Estuaries

Strand Living Systems

Topic Investigating watersheds

Primary SOL 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
d) wetlands;
e) estuaries.

Background Information

Estuaries are partially enclosed bodies of water where freshwater from streams and rivers meets salty ocean water. Bays, lagoons, harbors, inlets, and sounds are examples of estuaries. Estuaries perform important functions, such as providing habitat for many organisms and serving as nurseries for their young. A very large number of fish that are used commercially return from the ocean to spawn in the protective waters of estuaries. Seventy-five percent of commercial fish catch and 80 percent of recreational fish catch make their home in estuaries. Oysters, clams, and crabs thrive in the bays and inlets. Estuaries provide a habitat for endangered and threatened birds.

People depend on estuaries for trade, food, and shelter from violent open ocean storms. Among other benefits, estuaries provide recreation in the form of swimming, boating, fishing, surfing, and bird watching. Estuaries act as a natural laboratory for scientists and students. The economy of many coastal communities is directly linked to the aesthetic beauty of the estuary nearby.

Like our rivers and streams, estuaries are in danger as a result of human activity. Much trash and sediment from upriver are carried into the estuary. Chemical contamination in an estuary can linger for years and close down fishing in that area. Silt and other sediment caused by erosion can suffocate bottom-dwelling plants and animals. Nutrients from upstream make their way into the estuary and cause overenrichment of the water and oxygen depletion. Altering the natural water flow primarily by dredging and filling wetlands for development purposes has devastating effects on the estuary. Wetlands act as a buffer zone to the estuary by filtering and breaking down nutrients.

The Chesapeake Bay is an estuary where fresh and salt water meet and are mixed by tides. It is the largest estuary in the contiguous United States and one of the most productive. However, the population around the Chesapeake Bay has reached more than 15 million people and the bay's natural resources are being threatened.

Materials

- Copies of the attached handouts
- Colored pencils
- Map of the Virginia Chesapeake Bay watershed (Use grade-six map distributed by the Department of Game and Inland Fisheries.)
- Map of Virginia Chesapeake Bay wetlands

Vocabulary

brackish, estuary, harbor, inlet, lagoon, salinity, sediment, wetland

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Introduction

1. Distribute copies of the attached Watershed Brain Drain handout. This will help students organize their thoughts around the concept of watersheds. Students may draw pictures or write on it as the lesson progresses.
2. Tell students they have three minutes (adjust the time, as desired) to list as many facts about watersheds as they can think of. Ask guiding questions as needed, such as, "What are the parts of a watershed? What do watersheds carry?"
3. When time is up, ask students to share their brain drain with partners. Ask them to indicate the facts they know are correct and the ones they are not sure about, so the class may investigate these further. Allow them to add facts to their charts if they know the facts to be true. Allow them to add other branches to their brain.
4. Ask students share their ideas as a class. Make a brain drain on the board to list their ideas.
5. Define *estuary* as a body of water where freshwater meets salty ocean water. Have students name some well-known estuaries in Virginia and elsewhere.
6. Ask students whether wetlands and estuaries are parts of a watershed. Discuss why they *are* parts of a watershed and why they are important. Have students add these facts to their brain drain, and add them to the class brain drain. Then, tell students that you will come back to the brain drain later in the lesson.

Procedure

1. Pass out maps of the Virginia Chesapeake Bay watershed to students. (Virginia watershed maps are available at Department of Game and Inland Fisheries Web site.)
2. Remind students that the Chesapeake Bay is an estuary. Lead a discussion about salinity by asking students to describe and compare how they think water samples taken upriver, in the Atlantic Ocean, and in the Chesapeake Bay would taste.
3. Have students color the water on the map according to salinity levels, reminding them that river water is fresh, water in the Bay is brackish, and water in the ocean is salty. Tell students to make a key on their maps for these three salinity levels.
4. Now that they know where the estuary is located, ask students where they think the wetlands are located. Show a map of the bay's wetlands, and have students add the wetlands to their maps. Ask students, "What are the benefits of the wetlands? How do the wetlands help the estuary?"
5. Have students return to their brain drains, and tell them that they are going to organize the information on a flow chart. Hand out copies of the attached Watershed Flow Chart, and explain that the completed chart will show them how waterways, wetlands, and estuaries all work together to make up the watershed.
    - On their brain drain, have students underline in one color all the facts that pertain to the *waterways*. These may be things that go into the water, such as runoff, pollutants,

and nutrients. Have students place these facts on the first oval of the flow chart, labeled "CREEKS, STREAMS, LAKES, MAJOR RIVERS."

- Have students use another color to circle everything on the brain drain that has something to do with *wetlands*. Then, have them add these items to the rectangle on the flow chart, labeled "WETLANDS."
- Have students use a third color to put a check mark next to any fact on the brain drain that tells about an *estuary*. Have them add these items to the second oval, labeled "ESTUARY."

Observations and Conclusions

1. Hold a class discussion on estuaries, using the following facts:
   - The population in the Chesapeake Bay watershed has grown to more than 15 million people.
   - The Chesapeake Bay's health and productivity has declined in the last several decades.
   - One reason for the decline is increasing land-use development. As population increases, people look for more and more places to develop land.
   - Increased land-use development has resulted in increased pollution of the bay.
   - Wetlands have been drained and filled to make places for housing and industries.
2. Have students look at their flow chart, covering up with another piece of paper the section that has to do with wetlands. Have them answer the question, "What effect does the destruction of wetlands have on the estuary?"

Assessment

- **Questions**
  - What is the definition of *estuary*?
  - Why are estuaries important to people and other animals?
- **Journal/Writing Prompts**
  - Explain why estuaries are considered a "natural laboratory."
  - Compare and contrast the features of fresh, brackish, and saltwater bodies of water that exist in the Virginia watershed.
- **Other**
  - Have students make a timeline that chronicles the path of a water droplet from a mountain stream to the Chesapeake Bay. Each entry should represent a significant change in the composition or environment of the water droplet.
  - Have students label Virginia watershed maps with key features described in this lesson.

Extensions and Connections (for all students)

- Have students research and write brief reports on an animal or plant that lives in the Chesapeake Bay watershed. Each report should include an illustration that can be mounted in the classroom.

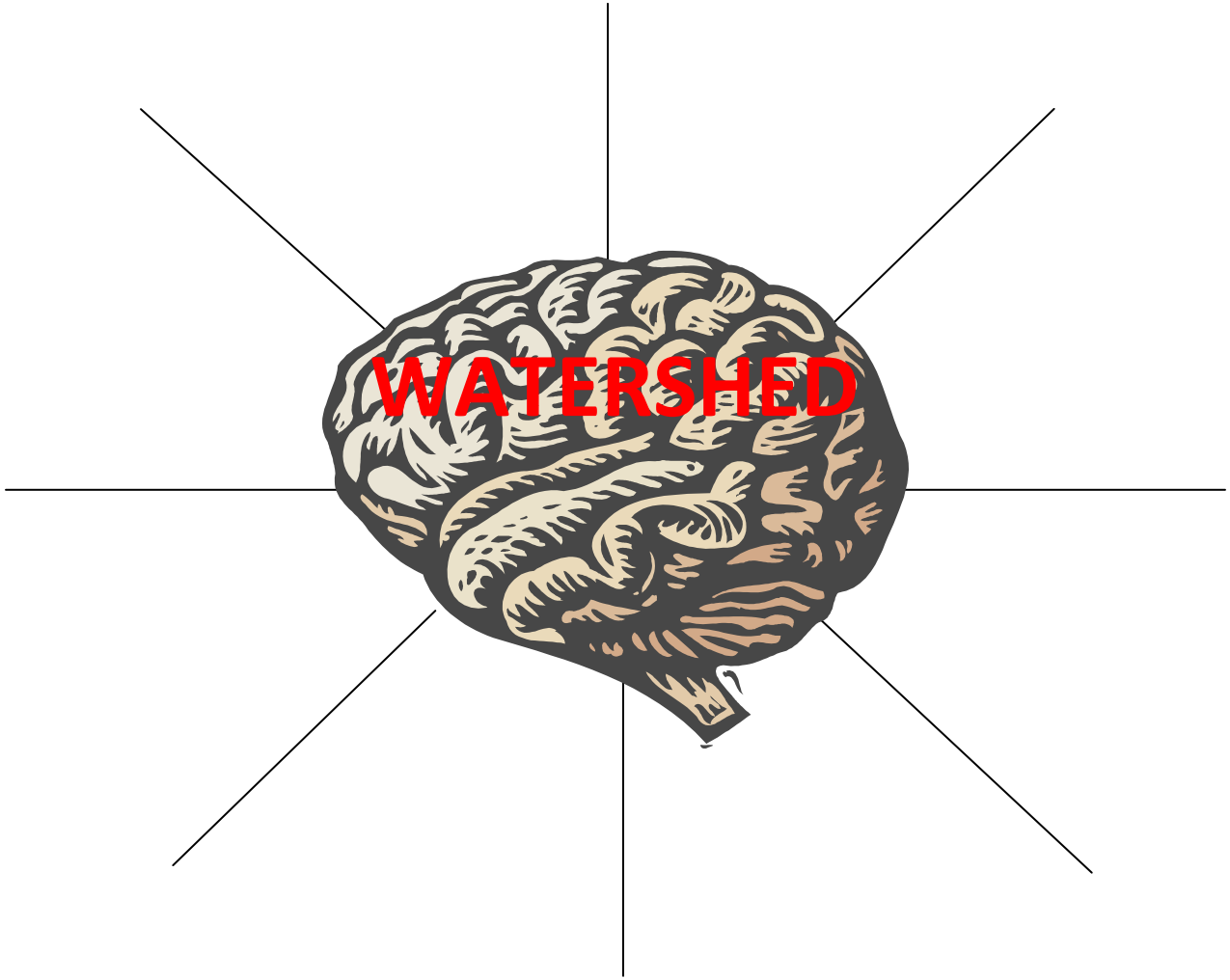
Strategies for Differentiation

- Create a memory game using the vocabulary terms in this lesson.
- Provide simplified, written, step-by-step procedures.
- Provide clean color copies of the Watershed Flow Chart, as necessary.

- Have students utilize an interactive Web site to explore the Chesapeake Bay and other ecosystems.
- Show the interactive video "It's Happening Today on the Chesapeake Bay." (Obtainable from the Chesapeake Bay Foundation)
- Use video clips from Internet sources such as *Discovery Education* to enhance students' understanding of estuaries.
- Have students contact the Virginia Institute of Marine Science to obtain literature about the research that has been conducted on the various effects human have had on the Chesapeake Bay.
- Have the class adopt a portion of a local tributary and design a project to improve its quality by improving its watershed.
- Have students create dioramas of an estuary, using materials such as construction paper, modeling clay, shoe box, miniature figurines, rocks, and sand. Have students present and explain their dioramas to the class.
- Divide students into groups to brainstorm ideas on ways they could help to improve Virginia estuaries (the state of the Bay). Have each group create a visual (e.g., poster, brochure, electronic presentation) to display their ideas.

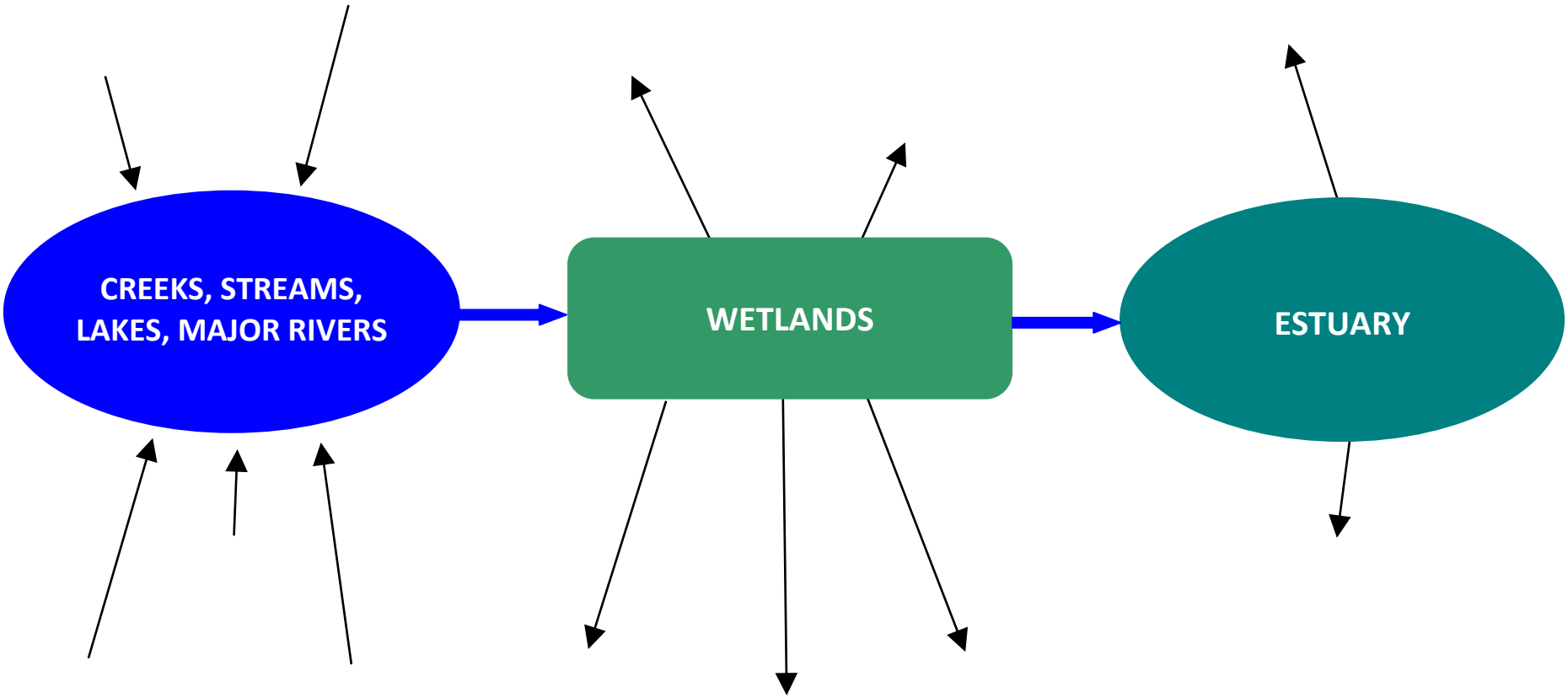
Watershed Brain Drain

Name: _____ **Date:** _____ **Class:** _____



Watershed Flow Chart

Name: _____ **Date:** _____ **Class:** _____



Watershed Flow Chart Answer Key