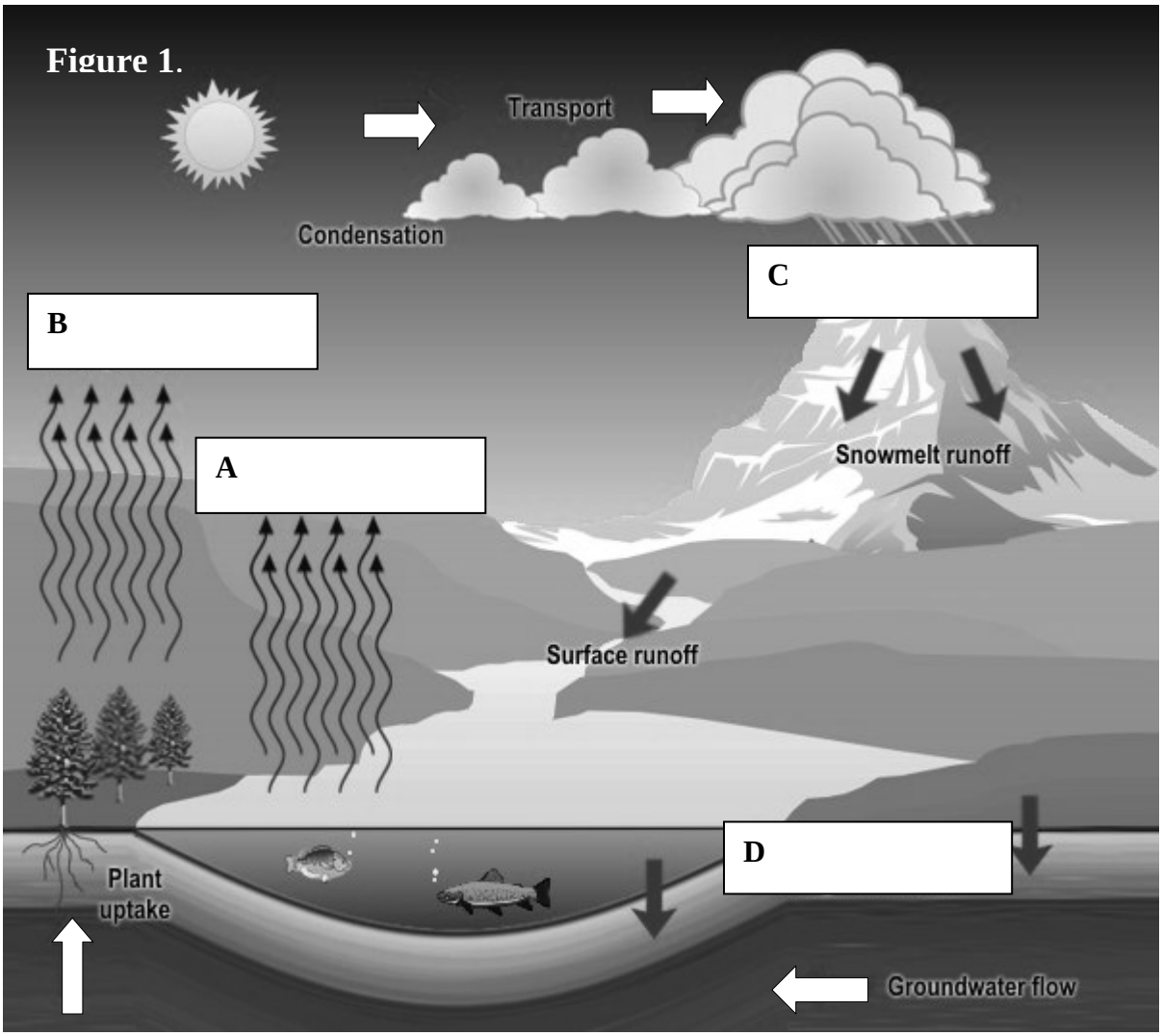
Team Number_____

2005 California Envirothon
Aquatics Station Test 1
Total = 100 points

Please write team number on top of each page of test. You may unstable the test and work on questions in any order, however, pages should be returned to correct order when test is turned in. You may choose to split your team up and work on multiple questions at once or work on questions together. Please show all work, as you may receive partial credit where possible.



The next five questions apply to Figure 1. **(**Answers to 1-5 can be found at: *http://www.srh.noaa.gov/srh/jetstream/atmos/hydro.htm)*

1. This figure is an illustration of the transfer of water from precipitation to surface water and ground water, to storage and runoff, and eventually back to the atmosphere. What is this cycle called? _____ (2 pts.)

2. Fill in the four blanks on figure 1 using options from the word bank. The blanks define processes (4 pts).

3. Evaporation is the change of state in a substance from

a _____ _____ _____ to a gas? (1 pt)

4. Of the transpired water passing through a plant only 1% is used in the growth process of the plant. The remaining 99% is passed into the

_____ _____(1pt)

5. Runoff occurs when there is excessive precipitation and the ground is

___ _____ _____(1 pt)

Word Bank for Questions 2-6.

Runoff
Percolation
Precipitation
Infiltration
Evaporation
Transpiration
Atmosphere
Saturated
Perspiration
Evaporate
Interception
Liquid

6. A portion of precipitation never reaches the ground because of vegetation, forest floors, or other surfaces. What is this process called? (Hint it is not evaporation, it is the process of being hung up on surface objects)

_____ _____(1 pt)

7. Impervious surfaces such as pavement and rooftops generate __ _ _____. more runoff than a woodland area of the same size. (1 pt) (Answer at *http://www.epa.gov/owow/nps/facts/point7.htm*)

a. 3-4 times b. 5- 6 times c. 9-12 times d. 100 times

True and False (1 pt each, 3 total points)

8. Nonporous urban landscapes like roads, bridges, parking lots, and buildings don't let runoff percolate into the ground. Water remains above the surface, accumulates, and runs off in large amounts. True or False (circle one)
http://www.epa.gov/owow/nps/facts/point7.htm

9. Streams interact with ground water in three basic ways: streams gain water from inflow of ground water through the streambed (gaining stream), they lose water to ground water by outflow through the streambed (losing stream), or they do both, gaining in some reaches and losing in other reaches. True or False (circle one)
http://water.usgs.gov/pubs/circ/circ1139/htdocs/natural_processes_of_ground.htm

10. The movement of water between ground water and surface water provides a major pathway for chemical transfer between terrestrial and aquatic systems. True or False (circle one)
http://water.usgs.gov/pubs/circ/circ1139/htdocs/natural_processes_of_ground.htm

Team Number_____

Use Figure 1.15 to answer questions 9-15. *http://abe.msstate.edu/Tools/csd/strm-cor-res/chap1v2.pdf*

Figure 1.15 is a storm hydrograph. It shows how stream discharge changes over time in response to a storm event. The area under the curve is the amount of water and the rate it flows down the creek after a storm. In this graph Q = discharge in cubic feet per second. Look at the lines that represent before and after urbanization and answer the following questions:

11. What is Figure 2 called? (1 pt) _____

12. Explain what the term 'lag time' means in Figure 2. (2 pts) _____

_____

_____

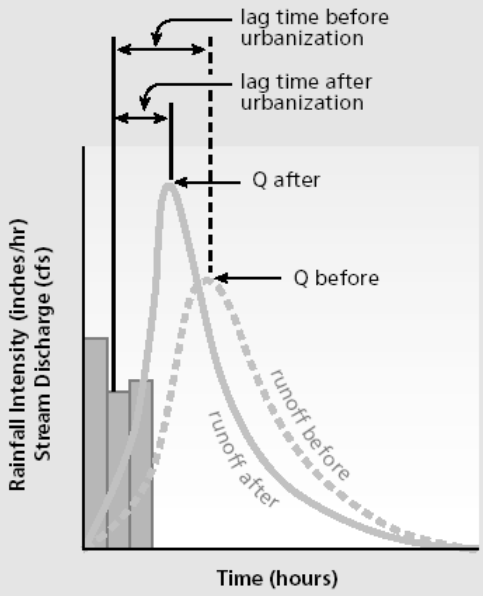


Figure 1.15: A comparison of hydrographs before and after urbanization
The discharge curve is higher and steeper for urban streams than for natural streams.

Change in Hydrology After Urbanization

The hydrology of urban streams changes as sites are cleared and natural vegetation is replaced by impervious cover such as rooftops, roadways, parking lots, sidewalks, and driveways. One of the consequences is that more of a stream's annual flow is delivered as storm water runoff rather than baseflow. Depending on the degree of watershed impervious cover, the annual volume of storm water runoff can increase by up to 16 times that for natural areas (Schueler 1995). In addition, since impervious cover prevents rainfall from infiltrating into the soil, less flow is available to recharge ground water. Therefore, during extended periods without rainfall, baseflow levels are often reduced in urban streams (Simmons and Reynolds 1982).

Storm runoff moves more rapidly over smooth, hard pavement than over natural vegetation. As a result, the rising limbs of storm hydrographs become steeper and higher in urbanizing areas (**Figure 1.15**). Recession limbs also decline more steeply in urban streams.

13. Would the lag time decrease or increase after the watershed was urbanized?

_____(1 pt)

14. Does the storm water run off an urbanized environment more or less quickly than a forested environment?

_____(2 pt)

15. Look at the hydrographs for before and after urbanization. Why do you think there is a difference in their shapes? (2 Pts) _____

_____

_____

16. What physical changes in the urban environment cause the change in the storm hydrograph? (2 pts)

_____

_____

_____

17. What practices could be done to help restore the storm hydrograph to a more pre-urbanized condition? (2 Points)

_____

_____

_____

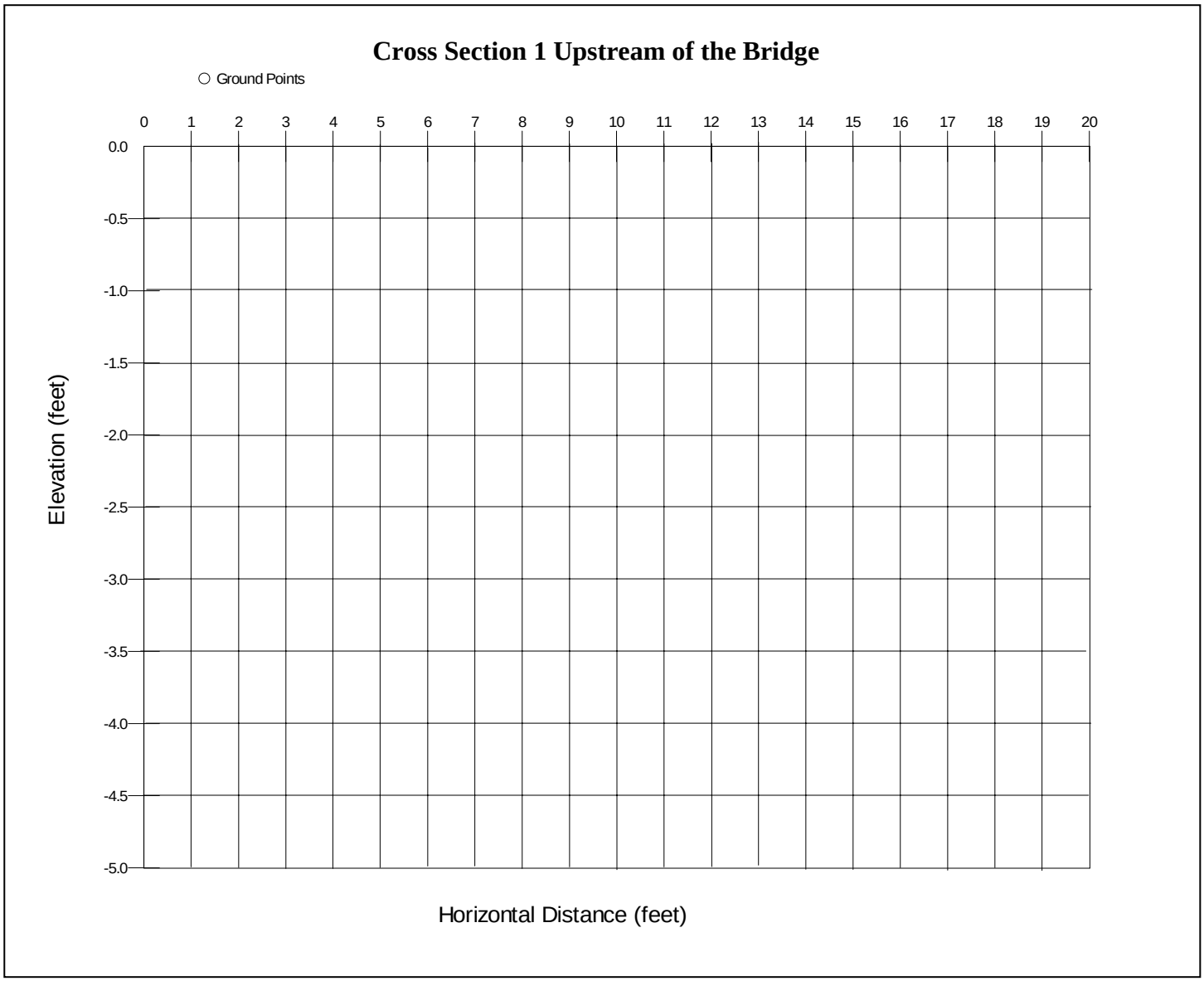
Team Name_____

Team Number_____

Field Application of Aquatics:

View upstream and downstream of the bridge
Draw a quick sketch of the cross section of the creek upstream and downstream of the bridge at the identified locations. This does not have to be exact however the two drawings should use a similar scale so if one cross section is deeper or wider in real-life the cross section should show a difference between the two sites. A tape has been strung for your use and a measuring device is available if you need it.

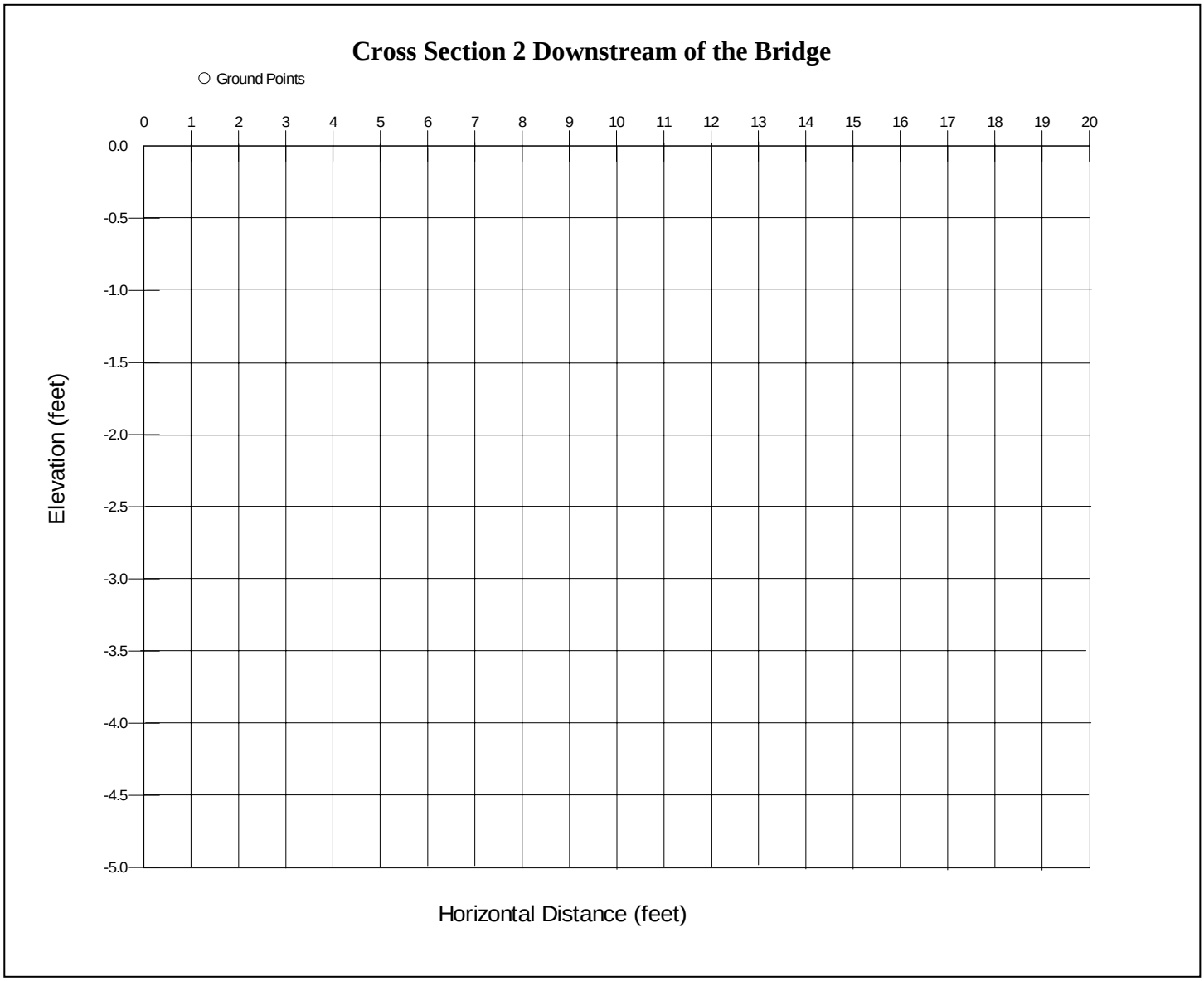
18. Cross-upstream of the bridge (closest to the pond) (6 pts)



Team Name_____

Team Number_____

19. Cross-section downstream of bridge (6pts)



Team Name_____

Team Number_____

19. Compare and Contrast Cross Section Characteristics using relative terms such as steep deep wide greater less than and be sure to quantify using terms like approximately 3 feet or about 12 feet, roughly 45 degree slope or almost flat. (16 pts)

Characteristic/Location	Upstream of Bridge 1	Downstream of Bridge
Gradient (2pts)		
Width (2pts)		
Depth (2pts)		
Width/Depth (rough estimate) (2pts)		
Sediment Size, Distribution, presence or absence of gravel/sand bars, etc. (fine versus coarse grained) (2pts)		
General Channel Shape (look at cross section) (2pts)		
Any other differences? Hint: Look at bank stability and vegetation (4pts)		

One of the biggest differences between the cross section stations is the presence of a small beaver dam. Look at the creek, your data (cross sections and channel characteristics) and answer the following questions.

20. What does the beaver dam do to the physical conditions of the channel and velocity water above and below the dam? (4 pts)

_____

_____

_____

_____

_____

_____

Team Name_____

Team Number_____

21. Fine sediment is indicative of low energy environments. Based on your field investigation (sediment distribution, raw banks, etc), where would you expect flow to have the most energy? _____ (1 pt)
    a. Above the bridge
    b. Below the bridge
    c. Under the bridge

22. Why? (2 pts)_____

_____
_____
_____
_____
_____
_____

23. Water Chemistry

Fill out the following table using the water quality testing equipment available at the station (20 pts).

Location	In the Creek	In the pond
a. Time/Date	(2)	N/A
b. Air Temperature	(2)	N/A
c. Water Temperature	(2)	(2)
d. PH	(2)	(2)
Dissolved Oxygen (DO)	(2)	(2)
e. Total Alkalinity	(2)	(2)

24. Based on the data provided in the above table what can you tell about the physical environment of the creek versus the pond? (1 pt)_____.
    a. Nothing not enough data.
    b. Possibly has a similar environment.
    c. Completely different.

25. What made you choose the answer to the previous question? (2pts)

_____
_____
_____

Team Name_____

Team Number_____

26. Laid out on the table are some aquatic insects collected from the pond and the creek below the pond. Using the identification cards, name the insects and draw them below. (8 Pts)

The Pond	Stream the Pond
a.	
b.	
c.	

Team Name_____

Team Number_____

27. What does the sensitivity of the insect populations you identified tell you about the two environments? (2 pts)

_____

_____

_____

28. Consider yourself an aquatic ecologist who has just been asked to summarize the effect of the dam on the chemical, physical and biological condition of this Creek. Please provide a short summary of the effects that natural and man caused influences may have had on this ecosystem. (5 Points)

_____

_____

_____

_____

_____

The map on this page is the watershed surrounding the pond. Draw the creek, the beaver dam, and the two cross section locations. Hint the pond is intersected by the creek. (1pt)