

The Potomac Highlands Watershed School
Lesson Plan for the Watershed Module
Rev. December 14, 2009

Purpose:

This module teaches students about watersheds, their parts, and the functions of each watershed part. Why watersheds? Because that's where we live – most obviously in mountainous terrain like West Virginia's Potomac Highlands.

Perhaps more importantly, the watershed – rather than political boundaries - has become the organizing concept underlying environmental assessment and protection efforts at both the local, state and regional levels. This is a logical approach, as most of us "live downstream" from somebody else, and that somebody we are downstream from lives in our watershed. For example, the Chesapeake Bay is "downstream" from West Virginia, and efforts to protect the Chesapeake Bay from pollution focus on pollution delivered through watersheds (like the Potomac).

Federal and State Government agencies - including those throughout the Chesapeake Bay Watershed - increasingly seek to solve problems by working with inclusive citizen's groups known as watershed associations; as the name implies, watershed associations consist of people living within a watershed. This has created a new and very positive way for citizens to work with and impact government action.

The Flash activities, scavenger hunts, links, and background information provide students with a solid base for understanding what a watershed is while giving them a sense of place in their own watershed. This foundation is important when learning about more complex topics such as pollution, development, and resource management.

Web Based Tools:

❖ **Interactive Learning Activities: What is a Watershed?, Potomac Watershed Puzzle and Watershed Creator**

What is a Watershed?, Potomac Watershed Puzzle and *Watershed Creator* were developed to provide students with most of the information they will need to have a basic understanding of watershed parts and functions. These activities do not discuss the hydrologic cycle in detail, largely because it is treated so well on a number of other websites. We have links to a number of these sites in the watershed section of the Bookshelf under hydrologic cycle. In particular the United States Geological Survey site offers a very comprehensive look at the water cycle anywhere and the Waterloo site has a nice water cycle animation. This allows the instructor to cover other topics such as those suggested below in the Follow Up sections.

What is a Watershed? (elementary, middle) is a simple Flash narrative about the watershed concept paced for the elementary school level. However, based on substantial feedback, is quite effective for middle school and even the high school level. The idea of using water flowing off the roof of a shed to introduce the watershed concept was based on an experience in the real world where CI staff was in a shed with a bunch of middle school students talking about watersheds - and it started to rain. While this activity does not focus on explaining the water cycle, it shows the portions of the water cycle most relevant to explaining the watershed concept

as rain falls from a cloud, runs over and through the ground to a stream, and is pulled by tree roots via evapotranspiration from the ground.

Potomac Watershed Puzzle (PWP). The purpose of this activity is to expose the students to the parts of the watershed, provide a definition for the “parts,” and provide a basic description about their functions. *Potomac Watershed Puzzle* has six distinct sections:

1. It opens with an animated sequence that is designed to gain the students attention as well as introduce the idea that the parts of a watershed aren't just on the surface, but also underground.
2. The second section provides a definition of a watershed, which leads into an opportunity to put a watershed jig-saw puzzle together. The puzzle introduces the idea that a watershed, like a puzzle, has many parts. This puzzle can be skipped if time does not permit it to be completed.
3. The third section opens with instructions. After reading the instructions, the user clicks on "buttons" that bring up text describing each part of the watershed. This is the first learning phase.
4. The fourth section is a matching quiz where students match watershed parts with watershed functions. It is "open book", which means that the student can review the information for each of the watershed parts before they choose their answer. Finally, it is scored very gently. The student has eight possible answers for each of ten matching questions, and each match has a maximum score of one. If their first guess is wrong, their score is dropped 1/8 of one point, if wrong twice, their final score is dropped 2/8 of one point, etc. The purpose here is to get them to READ the material. They do have to find the correct answer for each match before they can move on.
5. The fifth section is the true/false memory challenge, and here the students are on their own. There is no open book they can read to search for answers, and no second chance to get an answer right.
6. The final step is the results page. It includes the name of the game, the name of the student (if they signed in), the date the game was played, and a complete score sheet. The student should print this page and turn it in to their teacher. The results will also be stored in a database and can be retrieved at a later time.

Watershed Creator is designed for the middle or early high school level (or elementary if the instructor deems it appropriate). This activity provides students with more detailed information about the parts of a watershed and their functions. *Watershed Creator* has five sections:

1. The first section provides the definition of a watershed
2. The second section is a "how-to-play" tutorial.
3. The third section is a matching game that challenges students to connect watershed functions with watershed parts. As questions are answered, the parts of the watershed appear until it is complete. As in Watershed Puzzle, this section is "open book", which means that the student can read information about each of the watershed parts before they choose their answer. It is scored very gently. The student has seven possible answers for each of eleven matching questions, and each match has a maximum score of one. If their first guess is wrong, their score is dropped 1/7 of one point, if wrong twice, their final score is dropped 2/7 of one point, etc. The purpose here is to get them to READ the material. They do have to find the right answer for each match before they can move on.
4. As in Watershed Puzzle, the matching game is followed by a true/false memory quiz. There is no open book they can read to search for answers, and no second chance to get an answer right.
5. The final step is the results page. It includes the name of the game, the name of the student (if they signed in), the date the game was played, and a complete score sheet. The student

should print this page and turn it in to their teacher. The results will also be stored in a database and can be retrieved at a later time.

In the *Potomac Watershed Puzzle* and *Watershed Creator* each exercise is scored. The scores are available to print once the student has completed all of the exercises in either activity.

❖ **Potomac and Chesapeake Bay Watersheds Scavenger Hunt**

This activity is a web based scavenger hunt designed to provide students with additional information and facts about their local and regional watersheds, and to expose them to some of the many agencies and organizations working to protect the Potomac and Chesapeake Bay watersheds. It can be a stand-alone exercise used to improve computer skills or as a compliment to the interactive activities. This activity has both elementary and middle school levels.

The scavenger hunt involves answering a series of questions developed around specific text from internet sites. The scavenger hunt is started by clicking on Web Scavenger Hunt on the classroom's blackboard - which leads to the Potomac and Chesapeake Bay Watershed Scavenger Hunt webpage. This page contains the list of questions with hyperlinks to the websites containing the answers. If a direct hyperlink to the correct answer could not be offered, instructions are provided within a specific question on how to access the correct webpage.

Instructors are provided, on request, with a guide for this activity. The guide includes the questions, website links, text from each website that answers the questions, and a copy of the student question sheet. Please email us at pcrel@mountain.net and request this information. The question sheet can be downloaded by the students through the scavenger hunt webpage or handed out by the teacher. Both the student question sheet and the teacher guide are in PDF format.

❖ **Links**

A list of watershed curriculum links has been provided within the student classrooms, available by clicking on the watershed section of the bookshelf. The links pages contains both the relevant student links and links to other material and references complimentary to the topic. Instructors can guide their students to links through the classroom.

Instructional Procedure:

It is suggested that this module begin with very little introductory material. Background information, including the complete informational content of each activity, is available online in the classroom's bookshelf, but it is not necessary to have the students read this material before completing the online activities. The *Potomac Watershed Puzzle* and *Watershed Creator* were designed to provide students with most of the information necessary to understand the basics of watershed parts and functions. Once one or both of the activities are completed, they can be followed by the *Potomac and Chesapeake Bay Watersheds Scavenger Hunt* and/or the Follow Up information provided below. **These activities do not discuss the hydrologic cycle in detail**, largely because it is treated so well on a number of other websites. We have links to a number of these sites in the watershed section of the Bookshelf under hydrologic cycle. In particular the United States Geological Survey site offers a very comprehensive look at the water cycle anywhere and the Region of Waterloo site has a nice water cycle animation. We suggest that these sites be included in the watershed curriculum, as noted below.

Follow Up:

The information provided here is just a suggestion for follow up. More ideas can be found within the student and teacher links [here](#). Once the students have completed the web based activities additional information can be discussed in the classroom. The students can also explore watersheds through at home activities and internet and library research. These activities would also be ideal as a preliminary to hosting Cacapon Institute's Watershed Stewardship Fairs, or the WV Conservation Association's Conservation Field Days

Classroom Activities:

- ❖ What watershed do I live in? – A teacher led discussion to help the students learn about the watersheds they live in, from the small creek behind their house to larger watersheds such as the Potomac River. This information found on the internet through the Environmental Protection Agency’s website (see the links page) or through the use of topographic maps.
- ❖ Understanding the water cycle. As noted above, activities in the PHWS site do not discuss the hydrologic cycle in detail. Its not that the water cycle isn't important, but rather that the subject is treated so well on a number of other websites. We have **links** to a number of these sites in the watershed section of the Bookshelf under hydrologic cycle. The Region of Waterloo site has a very nice water cycle animation that introduces the way water moves through a watershed. We suggest starting at this site, and then visiting the United States Geological Survey site that offers a very comprehensive look at the water cycle. We suggest that students read the opening sections on the following topics: precipitation, infiltration, springs, surface runoff, and evaporation, followed by a classroom discussion on how different land uses might affect the way water cycles in a watershed.
- ❖ My role in the watershed. – A teacher lead discussion/lesson informing students about the role and impacts people have on watersheds. Government agencies - including those in West Virginia - increasingly seek to solve problems by working with inclusive citizen's groups known as watershed associations; as the name implies, watershed associations consist of people living within a watershed. This has created a new and very positive way for citizens to work with and impact government action. Topics covered could include pollution from humans (it is suggested to discuss locally relevant pollution sources), impacts humans have on ground water (see links page), and what people can do to help protect and improve the health of their watershed (information can be found at many of the links). This discussion could lead into the Pollution curriculum module.
- ❖ **Prince William County Schools** (Virginia) is using the eSchool as a part of their Meaningful Watershed Experiences curriculum for Grade 6 Students: ***From the Mountains to the Estuary: From the Schoolyard to the Bay***. With their permission, we have excerpted the Watershed Lesson Plans from their curriculum. It includes the following lessons: What is a Watershed?; Watershed Boundaries; Topographic Map Investigation: Play Dough Mountain; Overview of the Chesapeake Bay; Watershed Investigation (Part 1: Questions for Topographic Maps in Watershed Investigation, Part 2: How Humans Influence Watershed); Watershed Management Game: Where Has All the Water Gone?; Modeling: A Drop in the Bucket; Water Conservation; Wonders of Watersheds Vocabulary; Watershed Systems Board Game; and River Talk - Analogies of a Watershed.

- ❖ **Watershed Research** – Students can learn more about watersheds through internet and library research. Students can be given the task of preparing a one page paper on topics related to watersheds. This paper can either be presented in class or handed in. Suggested topics include:

- Additional research of watershed parts and their functions
- Research of locally relevant pollution sources
- Research on watershed resources such as timber, drinking water, etc. found in local watersheds.
- Research on organizations working to help improve and educate about watersheds. Focus on what they are doing and why.
- Research on watershed protection practices.

At Home Activities:

The links provided for this module contain various at home activities for students to complete, such as learning about water use in their home and what types of impacts a student's home is having on their watershed. It is easy to locate these activities when surfing through the websites.

CSOs: *Potomac Watershed Puzzle* (PWP) is the first of a series of activities that explores the physical landscape of the Potomac Highlands and interactions of people in that landscape. These activities are also intended to help teachers “provide opportunities for students to use education technology interwoven with relevant curricular content,” as required by the WV Content Standards and Objectives (CSO).

Social Studies. This curriculum can readily be used to provide the framework for regionally relevant discussions on citizen involvement in decision making.

Standard 1: Citizenship (SS.S.1)

Students will:

- develop and employ the civic skills necessary for effective citizenship by using criteria to make judgments, arrive at and defend positions and evaluate the validity of the positions or data (Evaluation Skills);
- demonstrate and employ the participatory skills of interacting, monitoring and influencing that are essential for informed, effective and responsible citizenship, including participation in civic life to shape public policy (Participatory Skills);

SS.5.1.1 describe how groups and institutions work to meet the individual needs and promote the common good (e.g., Red Cross, laws).

SS.5.1.2 explain the political process and describe its importance in decision-making.

SS.5.1.3 explain the consent of the governed as the source of authority of government

SS.6.1.2 evaluate, take and defend positions on the purposes that government should serve (e.g., debates, essays).

SS.7.1.2 explain actions citizens take to influence public policy decisions.

SS.7.1.4 locate, access and organize information about an issue of public concern from multiple points of view.

SS.8.1.1 evaluate how citizens can participate in government at the local, state and national levels (e.g., voting, community service, letter writing).

SS.8.1.2 identify and practice forms of civic discussion and participation consistent with the ideals of citizens in a democratic republic.

SS.8.1.5 explain the political process and the opportunities for citizens to influence government.

SS.8.1.6 locate, access, analyze, organize and apply information about selected public issues, recognizing and explaining multiple points of view.

SS.8.1.7 explain and analyze various forms of citizen action that influence public policy (e.g., how groups can work with governmental agencies to impact the development of tourism).

- SS.8.1.8 analyze the influence of diverse forms of public opinion on the development of public policy and decision making.
- SS.8.1.9 examine the strategies designed to strengthen the common good, which consider a range of options for citizen action.
- SS.8.1.10 identify, analyze, evaluate and interpret sources and examples of the responsibilities, privileges and rights of citizens.
- SS.9.1.1 compare and contrast various citizens' responses to controversial government actions.
- SS.9.1.3 make informed decisions as to what government should and should not do.
- SS.9.1.4 explain how the interactions of citizens with one another monitor and influence the government.
- SS.9.1.5 evaluate ways conflicts can be resolved in a cooperative, peaceful manner that respects individual rights and promotes the common good.
- SS.11.1.1 discuss ways citizens can work cooperatively to resolve personal, local, regional, and world conflicts peacefully.
- SS.11.1.2 analyze and evaluate the influence of citizen action on public policy and law making.
- SS.11.1.3 analyze the changing nature of civic responsibility.

Geography. Watersheds – rather than political boundaries - have become the organizing geographic concept underlying environmental assessments and protection efforts at both the local and regional levels. Therefore, curricula that add to an understanding of watersheds will interface seamlessly with common themes in the elementary and middle school geography CSOs, which include:

- describe and explain the physical processes that shape the earth's surface and create, sustain and modify the cultural and natural environment (Physical Systems);
- describe the physical and human characteristics of place and explain how the lives of people are rooted in places and regions (Places and Regions);

SS.5.4.4 - locate, identify and contrast the major rivers, landforms, natural resources, climate regions, major soil regions and deserts of the United States

SS.6.4.4 - locate and identify the continents, major climates, major bodies of water and natural resources (e.g., knowledge of landforms such as peninsulas, mountain ranges, plateaus, river valleys, lakes)

SS.7.4.10 - compare and contrast geographic regions (e.g., physical, cultural, perceptual, economic).

SS.8.4.4 - identify the four major geographic regions, major rivers, landforms and points of interest in West Virginia.

SS.9.4.4 - use the most appropriate maps and graphics in an atlas to answer specific questions about geographic issues (e.g., topography, transportation routes).

Science Standard 6: Science in Personal and Social Perspectives (SC.S.6)

Students will:

- demonstrate the ability to evaluate personal and societal benefits when examining health, population, resource and environmental issues;
- demonstrate the ability to evaluate the impact of different points of view on health, population, resource and environmental practices;
- predict the long-term societal impact of specific health, population, resource and environmental practices; and
- demonstrate an understanding of public policy decisions as related to health, population, resource and environmental issues.

SC.5/6/7/8.6.3 - critically analyze the effects and impacts of science and technology on global and local problems (e.g., mining, manufacturing, recycling, farming, water quality).

SC.9.6.1 - research uses and values of natural resources.

SC.9.6.2 - research current environmental issues (e.g., effects of pollution, solid waste management, local, national, and global issues).

SC.10.6.2 - research current environmental issues (e.g., depletion of fossil fuels, global warming, destruction of rainforest pollution).

SC.10.6.3 - describe the impact of cultural, technological, and economic influences on the evolving nature of scientific thought and knowledge.

AB.6.4 - describe the impact of cultural, technological, and economic influences on the evolving nature of scientific thought and knowledge.

BTC.6.2 - describe the impact of cultural, technological and economic influences on the evolving nature of scientific thought and knowledge.

AES.4.1 - review foundational earth science concepts including rocks and minerals, properties of waves, constructing and interpreting weather maps, surface features found on maps, climatic relationships to biomes, use of data gathering instruments, temperature-phase change relationships.

AES.4.32 - explain common problems related to the conservation, use, supply and the quality of water.

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