



Cleaning Up Our Act

NAAEE Guidelines for Learning:

4th Grade

Strand 2.2 C; Strand 2.3 C; Strand 2.4 A; Strands 3.1 A, B, C; Strands 3.2 A, C; Strand 4 B

5th - 8th Grade

Strand 2.3 C; Strand 2.4 A; Strands 3.1 B, C; Strand 3.2 C; Strand 4 C

Lesson Outcomes:

Students will understand...

- different BMPs that government and local organizations promote to reduce **point** and **non-point source** pollutants
- that BMPs must be adapted to address the environmental issues specific to an area
- that everyone in a community must be part of the effort to reduce water pollution

Students will be able to...

- identify specific ways to reduce pollutants in their community
- identify and distinguish between BMPs for urban and rural areas
- write an essay on what they have learned about BMPs

Duration of Activity:

Two hours

Vocabulary Words:

Algal blooms, aquatic organism, Best Management Practices, compost, conservation tilling, crop rotation, decompose, eroded, erosion control, fecal coliform, green roof, groundwater, leaching, nutrients, organic, no-till, phosphorous, pollution, porous pavement, rain barrel, rain garden, riparian forest buffer, runoff, rural, sediment, sewage, urban

Setting:

Indoors

Materials:

Student Pages:

1. "Match It Up:" One printed copy per student
2. "Potomac River Watershed Board Game:" One printed copy per group of three to four students (printed on a large sheet of paper and glued together on poster board to create a large game board)
3. "Potomac River Watershed Board Game Instructions:" One printed copy per group of three to four students
4. "Potomac River Watershed Board Game Cards:" One printed set per group of three to four students (print cards double sided)
5. "Cleaning Up Our Act Worksheet:" One printed copy per student

Teacher Page:

1. "Match It Up Answer Key"
- Blackboard/whiteboard and chalk/dry erase markers, or sheet of butcher paper and markers/crayons

Summary

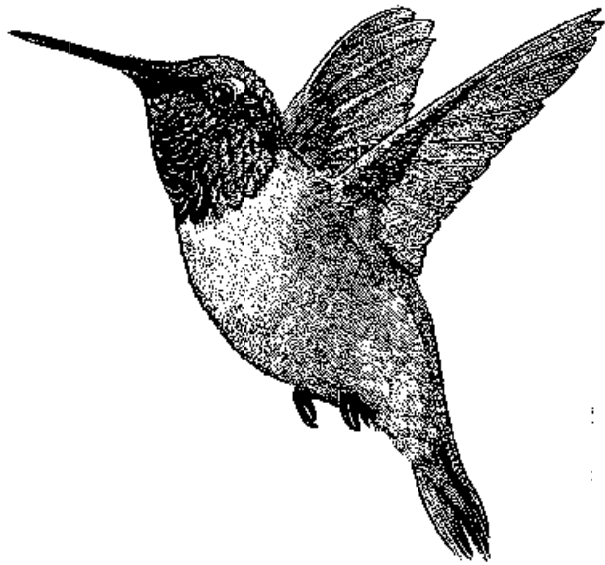
Students will discover specific **Best Management Practices (BMPs)** that reduce water **pollution**. Students will think creatively about strategies for implementing BMPs at their school and in their community.

Background Information

A multi-faceted approach is essential to effectively reduce pollution throughout the Potomac River **watershed**. To address water quality issues, government agencies and nonprofits are increasingly adopting Best Management Practices, or BMPs. BMPs are practices or a combination of practices that have been developed to provide the most effective and practical means of controlling both point and non-point source pollution.

Stormwater **runoff** is one of the greatest contributors of pollution to the Potomac River and its **tributaries**, and also the most challenging to manage. But a variety of BMPs are employed throughout the Potomac River watershed to filter, treat, and slow the flow rate of this runoff into rivers and streams.

Some of these BMPs—called **structural BMPs**—involve man-made structures, such as **sediment fences**, **porous pavement**, and **retention ponds**. Structural BMPs are most commonly used in **urban areas**, or in **rural areas** where land is void of protective vegetation. In more rural areas, **vegetative BMPs**, such as tree and grass plantings, are commonly used. **Managerial BMPs**, which establish runoff-prevention protocols (e.g., by recommending **pesticide** application procedures) are relevant in all settings (i.e., urban, rural, and suburban). All of these categories of BMPs manage stormwater runoff, ultimately minimizing its impact on nearby waterways.



In urban and suburban areas, BMPs must not only address stormwater runoff resulting from industrial and commercial sites, but also from residential construction sites, roads, parking lots, and lawns. A common BMP for remodeling or new development is **Low Impact Development (LID)**, which captures stormwater and provides many other conservation benefits. The goal of LID is to infiltrate stormwater directly at its source, rather than directing it through pipes or other channels. Because it replicates natural hydrology to maintain groundwater levels, in cities and suburbs, this BMP can be one of the most effective.

Examples of LID include **rain barrels**, which capture runoff from roofs that can be later used for watering plants. **Green roofs** have plants growing on them, and effectively filter and slow runoff originating from the building. Installing **rain gardens** (native plant gardens often situated in low-lying areas), retention ponds, and porous pavement on driveways and parking lots are also effective BMPs in urban and suburban settings. Additionally, encouraging homeowners to apply fertilizers and pesticides to their lawns and gardens in the right amounts at the right time can reduce **nutrient pollution** originating from suburban areas.

In rural and agricultural areas, a different variety of BMPs are applied to reduce or stop soil **erosion**, reduce nutrient levels in runoff, and prevent runoff altogether. **Agricultural BMPs** include creating **infiltration ponds**; installing manure storage structures to contain animal waste; constructing fencing to keep livestock out of streams; planting vegetated **buffer strips** at the edges of crop fields and cattle pastures; using animal waste as **fertilizer** on cropland; and leaving crop residue on fields after harvest. Farmers can also alternate strips of crops planted and sow seeds in a way that follows the contour of the land, a process called **contour strip farming**.

To address bare stream banks that run through farmland, BMPs include planting **riparian buffers**, building livestock watering

stations that are fed by wells, and fencing livestock out of waterways. In addition, by applying appropriate amounts of fertilizers and pesticides to crops at the right times, farmers can protect water quality while also saving money.

The diversity of BMPs offers promise to better protecting our waterways from pollution. But the success of these practices lies largely in the extent to which they are adopted by farmers, homeowners, and businesses alike. Governmental and nonprofit organizations throughout the Potomac River watershed are partnering with individuals and communities to increase awareness of the importance of these practices, the ease of adopting them, and the universal benefits they offer to the quality of the water on which we all depend.

Essential Questions

- What specific pollutants come from urban areas? From rural areas?
- How much water pollution is too much?
- How can we regulate pollution levels?

Pre-assessment

Write the Essential Questions on a chalkboard, whiteboard, or piece of butcher paper. Lead the class in a group discussion of the questions, encouraging them to share personal observations and experiences they have had with pollutants in their own community. Record students' answers.

Lesson Procedures

1 Explain that the Environmental Protection Agency and other organizations implement Best Management Practices (BMPs) to protect and improve water quality in rivers and streams throughout the Potomac River watershed. Write this definition of Best Management Practices on a chalkboard, whiteboard, or piece of butcher paper: *Best Management Practices (BMPs) are procedures or a combination of procedures that have been developed to provide the most effective and practical means of controlling both point and non-point source pollution.* Ask a student volunteer to read the definition aloud to the class. Keep the definition posted throughout the lesson for students to reference.

2 Distribute one copy of "Match It Up" to each student, and assign them to individually complete the worksheet for both urban and rural BMPs.

3 After students have completed "Match It Up," give them an opportunity to compare answers with their neighbor. As a class, review the worksheet, allowing time for students to ask questions and further discuss the BMPs. Refer to the "Match It Up Answer Key" for the correct answers.



4 Play the “Potomac River Watershed Board Game.” To do so, divide the class into teams of two to three students and assign three to four teams to each game. Distribute one “Potomac River Watershed Board Game,” one copy of “Potomac River Watershed Board Game Instructions,” and one set of “Potomac River Watershed Board Game Cards” to each group. Give the students at least 20 minutes to play the game, and award the winners with prizes.

5 Keep students in the same groups in which they played the board game. Ask each group to write down at least ten BMPs that would benefit water quality in their own community. Allow five to ten minutes for this exercise. Assign a representative from each group to present the group’s ideas to the class.

Post-assessment

Distribute one copy of the “Cleaning Up Our Act Worksheet” to each student. For homework, assign the students to select one question to write a short essay in response to; for the remaining two questions, they should write a three- to four-sentence answer. Collect and review (using the resources within

this Lesson) the essays to assess students’ understanding of the Lesson matter and to evaluate their writing skills.

Extensions

- Install a rain barrel at your school to prevent runoff. Survey the school building to locate downspouts and choose an appropriate location for a rain barrel. Visit www.rainscapes.org, a collaboration of the Potomac Conservancy and the Montgomery County Department of Environmental Protection, for more information on where you can purchase and install a rain barrel.
- Plant a rain garden on your school grounds. Ask students to draft a proposal to the school principal describing what a rain garden is and why one should be installed at the school. If permission is granted, lead students in constructing a rain garden. Visit www.rainscapes.org to learn more. If monies are not available to support the creation of a rain garden, have students host a fundraiser.
- Work with students to encourage your school to install permeable pavement, in the place of regular pavement, to allow water to infiltrate into the ground.

Take Action:

Encourage students to:

- Work with their family to install a rain barrel to capture water from their downspouts. They can use the water to water their garden or landscaping.
- Encourage their parents to install a rain garden in their yard, which can provide an example for their neighborhood.
- Encourage their family to implement Low Impact Development practices. Students can learn more by downloading a free copy of the *Good Neighbor Handbook* from www.potomac.org, and referring to the “Waste Not, Want Not: Capturing and Using Stormwater” chapter.

Additional Resources:

- Berres, Matt, Stephanie Flack, Meredith Lathbury, and Jennifer Schill. *Good Neighbor Handbook: Tips and Tools for River-Friendly Living in the Middle Potomac Region*. Potomac Conservancy and Nature Conservancy, 2005. http://www.potomac.org/site/wp-content/uploads/pdfs/good_neighbor_handbook.pdf.
- “Mid-Atlantic Water: Total Maximum Daily Loads (TMDL).” U.S. Environmental Protection Agency. <http://www.epa.gov/reg3wapd/tmdl/index.htm>.
- *The Northern Virginia BMP Handbook*. Annandale, Virginia: Northern Virginia Planning District Commission and Engineers & Surveyors Institute, 1992. <http://www.novaregion.org/bmp.htm>.
- RainScapes. Montgomery County Department of Environmental Protection and Potomac Conservancy. www.rainscapes.org
- Sprague, E., et al. *The State of Chesapeake Forests*. Arlington, Virginia: The Conservation Fund and The Northeastern Area, 2006.
- “Tracking Restoration Efforts in Maryland’s Tributaries.” Maryland Department of Natural Resources. <http://dnrweb.dnr.state.md.us/watersheds/surf/bmp/>.