

Shared Waters: Making a positive impact on our local watershed



Authors: Nanette Marcum-Dietrich, Ph.D.¹, William McConnell, Ph.D.²

Contributors: Abdul Ibrahim, Ed.D.¹, Bradley Showalter³, Elizabeth Fulton¹, Katherine Harnish³

¹Millersville University of Pennsylvania, 40 Dilworth Road, Millersville, PA 17551

²Virginia Wesleyan University, 5817 Wesleyan Drive, Virginia Beach, VA 23455

³Penn Manor School District

Preferred Citation:

Shared Waters. (2023). Shared Waters: Making a Positive Impact on Our Local Watershed. Millersville, PA: Marcum-Dietrich, N., McConnell, W., Ibrahim, A., Showalter, B., Fulton, E., & Harnish, K.

Author's Note:

Nanette Marcum-Dietrich: <https://orcid.org/0000-0001-7535-3984>

William McConnell: <https://orcid.org/0000-0002-7050-2167>

Abdulsalami Ibrahim: <https://orcid.org/0000-0001-7778-3582>

Elizabeth Fulton: <https://orcid.org/0000-0002-1474-708X>

Copyright:

This work was funded by the National Oceanic and Atmospheric Administration B-WET Grant NA21NMF4570498. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration.

Correspondence concerning this curriculum should be addressed to:

Nanette Marcum-Dietrich, Ph.D., Millersville University, 51 Lyte Road, Millersville, PA 17551, USA. Email: nanette.marcum-dietrich@millersville.edu

Usage Statement:

Individual teachers are welcome to use the "Shared Waters" curriculum for classroom purposes without seeking permission. However, the use of this curriculum for school professional development or by other professional development providers is prohibited without prior written consent from the authors. Any sale of materials designed and advertised for use with this curriculum is strictly prohibited.



Lesson 5: Modeling Changes to the Schoolyard

(2 days)

Overview:

Lesson 5 builds upon lesson 4, where students learned about what factors influence runoff and how the amount of runoff impacts the watershed. In lesson 5, we will focus on the effects of human activities on our watershed. Technological advances and development have impacted how we use the land. In this lesson, we will explore how technological advances and development have changed how we use the land and how these changes impact the watershed. We will then learn how installing conservation practices can help reduce runoff in developed spaces using the Model My Watershed® online GIS application.

We begin by taking a trip back in time. Pennsylvania's history of human habitation extends thousands of years, starting when humans first entered the area now known as Pennsylvania. In the first activity, we identify the indigenous people who historically and presently inhabit our local watershed using the native-land.ca website. When indigenous people first settled in Pennsylvania, the land was covered by forests. These forests inspired the name Pennsylvania, which means– Penn's Woods. Have students imagine what the area around the school looked like in the past. Over time, technological innovation and development have changed how we use the land. How have these changes impacted our watershed? Refer to previous lessons for inspiration. Review the runoff simulation lesson where we compared the impact of different landcover types on the amount of runoff. Next, reference the crumpled paper watershed to illustrate how runoff moves across the landscape. Ask students, "What kinds of development does a community need today for people to lead happy, healthy, and productive lives? What did your students include in their watershed? Parks, homes, schools, stores, or roads? For a community to thrive, we need those things, but we can be thoughtful in developing the land to reduce negative impacts. Students will then imagine and draw what the area may have looked like before European colonization and what a community looks like today, including all of the developments needed for a happy and healthy community, to identify necessary land types.

In the next activity, students will analyze the schoolyard using the Model My Watershed® (MMW) – Site Storm Model to explore ways to reduce runoff by changing land cover or adding conservation practices to the schoolyard property. As we learned, runoff can harm watersheds as pollutants and sediment can be carried into the waterways. Conservation practices can prevent excess runoff and improve infiltration and evapotranspiration.

The Site Storm Model within MMW is a powerful online GIS tool that includes real data from national databases on land cover, soils, stream maps, water quality, and more. MMW is a professional-grade application that teachers can use, students, land use planners, conservation planners, scientists, citizen



science groups, and the public to understand how human activities landcover and the installation of best management practices (BMPs) can protect and conserve the quality of water in their watersheds. In this activity, students create scenarios to reduce runoff and improve infiltration by modifying the land cover and adding conservation practices to their schoolyard. Students should refer to the Schoolyard Maps they made in Lesson 3 to identify areas in the schoolyard that need change. * Instructional Video to walk you through how to use MMW- https://youtu.be/qr_Xnhqdf0g .

Materials:

Materials provided in the lesson 5 Kit:

- **Activity 2:** [Conservation Practice Fact Sheets](#)

Materials you will need:

- [Lesson 5 slide show](#)
- **Activity 1:** computer/tablets and 25 copies of [Past and Present Worksheet](#)
- **Activity 3:** 25 copies of the [Model My Watershed Handout](#) and Computer/tablets

Websites:

- Native Lands Mapper - <https://native-land.ca/>
- Model My Watershed - <https://modelmywatershed.org/>

Learning Objectives:

At the end of the lesson, students will be able to:

- Recognize the indigenous peoples who have inhabited the region both historically and in contemporary times.
- Examine the impact of human activities on the watershed.
- Describe conservation practices that can reduce runoff.
- Propose ways to improve our watershed.

Activity 1 (15 minutes): Indigenous Peoples and Changing Land Cover

Have students navigate to native-land.ca and click 'open street map labels' in the bottom right-hand corner of the window to add current roads and towns to the map. In the top left corner of the window, enter your school's address to navigate to the appropriate location on the map and identify the indigenous territories present.

Next, hand out the [Past and Present worksheets](#) and art supplies to students. Have them start on the 'Past' side of the paper and draw what they imagine the land their town is on looked like 600 years ago, along with a descriptive sentence. Next, tell students that with advances in technology, how we use the land has changed. Ask them what a community needs to support happy and healthy people today. Have students imagine, draw, and write a sentence on the right side of the worksheet about what this ideal



town would look like. Once all students are done, have them reflect on the similarities and differences between the two drawings. Then, in small groups, students should share their community drawings.

Activity 2 (10 minutes): Conservation Practices

Begin this lesson by asking students to describe the best land cover to reduce runoff by thinking about what they learned in lesson 4 with the runoff simulation. Then, have students take out the schoolyard maps that they created in Lesson 3, where they identified pervious and impervious surfaces. The red areas on their map contribute to runoff in the schoolyard. Ask students, “How can we change our schoolyard to reduce runoff.” In lessons 3 and 4, students should reply that changing the land cover to a pervious surface (e.g., grass, forest, etc.) will help. This is an excellent time to discuss how we need some of these impervious surfaces for practical reasons. We need parking lots, roofs, outdoor basketball courts, etc., but there are ways to improve these surfaces for the watershed. We call these better choices **conservation practices**. We can use porous pavement for the parking lot. We can add green roofs to the school. We can even improve pervious surfaces by adding rain gardens to areas where puddles form, planting trees, and replacing grass with meadows. Use the [conservation practices fact sheets](#) to enhance this discussion.



Conservation
Practices:



Rain Garden: A rain garden is a low-lying (shallow) area that slows down, soaks up, and filters precipitation (rain, snow, sleet, or hail) from downspouts, roofs, streets, driveways, and other impervious surfaces.



Vegetation Infiltration Basin: A vegetation infiltration basin is a large, constructed depression (sunken land) that captures runoff from storm-drain sewers or directly from impervious surfaces like parking lots, roads, or sidewalks.



Porous Paving: Porous paving, stones, bricks, and special mixes of concrete or asphalt are used in place of impervious paving materials. These materials have pores (or small holes) for water to soak through the paving and infiltrate into the ground below.





Green Roof: A green roof is a flat or gradually sloped roof that is partially or entirely covered with vegetation. Most green roofs have layers of material that keep the interior of the building dry, slow the movement of water off the roof, keep the plant(s) alive, and reduce runoff.



No-Till Agriculture: No-till agriculture is a conservation practice in which farmers plant crops without disturbing the soil or removing the already existing plants. This improves the infiltration rate of the soil, reduces erosion, and builds the organic matter and nutrient cycle in the soil.



Cluster Housing: Cluster housing is a way of building residential areas where homes are built in groups closer together, which allows for larger open spaces between the buildings. The larger open spaces are often planted with trees and vegetation that enhance infiltration, reduce runoff and erosion, and provide recreational space for the inhabitants.

Activity 3 (20 minutes): Model My Watershed (teacher-led)

What improvement strategy will students think will decrease runoff around the schoolyard? Let's explore the Model My Watershed Website. <https://modelmywatershed.org/> Here, the class will examine how human activity(ties) affect the watershed, specifically their school environment. Teachers will guide students to explore conservation practices on MMW and propose ways to improve their schoolyard using different conservation practices while recording data on the [worksheet](#).

Instructional Video to walk you through how to use MMW- https://youtu.be/qr_Xnhqdf0g

Step by Step summary of MMW directions:

1. Visit the Model My Watershed website.
2. Type the location of the school in the address bar.



3. On the Layers menu– (under the tab that looks like little sheets of paper), click Satellite with Roads.
4. Click on the Green GET STARTED button on the left of the screen.
5. Under Draw Area, choose Square KM.
6. Put the cursor right over the school location and click. (You can zoom in or out if needed.)
7. This shows a square km boundary surrounding the school.
8. Choose Model on the left side of the screen.
9. Click on Site Storm Model.
10. You see a color grid showing Evapotranspiration, Runoff, and Infiltration.
11. Click on Add Changes to this Area on the upper right-hand side of the screen.
12. Choose different options under the green-colored Conservation Practice and Land Cover buttons at the top of the screen.
13. Click on compare to see how your changes compare to the original condition and to a complete forest.
14. Download your work and save for use in Lesson 9.

Assessment: Exit Ticket

If you were to modify your **home** environment, what would you do differently than what you did in your schoolyard?

