

## Flood Plain Functions

### Lesson Abstract

**Summary:** Students will connect knowledge from previous watershed lessons to understand the functions of flood plains by participating in group activities. The main activity allows students the opportunity to put themselves in the shoes of community settlers of long ago and identify problems and solutions for the watershed flood plain land use practices of today.

**MO GLE:** SC4.1.A.6; 4.1.D.6

**Subject Areas:** Science, Communication Arts, Social Studies

**Show-Me Standards:** Goals – 1.6, 1.10, 2.3, 3.1, 3.4, 3.6, 3.7, 3.8, 4.7  
Strands – SC 1, 2, 5, 8; CA 6; SS 7

**Skills:** Analysis, synthesis

**Duration:** 1 to 2 class periods (50 minutes)

**Setting:** Classroom

**Key Vocabulary:** Watershed, flood plain, best management practices

### Rationale:

- Flood plains exist throughout the state of Missouri and provide natural functions for a river system that cannot be satisfied by any other natural feature.
- Many Missouri communities are located in flood plains and are impacted both positively and negatively by land use practices within the flood plain and watershed.

### Student relevance:

- Flood plains provided early communities with a diversity of benefits. Today the communities that are located in flood plains face challenges managing water quality and quantity in their flood plains.
- Billions of tax dollars are spent to protect and replace flood plain property destroyed by floods.
- Floods will continue to threaten property and water quality in flood plains.
- Land use practices with a watershed and flood plain can increase or decrease damages caused by flooding.

- Wetlands in flood plains slow water runoff, filter pollutants, neutralize acid runoff and provide wildlife habitat.

## Learning Objectives:

Upon completion, students will be able to . . .

- Identify, compare, and contrast the three phases of river formations (young, mature, old).
- Identify the valuable functions of flood plains: wildlife habitat, wetland locations, and dissipation of flood water energy.
- Determine why residents of an 1800s community would have located in a flood plain.
- Discuss what challenges watershed and flood plain residents face today.
- Identify those watershed and flood plain land use practices which protect water quality and decrease flooding verses those which threaten water quality and increase flooding.

## Students Need to Know:

- Water travels downhill.
- Land use practices upstream affect downstream water quality (see Land Use & Watershed Pollution lesson).
- Floods occur along river borders.
- Floods damage property.
- Floods are natural events and flood plains function to prevent damage by decreasing the potential energy of flood waters and also provide wildlife habitat.
- Rivers change over time, naturally, in stages.
- Human land use practices within a watershed and flood plain affect the quantity and quality of runoff that feeds a river system.

## Teachers Need to Know:

- Natural phases of river development (young, mature, old).
- The natural functions of flood plains (see Introduction).
- Watershed practices that affect flooding and water quality (see *Watershed Challenge Cards* in lesson).
- General history of settlement practices along rivers and land use challenges affecting flood plain areas today.

## Resources:

The following materials are available from the Missouri Department of Natural Resources, Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65402, (573)368-2125.

*Surface Water Resources of Missouri, Water Resources Report No. 45*  
*Water Use of Missouri, Water Resources Report No. 48*

Website for DNR publications:

<http://www.dnr.mo.gov/geology/adm/publications/pubscatalog.pdf>

## **Materials Needed for Lesson:**

### Demonstration Items

Assorted water guns, small size to large (super soaker if possible)

Plastic chess pieces

### Transparencies (copies provided on page 41?)

*Watershed Map*

*River Phases Diagram*

*River Phases Chart*

*Watershed Basin Diagram*

*Flood Plain Functions*

### Handouts (copies provided)

*Watershed Map* (one per group of 2-4 students)

*Occupation Cards* (one per group of 2-4 students)

*Watershed Challenge Cards* (one per group of 2-4 students)

### Optional

Stream Table

Video Clip of Flooding and Flood Damage

## **Procedure:**

### Part One: Watershed Connections

- Ask students to think about what they learned about watershed land use and pollution from the previous lessons.
- Have students share what they remember from the previous lesson.
- Call on students to state what they learned and instruct a student to summarize these items on the board. (Note: The teacher may need to paraphrase and instruct the student on what to write.)

### Part Two: River Evolutional Phases in Watersheds

- Place the transparency of the *Watershed Map* on the overhead.
- Ask students to locate where the greatest and least amount of water would be found in the watershed and explain their reasoning.
- Show students the transparencies of the *River Phases Diagram* and *River Phases Chart* and discuss the differences between the three phases, noting path directions, gradients (slope), and water speeds.

- Show students the *Watershed Basin Diagram* and compare and contrast their differences, being sure to note that large rivers such as the Missouri and Mississippi can be in all three phases at the same time at different locations.
- Refer to the *Watershed Map* transparency again and ask students to infer where different river phases may be located in the watershed.

(Note: The first order streams in the upper levels of the watershed characterize youthful streams. Higher order streams in the watershed characterize mature and old river phases depending on the river's relative location to its mouth with a basin.)

### Part Three: Flood Plain Functions

- Sum up the lesson thus far.
- Tell students that the flood plains in mature and old phase rivers have many natural functions.
- Place the *Flood Plain Functions* transparency on the overhead. Discuss the transparency by questioning students.
- Demonstrate how water in a narrow space can be forceful by using water guns with different size water reservoirs to knock down plastic chess game pieces with different forces.
- Compare the water guns to flood waters, noting that water constricted in small space has a greater destructive force.
- Explain how flood waters held back with dams, levees and walls result in increased water energy.
- Ask students what would happen if the hole at the end of each aw gun was enlarged. Have students explain their answer and compare it to allowing a river to flood in its flood plain rather than constricting a river to a narrow channel.
- Discuss the effects of the flood of 1993 and/or other recent floods and the destructive force of the water. If possible, show a short video clip of flood destruction.
- Note that the reasons for the flood of 1993 were complex and varied. The President's Task Force on Flood Plain Management which studied the flood concluded that:
  - The flood resulted from a significant meteorological event.
  - Land use practices within the Mississippi Basin increased the runoff from these rains.
  - The destruction of wetlands (90 percent in Missouri alone) contributed to the increase and speed of runoff.
- The Task Force recommended:
  - Some farmers and other property owners in flood plains sell their property to wetland reserve and other programs allowing seasonal use of the land by public groups.
  - Overhaul the flood insurance program so taxpayers would not continuously pay for repeated destruction of homes and businesses located in flooded areas.
- Optional – Demonstrate all three river phases and flood plain functions with a stream table.

## Part Four: Flood Plain Settlement

- Explain to students that communities settled in flood plains because of the numerous advantages they provided. Have students brainstorm these advantages: transportation, water sources, flat land, building materials such as gravel, food sources, etc.
- Explain that they will be in the shoes of earlier settlers with this activity.
- Give each group (2-4 students) a *Watershed Map* and *Occupation Cards*.
- Ask students to take turns reading the *Occupation Cards* one at a time. As a group, they need to decide where in the watershed this person's business would best be suited. Ask students to draw the symbol for the occupation at the location they picked out on the map. Repeat until all *Occupation Cards* are read and symbols drawn on the map.
- If time permits, have groups compare and contrast their watershed maps when completed.
- After they have placed all of the occupation symbols on their map, tell them that a large flood occurs. Ask students to discuss what businesses (based on their location) would be affected the most. Have the students "X" out these businesses on their map.
- Have groups share their conclusions. Note, businesses located in the flood plain at the lower end of the watershed should be crossed out.
- Give each group copies of the *Watershed Challenge Cards*. Tell students that 100 plus years have passed and that the cards represent changes in the watershed.
- Ask students to take turns drawing and reading cards within their group. After reading one card at a time, have students discuss it and determine if the change on the watershed card caused an increase or decrease of flooding in the flood plain. After determining this change, tell students to separate the cards into piles according to their decision (increases or decreases chances of flooding.)
- After students have completed reading, discussing and dividing the challenge cards, go over what cards should be located in which pile and discuss any misunderstanding students may have with incorrectly placed cards. (See headings on copy pages to determine classification of cards.)
- Sum up the activity by explaining that watershed and flood plain management is a complex issue. It requires people with many different needs, concerns, and viewpoints working together over many years to solve parts of the problem.

### **Evaluation Strategies:**

- Have students draw picture frames or summarize in writing: river phases, flood plain functions, flood plain settlement patterns, and land use practices affecting flooding.

### **Extension Activities**

- Have students study a given watershed's past, present or future. Divide students into groups to determine physical characteristics, settlement patterns, land use practices, and flood problems and solutions.

- Have students collect articles about floods and wetlands. Make a concept map: mural with the articles.
- Interview farmers and business owners who live and/or work in a flood plain.
- Invite city officials who deal with storm drain runoff to discuss the problems and solutions they face.
- Work with city officials to have students stencil storm drains.

## Suggested Scoring Guide:

### Flood Plain Functions

---

Teacher Name: \_\_\_\_\_

Student Name: \_\_\_\_\_

CATEGORY	2 Points	1 Point	0 Points
<b>Prepared</b>	On time for class, has book, folder, pencil, planner, has taken restroom/drink break.	On time for class, Has most supplies needed for class.	Is late for class, not prepared for class, leaves classroom continually.
<b>Discussion</b>	Participates in discussion without shouting, listens to others speak, pays attention to teacher/presenter.	Sometimes participates in discussion or shouts during discussion, sometimes listens and pays attention.	Does not participate in discussion, does not listen to others or pay attention to teacher/presenter.
<b>Behavior</b>	Remains in seat unless asked, keeps hands and feet to self, treats others with respect, uses appropriate language and voice level.	Occasionally out of seat, keeps hands and feet to self, treats others with respect, uses appropriate language and voice level.	Always out of seat, does not keep hands and feet to self, is not respectful to others, uses improper language and voice level.

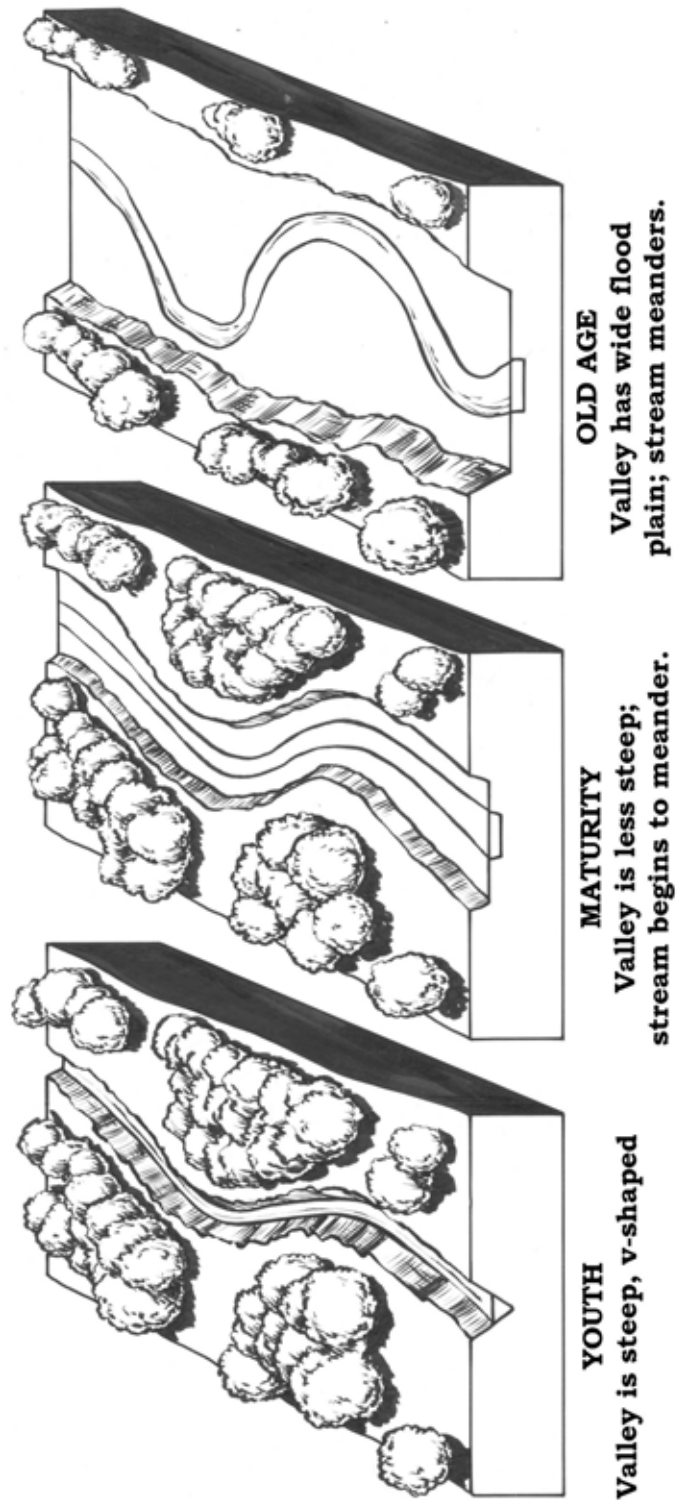
Rubric Made Using: **RubiStar** (<http://rubistar.4teachers.org>)

# Watershed Map

## Flood Plain Settlement Activity



# River Phases Diagram

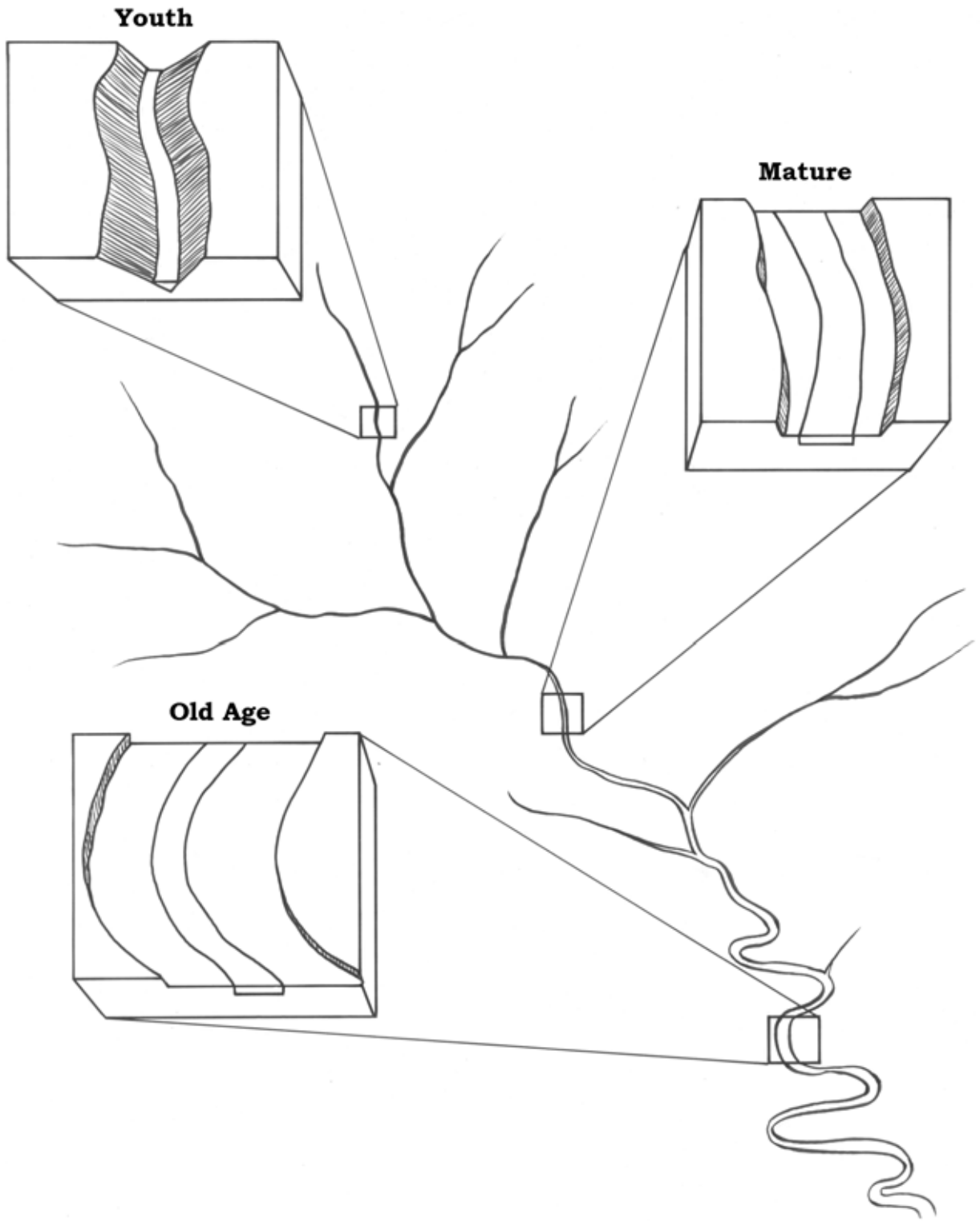


Source: *Handbook of Earth Science Activities*, 1988. Activity by Roger Siebert.

## River Phases Chart

Young River – Youth	Mature River – Maturity	Old River – Old Age
Steep gradient	Reduced gradient	Very gradual slope
Rapid Velocity	Reduced velocity	Sluggish
Cutting down into bed to form V-shaped valleys	Lateral sideward erosion	Sweeping meanders (bends and turns)
Rapids and falls, pot-holes	No rapids or falls (they have retreated to source and disappeared)	Oxbow lakes, cutoffs
Relatively straight course	Forming crescent-shaped meanders	Chief action is deposit of materials, forming natural levees and flood plains
Few branch streams	Forming flood plains	
Lengthens by headwater erosion, i.e., Columbia, Niagara, St. Lawrence rivers (Mississippi—young in headwaters)	Examples: Ohio, Missouri and Nile rivers (Mississippi River mature in middle course)	Example: Lower Mississippi River

# Watershed Basin Diagram



# Flood Plain Functions

## Physical Functions

Allow flood waters  
to spread out

Potential energy of  
floods are reduced

Flood waters soak in  
and are exposed to more  
evaporation

## Biological Functions

Provide wetlands

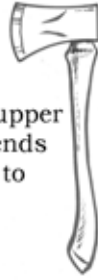
Provide fish and wildlife  
habitat-recreation

Plants filter  
pollutants

# Occupation Cards

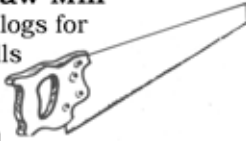
## Logger Luke

Luke logs in the upper watershed and sends logs downstream to the saw mill.



## Stephen's Saw Mill

Stephen saws logs for lumber. He sells lumber locally and he ships lumber as well.



## Micky's Mill

Micky grinds wheat and corn for the farmers. The grain is sold locally and transported down river.



## Farmer Fred

Fred grows grain in a relatively flat area where water is close by for irrigation ditches.



## Bob's Boats

Bob ships goods and raw materials up and down the river.



## George's General Store

George sells dry goods to local businesses and people. Many of the goods come up river on Bob's boat.



## Sam's Saloon

Sam sells beverages to local townspeople and travelers who come to town to buy, sell, and trade their wares.



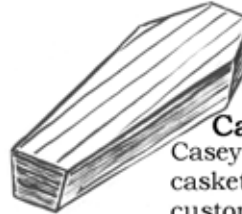
## Miner Mike

Mike digs for iron ore in the hills. He ships his iron to the big city down the basin.



## Casey's Caskets

Casey makes and sells caskets to needy customers in town.



## Suzie's Soap & Bath House

Suzie provides hot baths to travelers and townspeople for a small fee.



## Occupation Cards (continued)

### Blacksmith Butch

Butch repairs wagons, horseshoes, farming, mining, and other equipment.



### Trapper Ted

Ted traps bear, beaver, bobcat, otter, and other mammals for the fur trade.



### Tim's Trading Post

Tim buys, sells, and trades furs, guns, knives, and housewares.



### Rhonda's Restaurant

Rhonda sells meals to local townspeople and travelers. She makes the best pies in the watershed.



### Gunsmith Gary

Gary makes and repairs guns in the back of Tim's Trading Post.



### Carpenter Carl

Carl makes furniture and assists with local building projects.

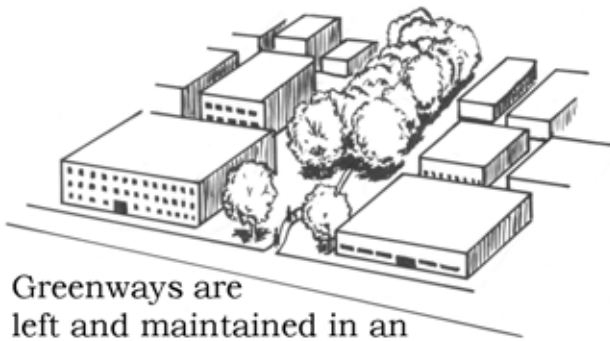


### Chris' Church

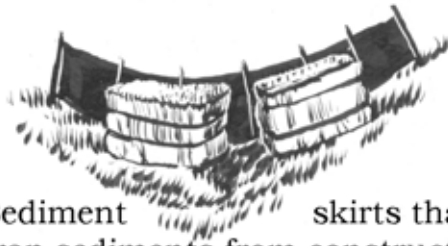
Preacher Chris provides worship services for Sundays, weddings, and funerals.

# Watershed Challenge Cards

(Decrease flooding)

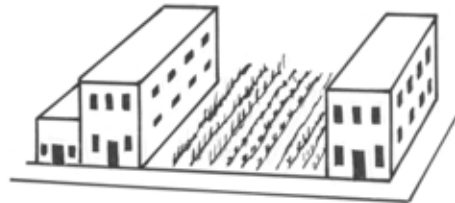


Greenways are left and maintained in an urban subdivision.

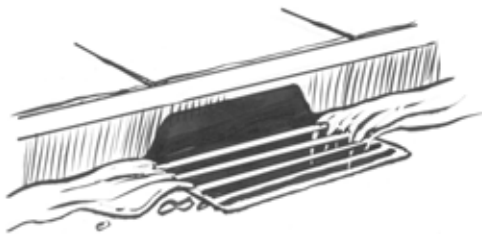


Sediment skirts that trap sediments from construction sites of five acres or more are properly installed and maintained.

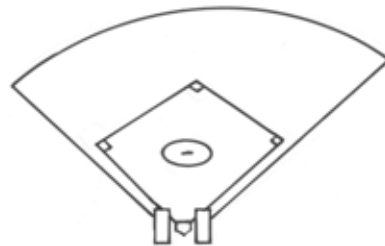
A farmer takes part in a soil conservation program to decrease erosion.



An old building that is condemned is torn down and becomes a neighborhood garden plot on River Street.



Storm water is captured and released into a wetland before entering the river.

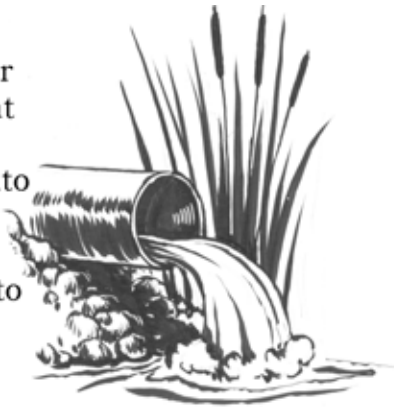


The flood plain is zoned for structures that can withstand periodic flooding.

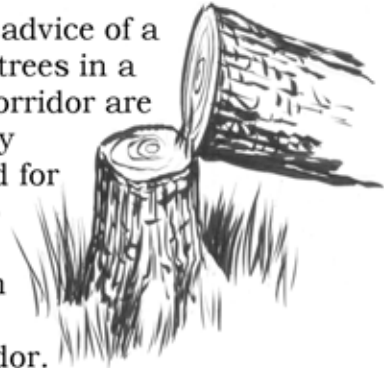
## Watershed Challenge Cards (continued)

(Decrease flooding)

The wastewater treatment plant discharges the treated water into a constructed wetland before discharging into the river.



With the advice of a forester, trees in a stream corridor are selectively harvested for timber to maintain long term health of the corridor.



A STREAM TEAM plants trees on an eroded stream bank.



A farmer uses contour farming and terraces to decrease erosion.



**WETLAND  
RESERVE**

Land that is frequently flooded is sold to the Wetland Reserve Program.



Stream gravel is removed from a stream bed according to guidelines which minimize negative impacts in the stream channel.



# Watershed Challenge Cards

(Increase probability of flooding)



A river is dammed to generate electricity.



A river is channelized (straightened) in a farmer's field.



Levees are installed in the flood plain to hold back flood waters.



The flood plain is cemented and constructed with downtown businesses, road, and homes.



Wetlands are drained to create a subdivision.



Storm drains are cemented through a subdivision.



Excessive plowing causes erosion.



A wooded area is completely cleared for lumber and future construction of a large subdivision.



A farmer cuts down the trees along his stream.