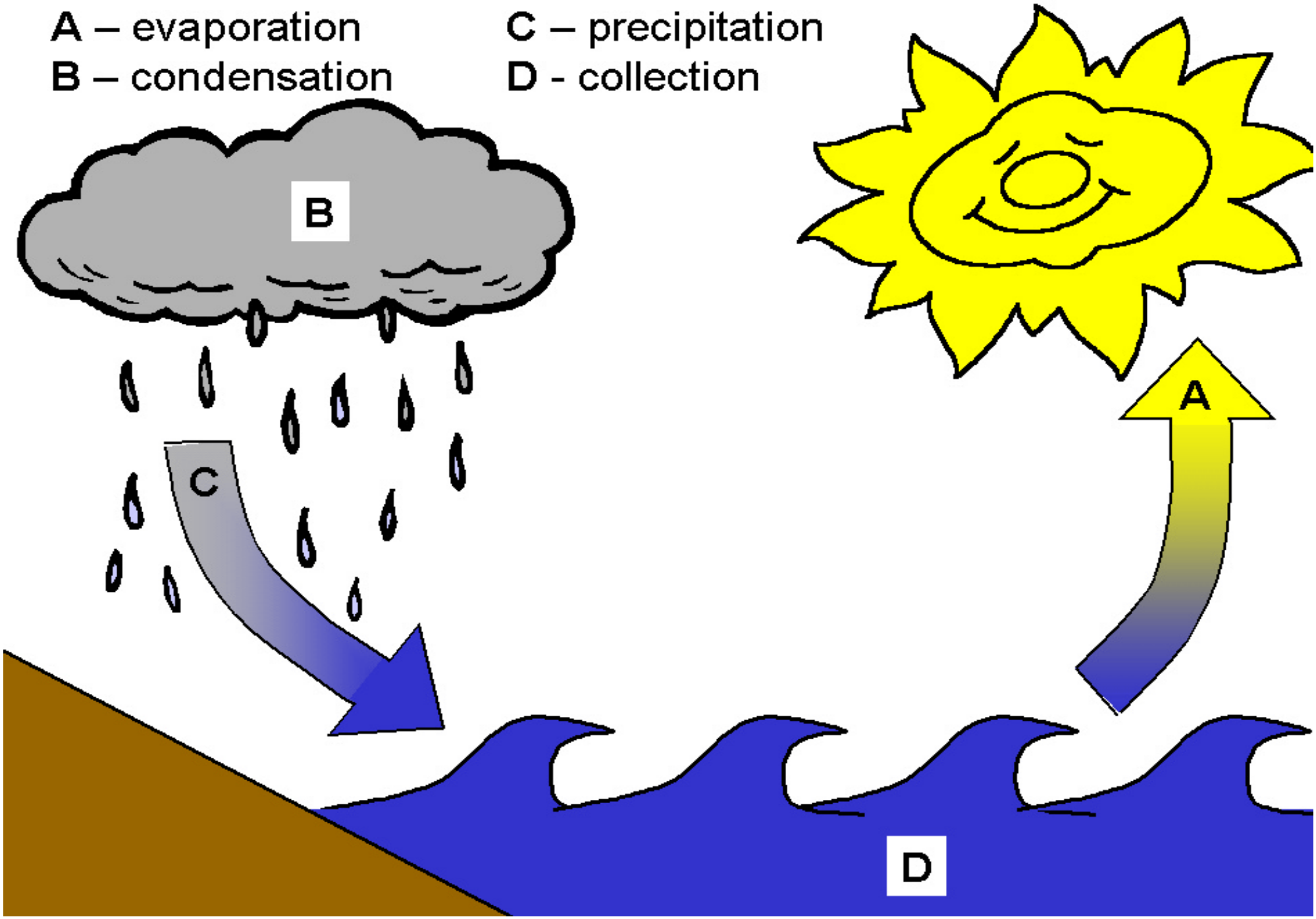
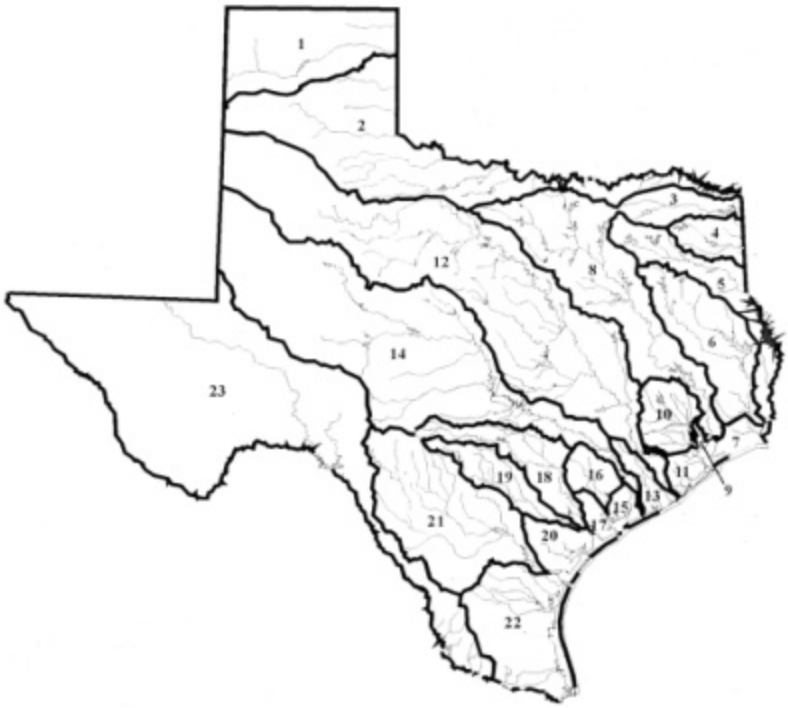

A – evaporation
B – condensation
C – precipitation
D - collection
B
C
A
D

Texas Rivers

The combined length of all Texas rivers, 191, 288 miles, is long enough to go around the equator almost eight times! Of all these streams, Texas has 14 major rivers.

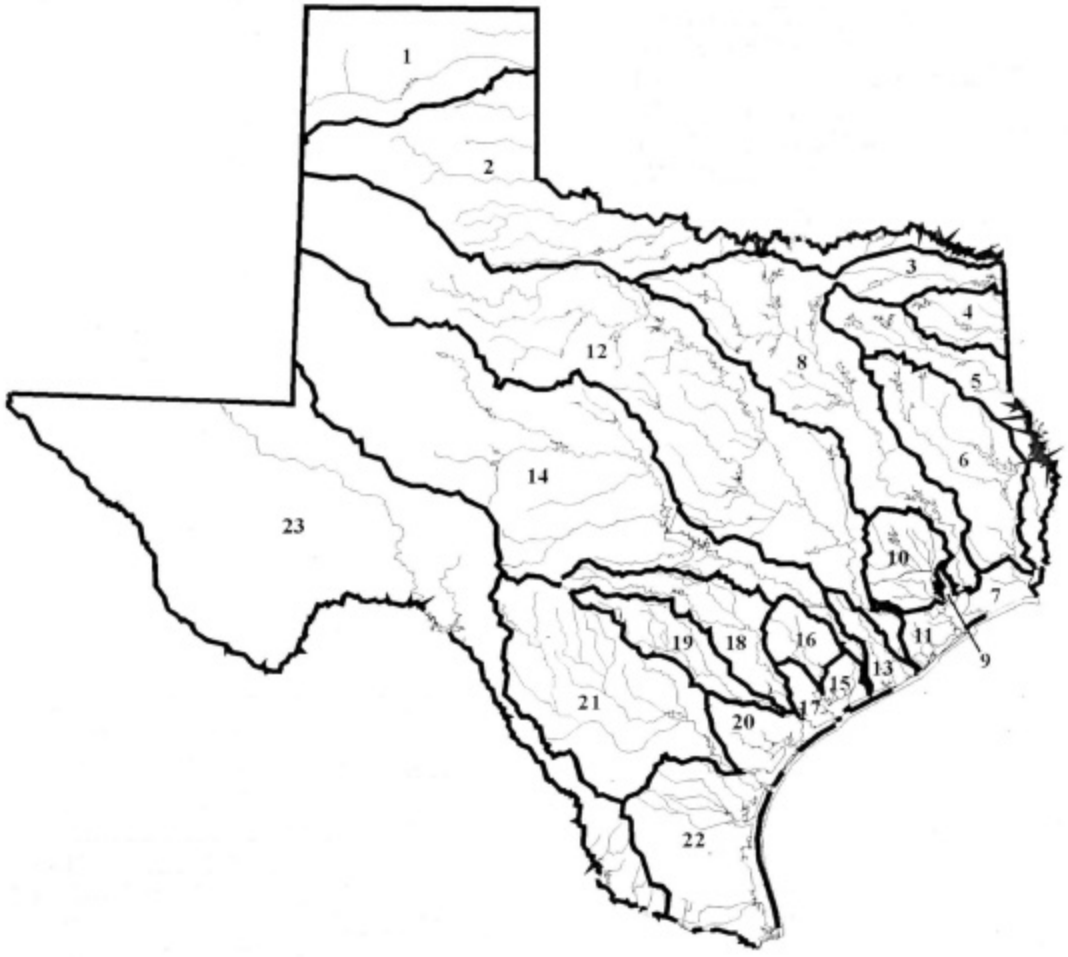
1. Brazos
2. Colorado
3. Canadian
4. Guadalupe
5. Lavaca
6. Neches
7. Nueces
8. Pecos
9. Red
10. Rio Grande
11. Sabine
12. San Antonio
13. San Jacinto
14. Trinity

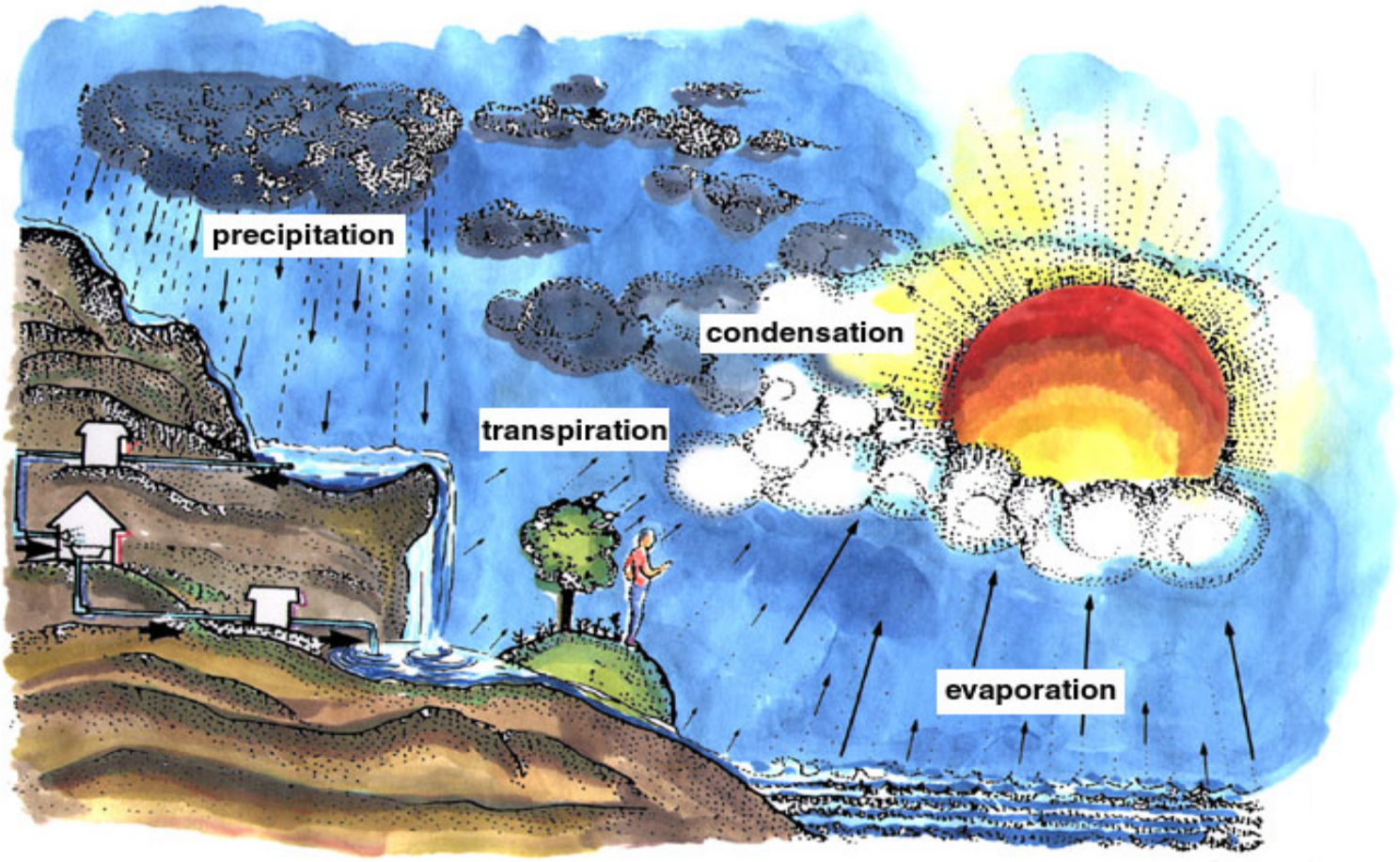
Texas River Basins



1. **Canadian River Basin**
2. **Red River Basin**
3. **Sulphur River Basin**
4. **Cypress Creek Basin**
5. **Sabine River Basin**
6. **Neches River Basin**
7. **Neches-Trinity River Basin**
8. **Trinity River Basin**
9. **Trinity-San Jacinto River Basin**
10. **San Jacinto River Basin**
11. **San Jacinto-Brazos River Basin**
12. **Brazos River Basin**
13. **Brazos-Colorado River Basin**
14. **Colorado River Basin**
15. **Colorado-Lavaca River Basin**
16. **Lavaca River Basin**
17. **Lavaca-Guadalupe Coastal River Basin**
18. **Guadalupe River Basin**
19. **San Antonio River Basin**
20. **San Antonio-Nueces River Basin**
21. **Nueces River Basin**
22. **Nueces-Rio Grande Coastal Basin**
23. **Rio Grande River Basin**

Major River Basins of Texas





Water Cycle

Precipitation, Transpiration, Evaporation, Condensation

Point Source and Nonpoint Source Pollution

Circle whether each source of pollution is nonpoint or point source pollution.

Erosion	Point Source	Nonpoint Source
Factory	Point Source	Nonpoint Source
Solid Waste Landfill	Point Source	Nonpoint Source
Storm Drain Pipe	Point Source	Nonpoint Source
Leaking Septic Tank	Point Source	Nonpoint Source
Washing Car	Point Source	Nonpoint Source
Oil/Fluid Leaks	Point Source	Nonpoint Source
Broken Sewage Pipe	Point Source	Nonpoint Source
Sewage Treatment Plant	Point Source	Nonpoint Source
Pesticides	Point Source	Nonpoint Source
Agriculture	Point Source	Nonpoint Source
Lawn Fertilizers	Point Source	Nonpoint Source
Animal Wastes	Point Source	Nonpoint Source
Insect Spray	Point Source	Nonpoint Source
Turpentine and Paint	Point Source	Nonpoint Source
Litter	Point Source	Nonpoint Source
Plowing Fields	Point Source	Nonpoint Source
Abandoned Mine	Point Source	Nonpoint Source
Moth Balls	Point Source	Nonpoint Source
Transmission Fluid	Point Source	Nonpoint Source
Fertilizers	Point Source	Nonpoint Source

Point and Nonpoint Source Pollution Study Sheet

Define the following terms and answer the following questions:

Nonpoint Source Pollution

_____
_____
_____

Point Source Pollution

_____
_____
_____

List three types of nonpoint source pollution:

1._____
_____
2._____
_____
3._____
_____

List three ways you can prevent nonpoint source pollution

1._____
_____
_____
2._____
_____
_____
3._____
_____
_____

Physical Indicators of Water Pollution

Color of Stream

Green
indicates the possibility that nutrients are being released into the stream and feeding algae. Check watershed for possible fertilizer or manure runoff areas.

Orange-red
indicates the possibility of acid drainage. Check the watershed for mining and watch for industrial waste draining into the stream.

Light brown
indicates sediment deposition caused by erosion. Check upstream for disturbed ground left open to rainfall.

Yellow coating on stream bed
indicates sulfur entering the stream. Check upstream for industrial waste or coal using operation.

Multi-color sheen
indicates oil floating in the stream. Check closely upstream for the source—waste oil may have been dumped along the stream or the sheen may be the result of nonpoint source runoff from automobile use.

Yellow brown to dark brown
indicates acids being released from decaying plants. Check for dead leaves collecting in the stream. This color is also common in streams draining marsh or swampland.

White cottony masses on stream beds
indicates the possibility of "sewage fungus." Check for sewage or other organic pollution.

Stream Odor

Rotten egg odor

Check for sewage pollution. The odor may also be present in marsh or swampy land.

Musky odor

Check for the possibility of untreated sewage, livestock waste, algae or other conditions.

Chlorine

Check to see if a near-by sewage treatment plant is chlorinating their effluent.

Foaming

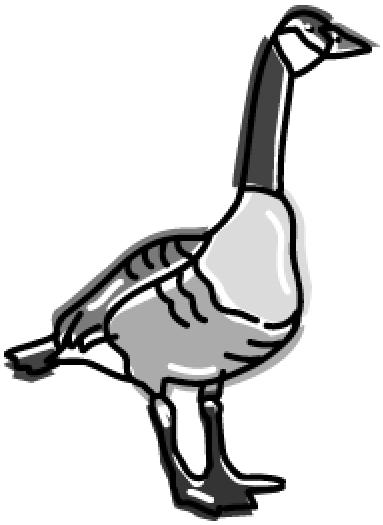
When white, and greater than three inches high, it indicates the presence of detergents. Check upstream for industrial or residential waste entering the stream.

Watershed Walk Worksheet

Team Names

_____

Date _____



During your walk, you will observe the watershed (the area surrounding your adopted waterway) and the riparian zone of your adopted waterway. Make observation notes on your worksheet and on your watershed map where appropriate.

Watershed Survey Questions

While you walk along the waterway answer the following questions:

Describe the Land Uses

1. Check off the land uses in the area:

__ roads__houses __apartments __shopping malls __schools __parks __open space __animal pastures __farms __golf courses __sewer covers __landfills/trash dumps __stormwater drains

Mark primary locations on your watershed map.

2. What percentage of the watershed is open lands (park, lawns, golf courses, open space, other)?

3. What percentage of the watershed is developed?

4. What is the main vegetation types in the watershed?

5. Where does rain go when it falls? Are there many areas where rainwater can soak into the soil or does it run off paved areas?

6. Find a storm drain and draw a picture of it. Mark storm drains on your map.

7. What are storm drains for? Where does water go after it flows into the storm water drains?

8. Do you see trash in the streets? What happens to the trash when it rains?

DID YOU KNOW?

In most of the western United States, storm drains collect rainfall and snow melt runoff from streets, sidewalks, building tops and lawns. Storm drains carry this excess water to the nearest waterway

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Waterway Survey Questions

Describe the Stream/Pond/Wetland:

1. What are the major land uses directly bordering your waterway?

2. Do you see any outfall pipes along the banks that might discharge water into it?

3. What are the pipes made of?
__ metal? __concrete? __plastic?

4. Do you know where they are coming from?

5. What impacts might this outfall pipe have on your waterway?

6. Is the waterway natural or has it been changed or even made by people?

7. Mark the following characteristics that best describe your waterway:
__channeled __dirt and vegetation on stream banks
__riffles and pools __rocks on the bottom __concrete sides
__stone walls __concrete bottom

8. Describe the vegetation that is growing on the banks.

9. Do you see trash in the water? Describe what kind of trash you see.

10. Do you smell any unusual odors or does the water have any strange colors? Describe the smells and colors.

11. Do you see signs of animal life in or around your adopted waterway? Draw pictures of the animals or their tracks you may see.

12. Do you see animal houses such as beaver dams, bird nests, squirrel holes? What is another name for the place an animal lives?

13. List the animals, birds, and other wildlife you see on your walk.

14. Can you see fish in the water? How many? How big are they? Can you name the species?

15. Do you see or hear insects? What do you see or hear?

Six Cardinal Laws of Contours

As you map your watershed, it is important to remember the following rules of contour maps:

1. Contours always occur in pairs. Contours that indicate a ridge will always close; therefore, on a map if you crossed a 50 ft. contour when moving in a downhill direction.

2. Contours never cross. Contour lines will never cross unless an overhanging ledge is indicated.

3. Contours have equal vertical separation. The vertical distance that is measured between two contour lines is the same for any two adjacent lines on a map.

4. All contour lines close on themselves. All contour lines will close someplace on the earth, even though they may appear to be a single line on a map.

5. Contour lines do not merge or split. Since continuous and close themselves, they cannot merge or split.

6. The steepest slope is perpendicular to the contour. This principle is illustrated by streams that always flow along the steepest slope and always cross contour lines perpendicularly.

Classifying Streams by "Order"

Streams that have no tributaries flowing into them are called first-order streams.

Streams receiving the flow from only first order streams are second-order streams.

When at least two second-order streams combine, the result is a third-order stream.

This continues until all the streams merge into the larges river, which ultimately drains into a lake or ocean.

Using the stream order classification method for river systems. Classify the river and streams using your 7.5 topographic map – you may label the streams/rivers on your map. Then complete the following table.

ORDER	NUMBER or TOTAL
1	
2	
3	
4	
5	
6	

Mapping Your Watershed

1. Determine the following from your map:

   Map Title _____

   Contour Interval _____

   Highest Elevation _____

   Lowest Elevation _____

   Stream Flow Direction _____

2. To map your watershed, follow these steps:

   a. Locate and mark the downstream outlet of the watershed. For lake watersheds, this will be the lake outlet. For rivers and streams, it will be the furthest downstream point that you are interested in.

   b. Locate all water features (streams, wetlands, lakes, reservoirs) that eventually flow to the outlet. Start with major tributary streams and wetlands, then include smaller streams and drainage channels. To determine if a stream is flowing to or from a lake or river, compare the elevation of land features to that of the water body.

   c. Use arrows to mark the direction of stream or wetland flow.

   d. Now that the tributary waters have been identified, the watershed boundaries can be drawn. Find and mark the high points (hills, ridges, saddles). Then connect these points, following ridges and crossing slopes at right angles to contour lines. This line forms the perimeter of the watershed.

You have just mapped your watershed. Write the name of your watershed on your map. The next section will help you identify important characteristics of your watershed.

Land Use in Your Watershed

Use the map legend and your outlined watershed to answer the following questions.

1. According to the map legend, what do the following colors represent?

   Black _____

   Blue _____

   Brown _____

   Red _____

   Green _____

   Purple _____

2. Which of these colors are dominant in your watershed? _____

_____

3. What type of roads do you see close to your monitoring site? _____

_____

_____

4. List the type of buildings located in your watershed.

_____

_____

5. Do you see any pipelines or transmission lines in your watershed? YES NO

   If so, what kind are they? _____

   _____

   _____

6. Based on the above information, what would you say is the primary land use in your watershed? _____

_____

7. What potential environmental hazards exist for this monitoring site? _____

_____

_____