

# Baltimore County Public Schools

## Outdoor Science

### Maryland Green Schools

**Best Management Practice** – Water Conservation and  
Pollution Prevention

**Grade Level** – 5

**BCPS Unit** – Investigating Earth Changes,  
Topic 2: Constructive and Destructive Forces

### Voluntary State Curriculum

#### Standard

2.0 Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.

#### Topic

A. Materials and Processes That Shape a Planet

#### Indicator

2. Cite and describe the processes that cause rapid or slow changes in Earth's surface.

#### Objectives

- a. Identify and describe events such as tornadoes, hurricanes, volcanic eruptions, earthquakes, and flooding which change surface features rapidly.
- b. Recognize that the natural force of gravity causes changes in the Earth's surface features as it pulls things towards Earth, as in mud and rock slides, avalanches, etc.
- c. Cite examples that demonstrate how the natural agents of wind, water, and ice produce snow changes on the Earth's surface such as carving out deep canyons and building up sand dunes.

### Introduction

There are seven BMP's offered as choices for the Green School application. As a school, you are required to select four different BMP's to obtain Maryland Green School status. This document provides three possible projects for the Water Conservation and Pollution Prevention BMP. The projects are given for a specific grade level and are based on the BCPS curriculum and the VSC indicators. They execute the *Extension* piece of the 5E format for science curriculum fulfilling the Green School criteria for Best Management Practices through instruction as they broaden the existing science units.

Time will need to be allotted for implementation of these projects. The amount of time will vary with the complexity of the project. Your project might be defined as on-going activities (e.g., curbside recycling) or an annual event (e.g., Earth Day Celebration or a unit specific project). Teacher discretion will determine how to facilitate the project. Factors including student needs, time management, and available resources will need to be taken into consideration.

The three projects described below are only a few of the many possible projects that could be used to fulfill your school's BMP requirement. Please do not feel that you are limited by these suggestions.

## **BMP – Water Conservation and Pollution Prevention**

As the landscape of Maryland changed from rural to suburban and urban, formerly forested areas were converted to areas with increased impervious cover such as sidewalks, roads, and roofs. This has amplified the amount of stormwater runoff that is being carried directly to streams and ultimately, the Chesapeake Bay, with little to no removal of pollutants. Problems created by suburban and urban runoff include increased erosion, sedimentation, increased pollution entering Maryland waterways, increased pollution of the Chesapeake Bay, and increased costs for municipalities. When sediment enters the water, it clouds the water decreasing opportunities for predators to catch prey; it decreases the amount of sunlight reaching underwater plants; it smothers bottom-dwelling organisms; and it prevents young oysters from growing properly. Pollutants such as excess nutrients (phosphorus and nitrogen) cause blooms of algae which block sunlight from reaching underwater plants. As algae decomposes, it depletes oxygen in the water creating dead zones in the Bay. Pollutants are toxic substances, such as mercury, arsenic, antifreeze, gasoline, and oil. They can poison organisms outright, cause disease, build up in the tissues of animals making the organisms toxic to eat, and accumulate in bottom sediments affecting organisms in the future. Best Management Practices include, but are not limited to, evaluating the flow of water and preventing erosion on the school grounds through rain gardens and rain barrels, and preventing the waste of water through monitoring dripping faucets. Conserving water is simple and inexpensive!

### **BMP Project 1 – Rain Garden**

#### **Background**

The flow of water created by a rainstorm carries pollutants and sediment into storm drains and, ultimately, into local streams, rivers, and the Bay. A rain garden is a natural or dug shallow depression designed to capture and soak up stormwater runoff from roofs or other impervious areas around buildings (driveways, walkways, and even compacted lawn areas). The rain garden is planted with suitable native trees, shrubs, and plants, and then heavily mulched, allowing runoff to soak into the ground and protect water quality. Additionally, rain gardens add beauty to the landscape.

Storm water runoff is considered one of the main sources of water pollution nationwide. As watersheds become developed, urbanization and an increase in paved surfaces such as parking lots, driveways, and rooftops increases storm water runoff. This causes rainwater to flow quickly into storm drains and surface waters. Rain gardens filter and reuse this water, reduce stormwater pollution, recharge groundwater, and reduce the need for other costly stormwater systems. Rain gardens are a natural, beautiful way to help improve water quality while providing valuable habitat for wildlife.

## Resources

- Chesapeake Bay Foundation  
Philip Merrill Environmental Center  
6 Herndon Avenue  
Annapolis, MD 21403  
<http://www.cbf.org/site/PageServer?pagename=homev3>
- Marshy Point Nature Center  
7130 Marshy Point Road  
Baltimore, MD 21220  
410-887-2817  
<http://www.marshypoint.org/>
- The Maryland Association for Environmental and Outdoor Educators: *Rain Gardens*  
<http://www.maeoe.org/habitat/projects/raingardens.php>
- Community Watersheds: *How to Install Rain Gardens*  
[http://www.cwp.org/Community\\_Watersheds/brochure.pdf](http://www.cwp.org/Community_Watersheds/brochure.pdf)
- Chesapeake Bay Foundation: *Rain Gardens*  
[http://www.cbf.org/site/PageServer?pagename=action\\_outdoors\\_landscaping\\_gardens\\_raingarden](http://www.cbf.org/site/PageServer?pagename=action_outdoors_landscaping_gardens_raingarden)
- Maryland Department of Natural Resources: *Rain Gardens*  
[http://www.dnr.state.md.us/mydnr/askanexpert/rain\\_garden.asp](http://www.dnr.state.md.us/mydnr/askanexpert/rain_garden.asp)
- Virginia Department of Forestry: *Rain Garden Technical Guide*  
[http://www.dnr.state.md.us/forests/pdfs/VA\\_RainGardens.pdf](http://www.dnr.state.md.us/forests/pdfs/VA_RainGardens.pdf)

## Cross Curriculum Connections

- Math: Students could calculate the total area of pervious and impervious surfaces. The pervious surfaces include the rain garden and fields. The impervious surfaces include the building, sidewalks, and parking lots.
- Math: Based on the amount of mulch added to the rain garden, students could calculate its volume.
- Math: Have students calculate the total amount of plants needed based on the area of the rain garden.
- Technology: Students could use digital cameras to record the step by step creation of the rain garden to create a PowerPoint or PhotoStory presentation.
- Language Arts: Students could write a letter to a local nursery asking for a reduced price or donation of native plants.
- Language Arts: Students could read about the purpose of rain gardens, the design of rain gardens, and the importance and purpose of native plantings.

## Tips for Implementation

- Be sure to work with local agencies as a means of support. Local nurseries might be interested in providing native plants at little or no cost. If excavation is needed, contact a local contracting company. Media coverage and newsletter acknowledgement can be motivating and encourage community involvement and business partnerships.
- Ask members of the school community to lend their planting supplies (e.g. shovels, gloves, rakes). Be sure that they are labeled for easy return (masking tape and a marker work great).

## BMP Project 2 – Rain Barrels

### Background

A rain barrel collects and stores rainwater from rooftops to use at a later time for lawn and garden watering. Rainwater normally pours off the roof directly or flows through roof gutter downspouts and becomes stormwater runoff. Depending on your schoolyard site, this runoff can travel onto paved surfaces and eventually into a storm drain. Rain barrels are designed to collect this stormwater runoff. They conserve water and help lower irrigation costs (a rain barrel can save approximately 1,300 gallons of water during peak summer months). Rain barrels reduce water pollution by reducing stormwater runoff, which can contain pollutants like sediment, oil, grease, and nutrients. Rain barrels are inexpensive and easy to build and install. A rain barrel can be used to save water for irrigating plants during dry periods. Rain barrels can also be designed to slowly release the collected rainfall to areas that can soak up the water, reducing stormwater runoff, and increasing groundwater recharge.

### Resources

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- Marshy Point Nature Center  
7130 Marshy Point Road  
Baltimore, MD 21220  
410-887-4251  
<http://www.marshypoint.org/>
- Community Watersheds: *How to Build and Install a Rain Barrel*  
[http://www.cwp.org/Community\\_Watersheds/brochure.pdf](http://www.cwp.org/Community_Watersheds/brochure.pdf)
- Maryland Department of Natural Resources: *Build a Simple Rain Barrel*  
<http://www.dnr.state.md.us/ed/rainbarrel.html>

- Chesapeake Bay Foundation: *Rain Barrels*  
[http://www.cbf.org/site/PageServer?pagename=action\\_outdoors\\_landscaping\\_gardens\\_rainbarrels](http://www.cbf.org/site/PageServer?pagename=action_outdoors_landscaping_gardens_rainbarrels)
- The Maryland Association for Environmental and Outdoor Educators: *Rain Barrels*  
<http://www.maeoe.org/habitat/projects/rainbarrels.php>
- Arlington Echo Outdoor Education Center: *Roll Out the Barrels*  
<http://arlingtonecho.net/rainbarrel.htm>

## **Cross Curriculum Connections**

- Math: Students could calculate the total volume of the rain barrel. Students could calculate the area of the roof's surface flowing into the rain barrel.
- Math: If rain barrels are being constructed, students can calculate the total amount of materials needed.
- Technology: Students could create a PowerPoint presentation to illustrate the benefits of utilizing rain barrels.
- Language Arts: Students could write a letter to a local home improvement store to ask for reduced prices or donation of materials.
- Language Arts: Students could read about the purpose of rain barrels or the designing of rain barrels.
- Art: Students could decorate the outside of the rain barrels as class projects.

## **Tips for Implementation**

- Make sure the rain barrels have an overflow at the top.
- Do not use collected water for drinking or washing purposes.
- The water collected from the first few rainfall events may not be able to be used due to the buildup of pollutants.
- Use screens on the barrels to prevent mosquitoes from breeding in the barrel.
- Make sure the lid is tightly secured to prevent animals or children from falling inside.

## **BMP Project 3 – Water Conservation Posters**

### **Background**

Water can be used in many ways, but it is a limited resource. The average resident of the Bay region uses between 75 and 100 gallons of water per day. Only about four gallons of this is actually needed for survival. Much of the rest is used to carry away waste. Close to two billion gallons of wastewater from sewage treatment plants flows into the Chesapeake Bay every day. Most of us take for granted that clean water in unlimited quantity will always be available, yet rampant development in the area has increased consumption and added to stream, river, and Bay pollution. This can cause depletion of groundwater supplies and can, in effect, reduce usable water.

The first step in conserving water is to check for and eliminate any leaks occurring in faucets, toilets, hoses, and pipes. These leaks can waste huge amounts of water. At water pressures normally encountered in household systems, a 1/32 inch opening in a faucet can waste up to 200 gallons of water per day; a steady drip wastes roughly 20 gallons per day; and a leaking toilet alone may waste 200 gallons per day without making a sound! So if you find any leaks, fix them at once! Students play an important role in making sure that every drop counts and there are things they can do to help save water. If everyone saves a little, we can save a lot. Encourage students to create colorful posters depicting key water conservation themes. The students can then place these posters in strategic locations near water sources around the school.

### **Resources**

- Environmental Protection Agency: *Water: What You Can Do*  
[www.epa.gov/water/kids/you.html](http://www.epa.gov/water/kids/you.html)
- Maryland Department of the Environment: *Facts About Water Conservation*  
<http://www.dnr.state.md.us/ed/wc.pdf>
- Chesapeake Bay Foundation: *Use Water Responsibly*  
[http://www.cbf.org/site/PageServer?pagename=action\\_simple\\_ways\\_water\\_use](http://www.cbf.org/site/PageServer?pagename=action_simple_ways_water_use)
- Environmental Resources Center: *Give Your Water a Hand*  
<http://www.uwex.edu/erc/gwah/#What%20is>

### **Cross Curriculum Connections**

- Art: Students could make small signs to place in their house reminding them to turn off the water when brushing their teeth or lathering their hands.
- Language Arts: Students could write about water in haiku format.
- Language Arts: Students could write a letter to their parents telling them specific tips to reduce water use.
- Language Arts: Students could read about water conservation facts and tips regarding the reduction of water usage.

- **Math:** Students could collect the water lost from a leaking faucet for 10 minutes. They could then calculate the total volume of the water lost due to the leaking of the faucet. Next, the students could tally the number of leaking faucets found around the building. They could estimate the volume of water lost due to all the leaking faucets in the building. After that, the students could multiply the estimation by six to display how much water is wasted in an hour. That number could be multiplied by 24 to display how much water is wasted in a day. Finally that number could be multiplied by 365  $\frac{1}{4}$  to show the amount of water wasted in a year.
- **Technology:** Use *Microsoft Word* and *Clipart* to create signs regarding water conservation.

### **Tips for Implementation**

- Recruit the school custodian to join the water conservation effort and have them aid in the search for leaks around the building.

### **Additional Project Ideas for the Water Conservation and Pollution Prevention BMP**

- Inform the school staff, parents, and community members about more environmentally safe ways to handle ice removal during the winter weather. Home and Garden Information Center: *Melting Ice Safely*  
<http://extension.umd.edu/publications/PDFs/FS707.pdf>
- For larger scale projects, consider having the students apply for a grant to fund the project through the Chesapeake Bay Trust:  
[http://www.cbtrust.org/site/c.enJIKQNoFiG/b.2020181/k.A9BD/Types\\_of\\_Grants.htm](http://www.cbtrust.org/site/c.enJIKQNoFiG/b.2020181/k.A9BD/Types_of_Grants.htm)
- If your school has a nearby stream, plan a stream clean-up day. Purchase water quality monitoring equipment. Pre and post evaluations of the stream quality could also be completed using aquatic insects as stream health indicators.
- Rebuild an eroded area by planting native trees or shrubs to prevent future erosion. Coordinate this project with your BCPS Grounds Crew Supervisor.
- Create a “no-mow zone” to reduce rainwater runoff and attract wildlife at the same time. Coordinate this project with your BCPS Grounds Crew Supervisor.
- Create a wetland on the school grounds. If possible, place it near an impervious surface so that oil, gasoline, and pollutants will filter through the wetland. Coordinate this project with your BCPS Grounds Crew Supervisor.
- Tour a wastewater treatment plant to see firsthand the need for water pollution prevention.