Crumpled Paper Watershed Activity **By Rob Wade of Adopt-a-Watershed**

Prelude and Premise:

Using a piece of crumpled paper, students create a watershed model to demonstrate the geographical flow of water across the landscape, and the relationship of natural/cultural activities to water quality impacts. This model is a birds- eye watershed view and should develop watershed awareness and landscape ecological literacy.

After completing this activity, students will be able to…

- Define the term watershed;
- Use a model to show an understanding of the term "watershed;" and how to tell where the boundaries of a watershed are.
- Describe how pollution can get into our waterways through runoff and how runoff affects our water quality.

Materials - Purpose:

Paper (recycle old 8.5x11 or other paper) - this forms the watershed base model

Newspaper- for clean-up (place under the model)

Permanent Markers (red, green, etc.) - for drawing landforms and native vegetation

Water-Soluble Markers (blue, black, brown, etc.) - for drawing water flow and point-source impacts

Spray Bottle- For creating the precipitation

Share Watershed Definitions & Vocabulary:

"A watershed is more than an area of land defined by its ridges with one outlet for water to flow. A watershed supports a variety of resources, uses, and activities in such a way that eventually all things are affected by everything else in the watershed. A watershed contains the history of all that went before and the spirit of those who touched it remains." George Wingate

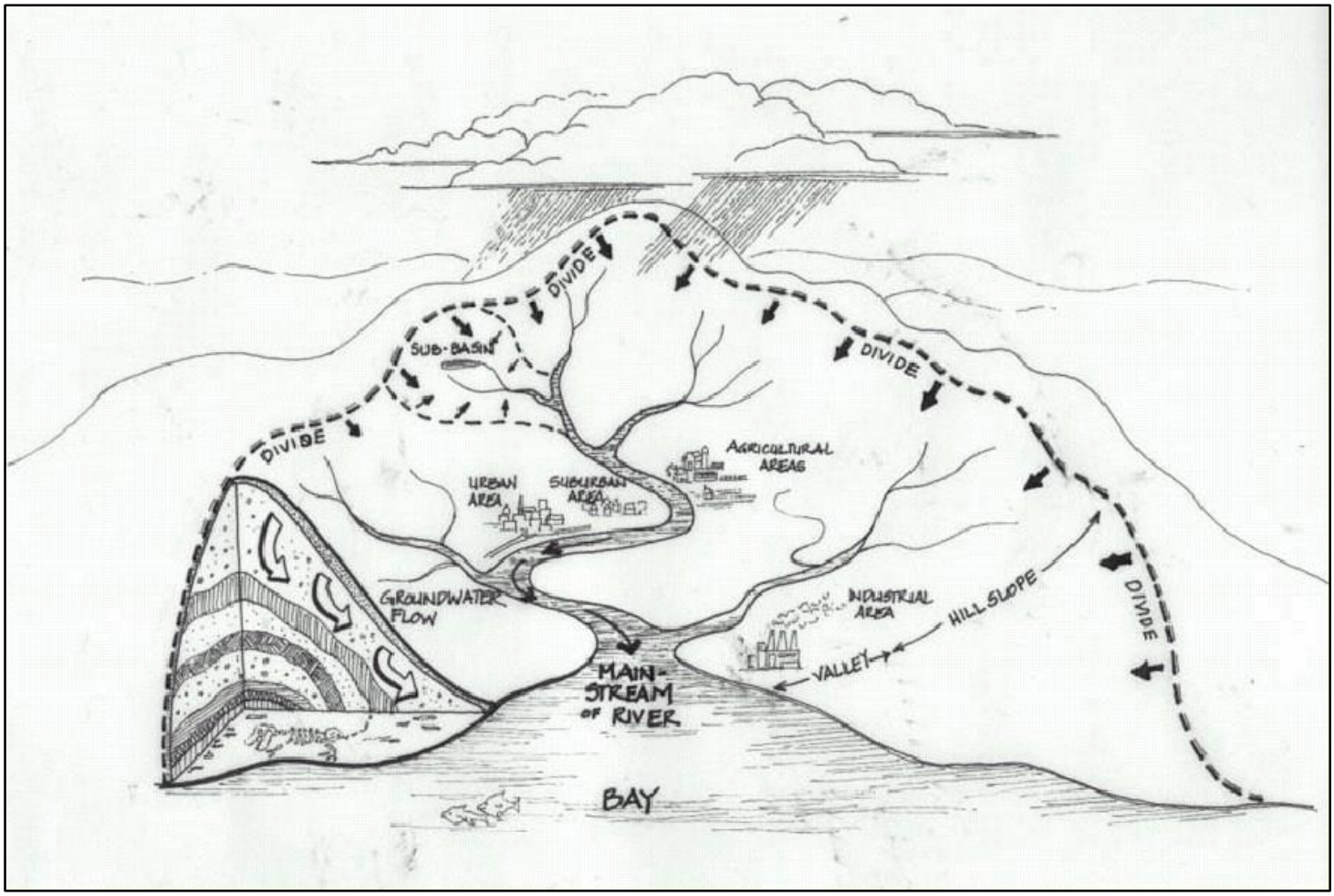
What Is A Watershed?

A watershed is all of the land that drains runoff (from precipitation) into a body of water, such as a creek, river, lake, bay or ocean. The boundary of a watershed is the ridgeline of high land surrounding it, like the edge of a bowl. Another term for watershed is "drainage basin."

As rainwater and snowmelt run downhill, they carry whatever is on the land, such as oil dripping from cars, trash and debris on streets, or exposed soil from construction or farming to the nearest water body.

Our Local Watershed

Everyone lives, works and plays on land that drains to a body of water, like a creek or river. Our local watershed may lead to a tiny creek, but that eventually drains into a river, to the Chesapeake Bay into the Atlantic Ocean.



Term	Definition
Landform	A physical feature, such as a hill, mountain, valley, plateau, river, lake, etc.
Ridge	The high points of a range of hills or mountains
Runoff	An overflow of rainfall or snowmelt that cannot be absorbed by soil and vegetation
Tributary	A stream feeding into a larger stream, lake, etc.
Watershed	All the land that drains water into a creek, river, lake, bay or ocean. The watershed is named for the body of water into which it drains.

The **Chesapeake Bay** is the largest estuary in the United States. It lies off the Atlantic Ocean, surrounded by Maryland and Virginia. The Chesapeake Bay's drainage basin covers 64,299 square miles in the District of Columbia and parts of six states: New York, Pennsylvania, Delaware, Maryland, Virginia, and West Virginia. More than 150 rivers and streams drain into the bay.

Estuary is a partly enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea

Estuaries form a transition zone between river environments and maritime environments and are subject to both marine influences, such as tides, waves, and the influx of saline water; and riverine influences, such as flows of fresh water and sediment. The inflows of both sea water and fresh water provide high levels of nutrients in both the water column and sediment, making estuaries among the most productive natural habitats in the world.[2]

Most existing estuaries were formed during the Holocene epoch by the flooding of river-eroded or glacially scoured valleys when the sea level began to rise about 10,000-12,000 years ago.[3] Estuaries are typically classified by their geomorphological features or by water circulation patterns and can be referred to by many different names, such as bays, harbors, lagoons, inlets, or sounds, although some of these water bodies do not strictly meet the above definition of an estuary and may be fully saline.

The banks of many estuaries are amongst the most heavily populated areas of the world, with about 60% of the world's population living along estuaries and the coast. As a result, many estuaries are suffering degradation by many factors, including sedimentation from soil erosion from deforestation, overgrazing, and other poor farming practices; overfishing; drainage and filling of wetlands; eutrophication due to excessive nutrients from sewage and animal wastes; pollutants including heavy metals, polychlorinated biphenyls, radionuclides and hydrocarbons from sewage inputs; and diking or damming for flood control or water diversion.

Tributary or **affluent** is a stream or river that flows into a main stem (or parent) river or a lake. A tributary does not flow directly into a sea or ocean. Tributaries and the main stem river serve to drain the surrounding drainage basin of its surface water and groundwater by leading the water out into an ocean or sea.

A confluence, where two or more bodies of water meet together, usually refers to the joining of tributaries.

The opposite to a tributary is a distributary, a river or stream that branches off from and flows away from the main stream. Distributaries are most often found in river deltas.

'Right tributary' and 'left tributary' (or 'right-bank tributary' and 'left-bank tributary') are terms stating the orientation of the tributary relative to the flow of the main stem river. These terms are defined from the perspective of looking downstream (in the direction the water current of the main stem is going).

Activity: Individual activity or small groups of 2 or 3 students. Loosely crumple paper (tight crumpled paper makes for a more complex watershed model). Imagine being in an airplane above this landscape. Find the tallest mountain or deepest canyon

Explain to participants that they will create a watershed model with a simple piece of paper. They will be able to see the ridges, slopes and drainages that make up a 3-D watershed landscape. Be sure to demonstrate and explicate each step so that there is understanding of how and why to do each step.

1. Crumple a piece of paper into a ball. Gently un-crumple the paper so that it will sit on a table but still maintain the folds and creases that will represent peaks ridgelines, valleys and watercourses.

2. Use a **permanent red marker** to outline the surrounding watershed divide. If desired also delineate **all upward-pointing creases, which are ridges.** Explain that although mountains and landforms are not permanent they are a more durable aspect of the watershed. **Ridges define the boundaries of watersheds – Big watersheds are made up of smaller watersheds. Even though defined by ridges they (WS) are named after the rivers & streams.**

3. Use the **green permanent marker** to indicate areas of native **forests** or other native **vegetation** types.

4. Using the **water-soluble blue marker, define the watercourses**. These drainages are **the creases on the page that bend down toward the table**, and should **represent where water will flow** on the model.

5. With a **water-soluble black marker or other color**(s) define patterns of **human development and use**, such as: **roads, industry, residence, and schools**. You should place them appropriately on the model.

6. With a **water-soluble brown marker, create other ground disturbances.** These can be **human caused or naturally occurring impacts** (clearcuts, skid-trails, landslide, intensive agriculture & grazing). **The most significant pollution of surface water is sediment/soil.**

7. What do they think will happen when it “rains”?

8. Lightly and evenly spray the models. Explain that this is precipitation. They should carefully watch and note how water flows across the landscape and how it affects the entire watershed, not just the watercourses and channels.

Observe, Discuss and Record:

- As your “rainfall” accumulates, observe the pathways where the excess “rainfall” travels.

1. What general observations did you make? Did water flow as anticipated?
2. Did you place your developments on a flood plain? What resulted?
3. Water cohesion allows for less impact (spread) on flatter surfaces than on slopes.where did most of the impact/pollution come from?

- Discuss the definition of point source and non-point source pollution.

1. How would our own watershed look as a model?
2. Where would the impacts be?

- Record Your Observations

  In the space below, record your observations about what happened (Use words and pictures if you wish).