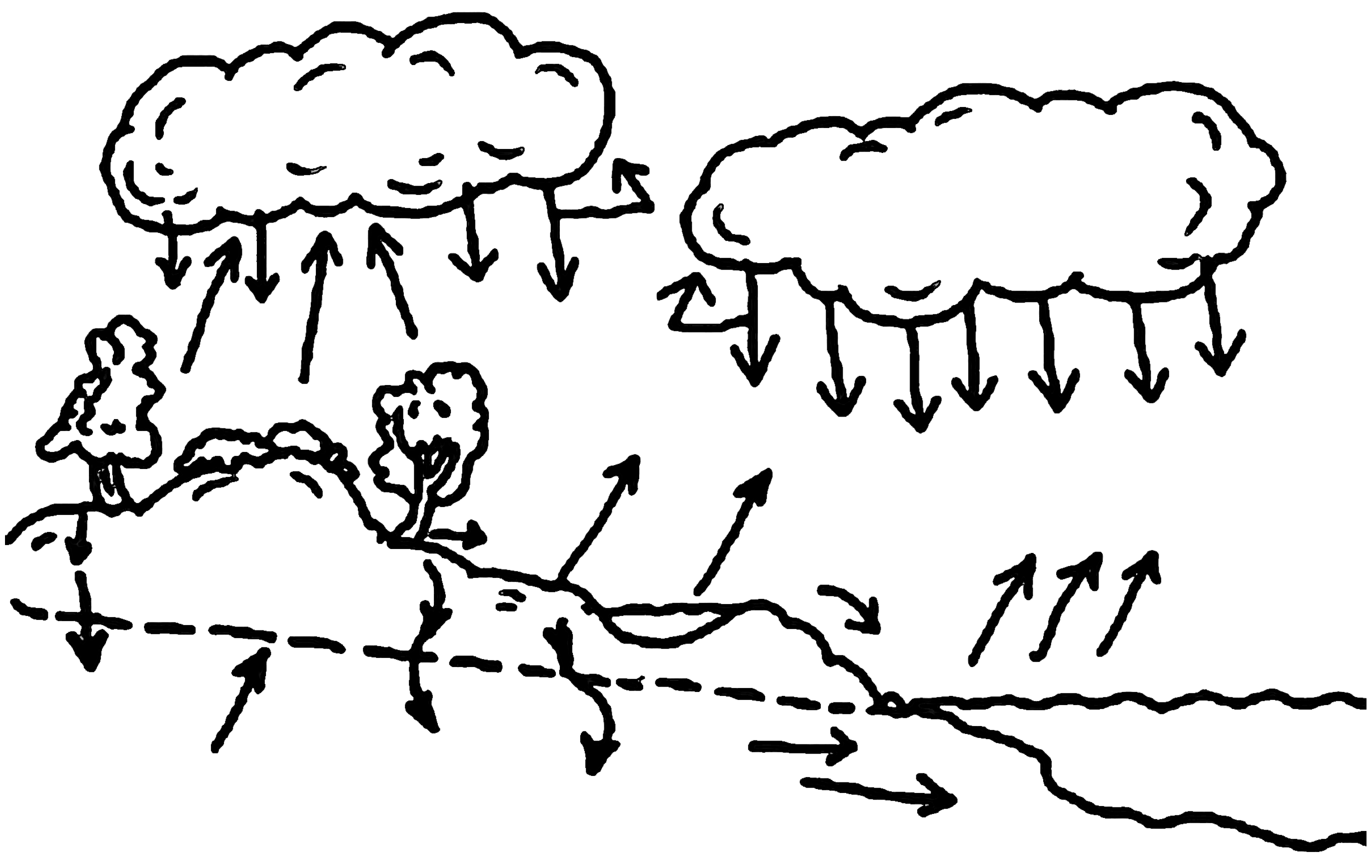
The Hydrologic Cycle

Name ______________________________

Directions: The hydrologic cycle consists of the processes that change and move water through the earth's system. Use the terms below to label the hydrologic cycle.

precipitation
transpiration
transport
zone of aeration
evaporation
infiltration
groundwater
zone of saturation
condensation
surface runoff
water table



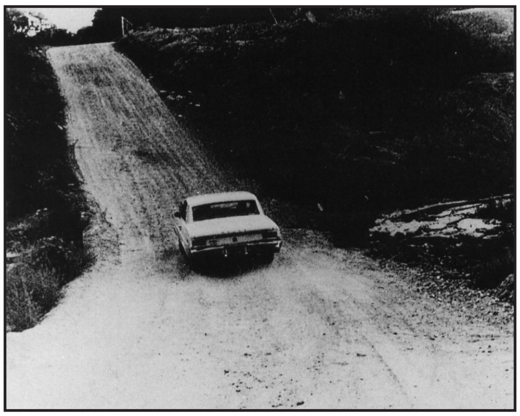
American Red Cross

Visit the American Red Cross Web site at *www.redcross.org/disaster/masters*

Types of Floods

Name ____________________

Directions: Consider each of the pictures below and hypothesize why this type of flooding occurs.



Flash Flood

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River Flood

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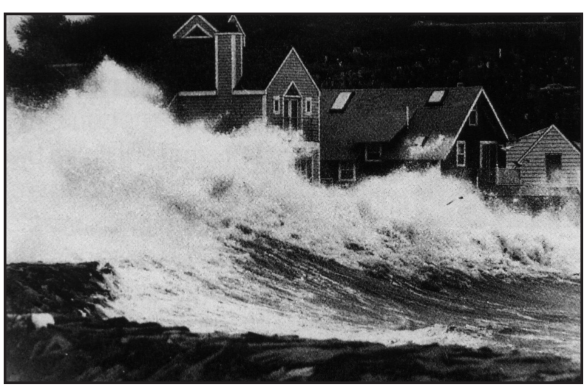

Coastal Flood

____
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Types of Floods

Urban Flood

Ice Jam

Debris Flow

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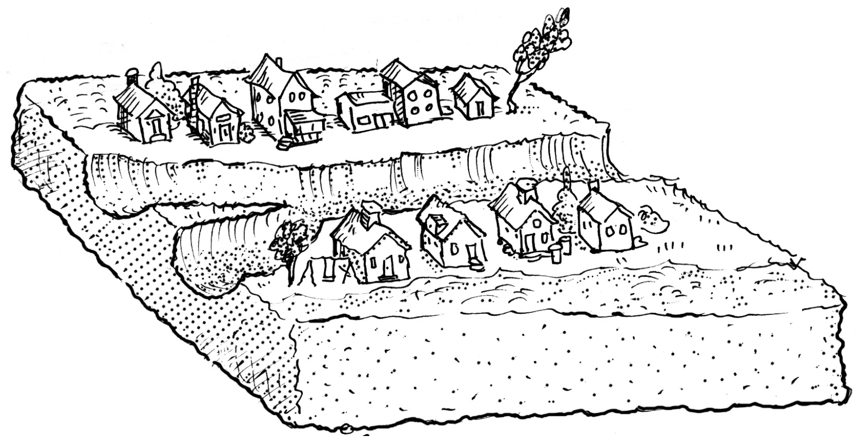
You’re the Hydrologist

Name ____

Directions: Follow the directions on pages 1 and 3 to show how rivers form and floods occur and to investigate the effect of floods on human lives. Then, try to analyze your results and answer the questions on pages 2 and 4.

What you need:
- Very large pan or plastic-covered box
- Water source with hose
- Large basin or area for drainage
- Bricks or blocks
- Soil of different types and porosity
- Toy houses, buildings and cars
- 2 or 3 spray bottles



What you do:
“Build a River”
- Fill the large pan with damp soil to a depth of about 4 inches (10 centimeters) and smooth it flat.
- Put a hole in the center of one end of the pan to act as a drain.
- Tape the hose to the other end of the pan.
- Place the “hose end” of the pan on blocks or bricks to tilt the pan slightly.
- Place the basin at the other end of the pan to catch the drainage. Let the water trickle into the pan until the soil is saturated. As the trickle continues, a channel begins to form.

Continuously check the stream table and draw what happens in the quadrants at the right.

Time: ______	Time: ______
Time: ______	Time: ______

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You’re the Hydrologist

1. Explain how this illustrates the way a river forms and changes with channeling, erosion and the formation of deltas.

Analysis:

2. What might happen if the angle of the slope were greater?

3. What might happen if the flow of water were greater?

Test your hypotheses on your stream table.

You're the Hydrologist

"Start a Flood"

Leave the riverbed and channels intact in the stream table. Use the soil around the stream to mold hills, valleys and lake areas. Add soil to create your landscape. Place the toy buildings, houses and cars into the stream table landscape to create a town.

Draw your stream table landscape.

Fill the spray bottles with water and spray the water onto the stream table to simulate steady rain across the landscape. What happens when the water hits the ground?

After a few minutes, open up the nozzles of the spray bottles and let a larger amount of water pour onto the landscape, simulating a heavy rainstorm. What happens now?

Analysis:

4. Does the water infiltrate the soil? Why or why not?

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You’re the Hydrologist

5. What happens to the streams and streambeds? Are new channels created? Explain.

____

____

____

6. Where does the runoff go on the stream table?

____

____

7. Which areas of the simulated landscape would be the “floodplain”? Why?

____

____

8. Which areas accumulate runoff water?

____

____

9. Where would be the safest place to build? Why?

____

____

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Floodplain

Name ____

Directions: Illustrate why floodplains have historically been important to a city's growth.

What you need:

- Stream table, constructed in *You're the Hydrologist*
- Plastic trough the length of the stream table
- Waxed paper, enough to cover the soil mixture in the stream table
- Waterproof tape, such as electrical tape
- Soil mixture (30 percent topsoil, 20 percent sand, 50 percent clay works well.)
- Bucket
- Water

What you do:

"Flood the Floodplain"

- To make the trough, cut a plastic 2-liter bottle or PVC tube in half lengthwise or use a length of narrow gutter. The plastic trough will act as your "river channel." Bury it down the length of the stream table, making sure that its sides are even with the surrounding landscape. Seal the surrounding landscape with waxed paper. You may want to tape the paper to the edges of the box and the edges of the trough to prevent leakage.
- Fill the trough about half way with the soil mixture, conserving some for use later. Compact the mixture tightly.
- Fill the bucket about two-thirds full of water and add the remaining soil mix. Stir the water and soil to create a suspension.
- Slowly, pour the water-soil mix into the river channel. Continue pouring until the water overflows the river and floods the surrounding land to a depth of about 1 inch (2.5 centimeters).
- Allow the water to evaporate. (*Note:* To speed the process, place the stream table in sunlight or use an artificial heat source.)
- When the water evaporates, illustrate where the soil mix was deposited and how much accumulated.

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Floodplain

Analysis:

1. Where did most of the deposition occur? Would this indicate agriculturally desirable land?

2. What materials were deposited the farthest from the river channel? How does this affect the nature of the soil away from the river?

3. Was there any apparent change in the composition of the soil mixture that was laid in the river channel prior to the “flood”? Explain.

Modeling Floods

Name ____

Directions: Follow the steps below to model, simulate and test possible ways to mitigate flooding in your local community.

What you need—
- Map of community waterways and floodplains
- Very large pan or flat plastic tub
- Modeling clay
- Toy buildings and cars (game-piece size)
- Water

What to do—
- Using the map as your guide, mold the modeling clay into the pan to simulate the landscape of a specific area waterway. If appropriate, include toy buildings, etc.
- Draw your model:

Modeling Floods

- Pour water into the waterway to a normal "stage."
- Begin to add water to simulate flooding conditions. What happens?

____

- Remove the water and begin mitigation. You may choose to add levees, berms, or flood walls; build a flood-control dam upstream; or dig irrigation channels or canals. Illustrate your changed landscape:

- Add water to simulate flood conditions. What happens?

____

Modeling Floods

Analysis:

1. Does mitigation decrease the risk of flood damage? Which mitigation efforts work best?

2. Which mitigation efforts are already in place in your community?

3. Which would you recommend? Why?

Speed of Stream Flow

Name ____

Caution: This activity must be done with an adult. Be sure to check the weather forecast and weather conditions before doing this activity.

Directions: You can test the speed of flow of a stream in your area with just a few simple items:

- Several oranges
- Stream of water
- Tape measure
- Stopwatch or watch with a second hand
- Pencil

Mathematical Note:
Water flows fastest near the surface because it has less friction from the bottom of the streambed. To get a good average speed for the entire depth of the stream, multiply your answers by 0.8. For example, if you find that the orange moved 100 feet in 25 seconds, the speed of flow would be 4 feet per second. Multiply this by 0.8 and the average speed of flow would be 3.2 feet per second.

What to do—

1. Measure and mark a specific distance alongside the stream.

2. Drop an orange upstream and start timing.

   Start time: ___________

3. When the orange reaches your measured length, stop timing.

   End time: ___________ Distance traveled: ___________

4. Repeat steps 1, 2 and 3 several times over different stretches of the stream.

   What is the **highest** speed of flow? _____________________________

   What is the **lowest** speed of flow? _____________________________

   What might account for the differences? __________________________

   What is the **average** speed of flow? ____________________________

5. Calculate your **average rate of flow** for the stream. ________________

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