows on stormwater management.

9. **The Stormwater Manager's Resource Center**
   www.stormwatercenter.net
   A web page from the Center for Watershed Protection with technical assistance on stormwater management issues.

STATE AND FEDERAL STORMWATER & NONPOINT SOURCE PROGRAMS

10. **Colorado Water Quality Control Division, Stormwater Program**
    www.cdphe.state.co.us/wq/PermitsUnit/wqcdpmt.html#Stormwater
    Information about regulation and permitting of stormwater pollution in Colorado.

11. **Nonpoint Source Colorado**
    www.npscolorado.com
    Nonpoint source pollution information, news, stories, meetings and projects in Colorado.

12. **U.S. Environmental Protection Agency, Stormwater Program**
    www.epa.gov/npdes/stormwater
    Technical and regulatory information on stormwater pollution in the U.S.

13. **U.S. Environmental Protection Agency, Nonpoint Source Program**
    www.epa.gov/owow/nps
    EPA's nonpoint source pollution site provides fact sheets, publications and information for students/educators.

14. **U.S. Environmental Protection Agency, Stormwater Month Outreach Materials and Reference Documents**
    cfpub.epa.gov/npdes/stormwatermonth.cfm
    EPA Stormwater Month brochures, posters, door hanger, stickers, bookmark, games, fact sheets, and other publications.

COMMERCIAL SITES WITH RESOURCES FOR SCHOOLS

15. **EnviroScape**
    www.enviroscapes.com
    A company that supplies great stormwater models, posters and other educational program materials.

16. **Earthwater Stencils**
    www.earthwater-stencils.com/foredu.html
    Information about and supplier of storm drain stencils as an educational, interactive tool to engage people of all ages.

Glossary

Best Management Practices (BMPs): Pollution controls that we can perform or install to prevent or reduce water pollution originating from human activity.

Buffer: A small area of permanent vegetation bordering a surface water or stormwater collection system, protecting the soil from wind and rain erosion, slowing water runoff, and trapping sediment and other pollutants.

Eutrophication: Process by which additions of nutrients causes an overgrowth of algae and subsequent depletion of oxygen in surface waters.

Illicit Discharge: The result of an illegal and/or improper discharge of material into storm drains or surface waters. Examples of illicit discharges include dumping of wastes, spills, connections of non-stormwater conveyances (such as sanitary sewers) to the stormwater system, industrial facilities allowing their process waters to discharge directly without permits, power washing, etc.

Impervious Surfaces: Surfaces that do not allow stormwater runoff (water) to seep into the ground, such as sidewalks, roadways, driveways, and rooftops.

Non-Point Source Pollution:
(i) The introduction of pollutants into a surface-water body or an aquifer, usually through a non-direct route associated with a rainfall or snowmelt event. They occur less frequently and for shorter periods of time than do point source discharges. Non-point sources of pollution are often difficult to identify, isolate and control.
(ii) Pollution from a discharge not covered under State or Federal point source permitting programs.

Nutrients: Substances required by organisms in order to grow and survive, such as nitrogen and phosphorus.

Point Source Pollution:
(i) Pollutants discharged to surface waters from any identifiable point, including pipes, ditches, channels, sewers, tunnels and containers of various types.
(ii) Pollution from sources requiring a State or Federal point source discharge permit. This includes discharges from discrete points where pollutants have been added, as well as stormwater from sources covered by stormwater regulations.

Sediment: Insoluble material suspended in water and consisting mainly of particles derived from rocks, soil and organic materials; a major stormwater runoff pollutant to which other pollutants may attach.

Sedimentation: The settling of sediment to the bottom of a waterway.

Soil Compaction: The pressing together of soil particles into a more dense mass that is less capable of allowing stormwater to infiltrate, and therefore increasing runoff.

Storm Drains: The drains that collect stormwater runoff and deliver it to surface waters.

Stormwater Infiltration: The portion of rainfall or surface runoff that moves downward into the subsurface rock and soil.

Stormwater runoff: Precipitation or snowmelt that flows overland to surface streams, rivers, and lakes (either directly or through storm sewers).

Surface Water: Water that is on the surface of the earth (in lakes, streams, rivers, oceans, etc.).

Turbidity: The cloudy or muddy appearance of water. Turbidity is mainly indicative of the amount of solids suspended in the water.

Watershed: The area of land drained by a stream and its tributaries; the dividing line between watersheds is physically defined by mountains, crests, hills, or the ridges of high ground.