

2004 California Envirothon
Aquatics Station Test 1
100 points
Suggested Time To Complete This Test - 35 Minutes

Please write team number on top of each page of test. You may unscramble the test and work on questions in any order, however, pages should be returned in 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.

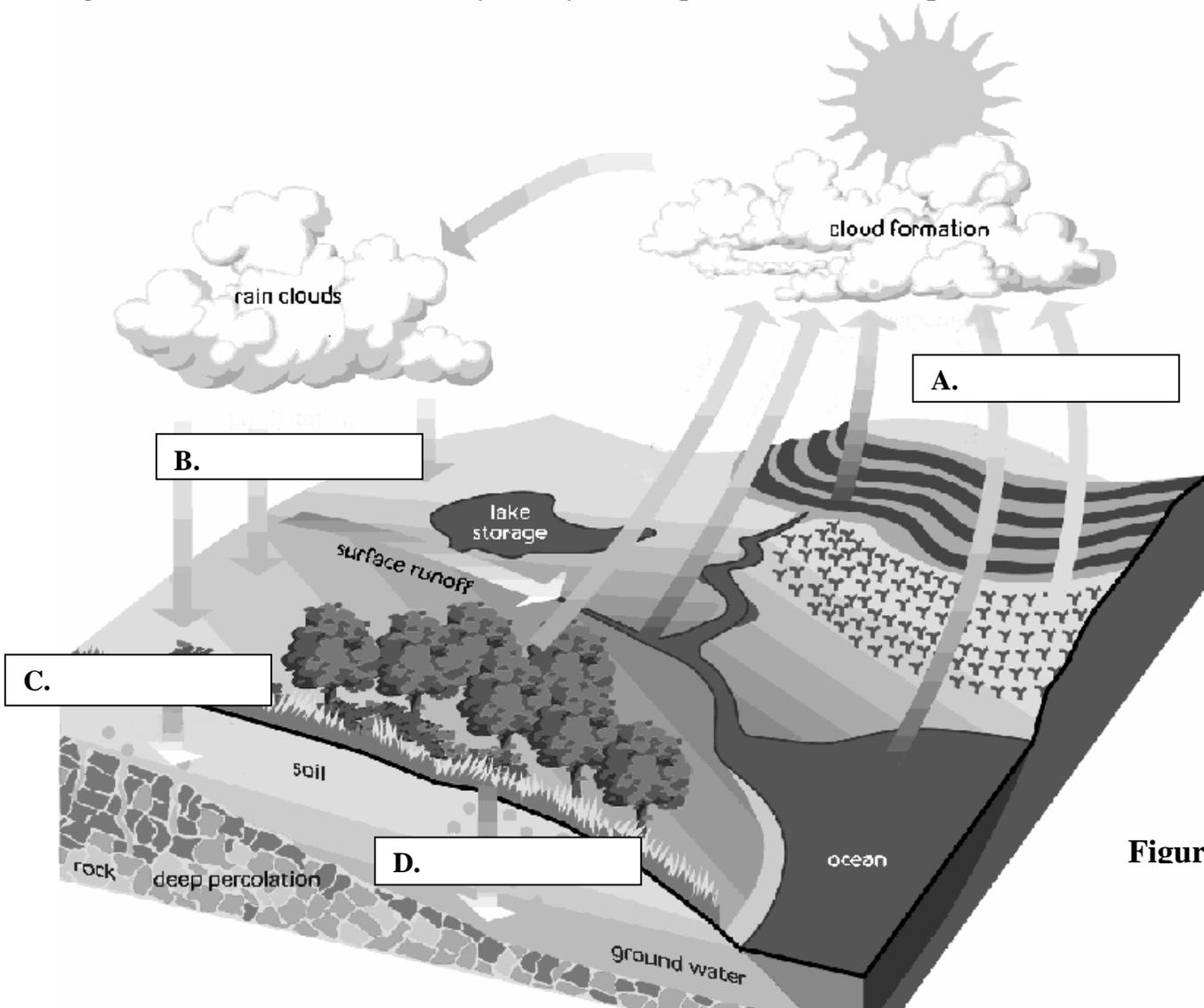


Figure 1.

The next five questions apply to Figure 1. (Answers to 1-5 can be found at: http://www.usda.gov/stream_restoration/newtofc.htm, Chapter 2, Page 2.3-2.4)

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. Precipitation can do one of three things once it reaches the earth. What are those three things? (3 pts)
 - a. _____
 - b. _____
 - c. _____

Word Bank for Questions 2-4.

Runoff
 Percolation
 Precipitation
 Infiltration
 Evaporation
 Transpiration
 Store
 Interception
 Perspiration
 Evaporate

4. 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)

5. 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)

6. 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)

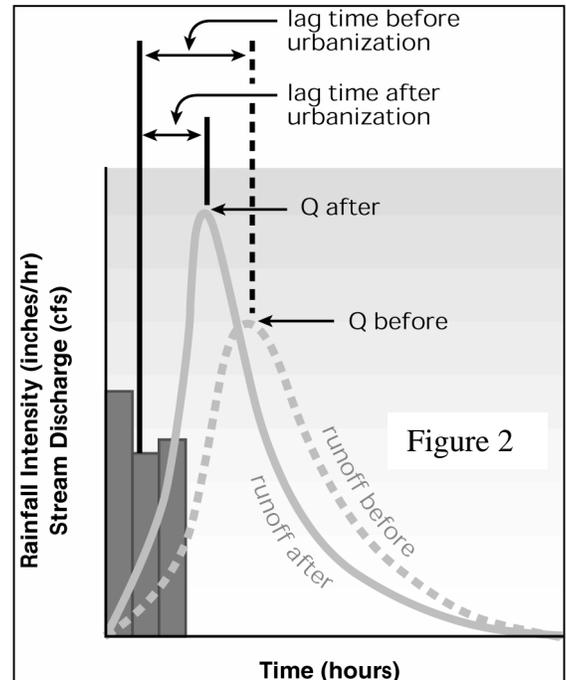
<http://www.epa.gov/owow/nps/facts/point7.htm>
7. Streams interact with ground water in three basic ways: streams gain water from inflow of ground water through the streambed (gaining stream), they lose water to ground water by outflow through the streambed (losing stream), or they do both, gaining in some reaches and losing in other reaches. True or False (circle one)

http://water.usgs.gov/pubs/circ/circ1139/hdocs/natural_processes_of_ground.htm
8. 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/hdocs/natural_processes_of_ground.htm

Use the following Figure 2 to answer questions 9-15. (Answers may be found at http://www.usda.gov/stream_restoration/newtofc.htm, Chapter 1, page 17.).

The figure below 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: (http://www.usda.gov/stream_restoration/newtofc.htm, Ch 1, Page 1-15)



9. What is Figure 2 called? (1 pt)

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

11. Would the lag time decrease or increase after the watershed was urbanized? (Circle one) (1 pt)

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

_____ (1 pt)

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

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

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



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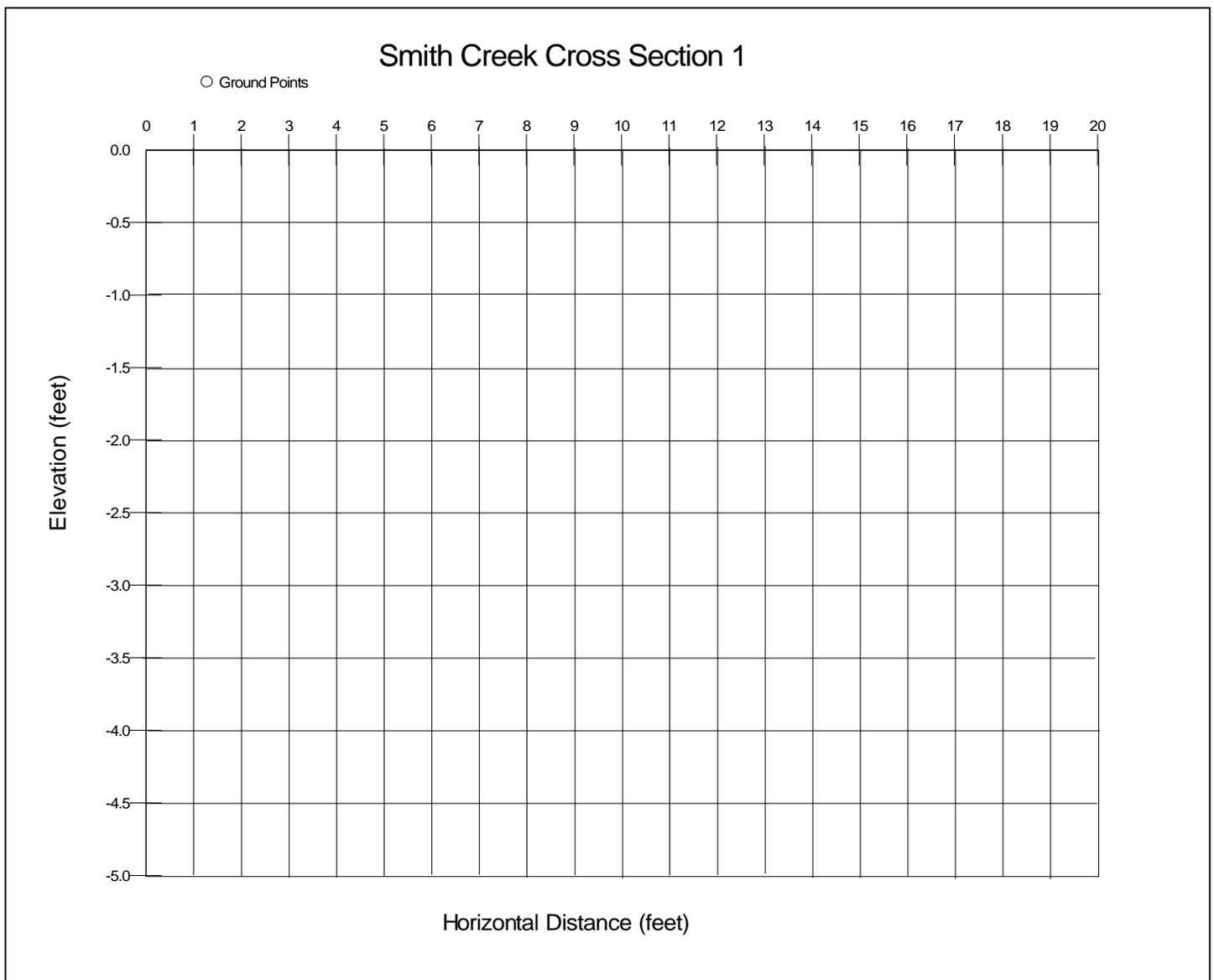
Team Number _____

Field Application of Aquatics: Smith Creek

Two stations have been established on Smith Creek. You will be expected to draw a graph of the cross-sections across the creek at these two sties and answer the following questions.

The Tape stretched across the stream represents the x-axis. Measure from the tape to the bottom of the channel-this represents the y-axis. Record the distance from the wadding rod to the tape as negative values. Plot these points on the graph below to create a representation of the channel cross section.

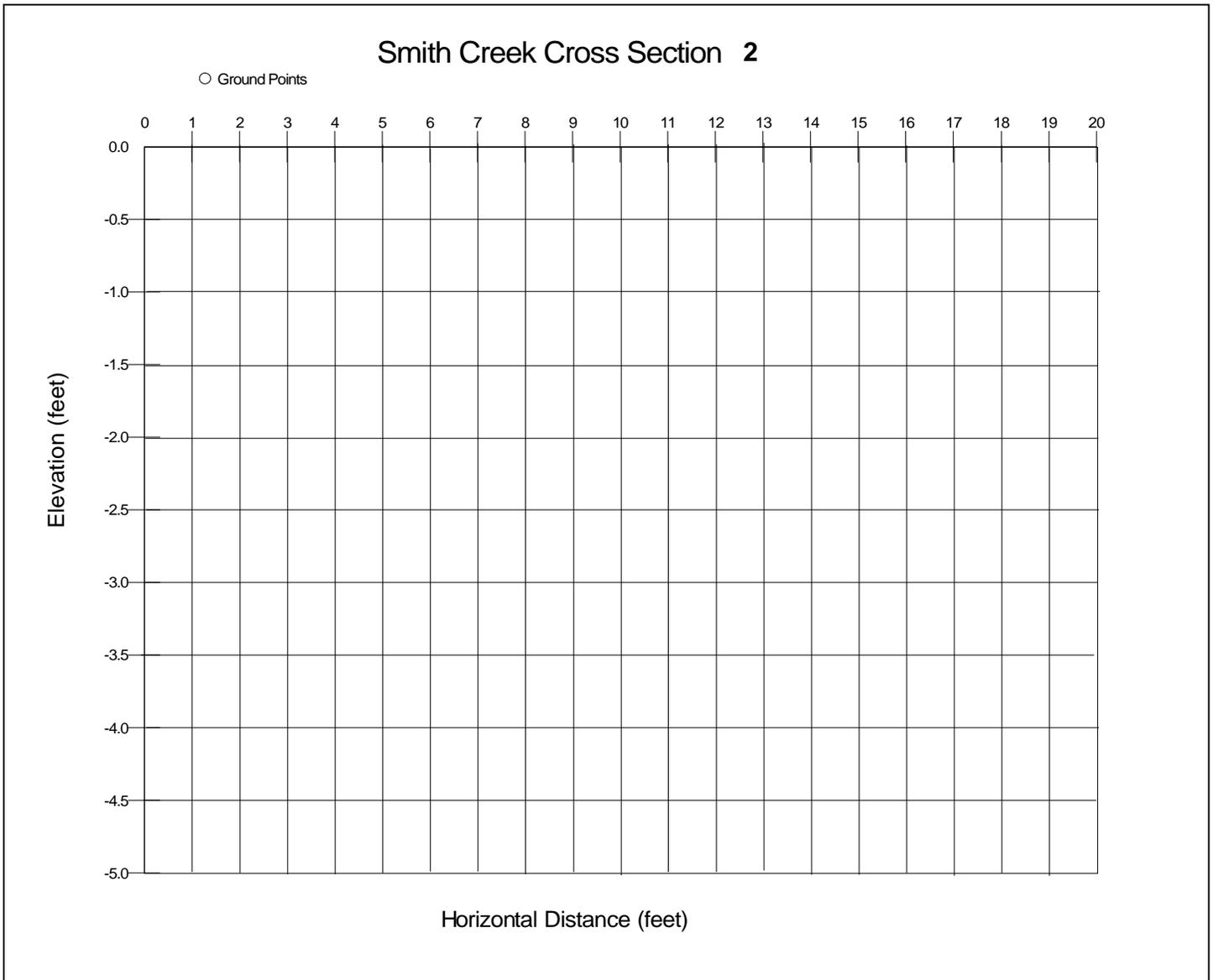
16. Cross-section at Station 1 (5 pts)



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17. Cross-section at Station 2 at Dam (5pts)



18. Determine the gradient at each cross section site (5pts).

- a. Use the provided tape, record the distance in feet from the stake upstream to the cross section location.
Distance from cross section to stake _____
- b. Use the laser level and rod to determine the change in elevation between the bottom of the channel at the stake and the bottom of the channel at the cross section location.

Rod reading at the cross-section _____ Rod reading at the stake _____

Rod reading at the cross section minus rod reading at the stake _____

Difference or rod reading divided by distance = gradient = _____

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Formula for gradient:

$$\frac{\text{Rod Reading}_{\text{cross section}} - \text{Rod Reading}_{\text{stake}}}{\text{Distance}} = \text{Gradient}$$

19. Repeat Procedure for Second Cross Section (5pts)

Distance from cross section to stake _____

Rod reading at the cross-section _____ Rod reading at the stake _____

Rod reading at the cross section minus rod reading at the stake _____

Difference or rod reading divided by distance = gradient = _____

20. Compare and Contrast Cross Section Characteristics (16 pts)

Characteristic/Location	Cross Section Station 1	Cross Section Station 2
Gradient		
Width		
Depth		
Width/Depth		
Sediment Size, Distribution, presence or absence of gravel/sand bars, etc. (fine versus coarse grained)		
Depth of Sediment, (use the ski pole)		
General Channel Shape (look at cross section)		
Any other differences? Hint: Look for physical barriers.		

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

21. There is a gravel bar in front of the spillway of the wooden dam. Using your knowledge of geometry and physics, specifically $A=W \times D$ (Area = Width x Depth) and $Q=V \times A$ (Discharge = Velocity x Area); can you explain why the gravel bar is present? (2 pts)

22. With the sediment occupying space in the channel where does the water flow at the dam site during high flows? _____ (1 pt)

- a. Over the dam at the spillway
- b. Under the dam subsurface
- c. Around the edges of the dam

23. 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 at the dam site? _____ (1 pt)

- a. Center of the channel
- b. Edges of the channel
- c. The same across the channel

24. Do you think the dam could fail? Look all around the dam for scour. Do you see any evidence of failure? If so comment on the stability of the structure and evidence for you opinion. (4 pts) _____

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25. Would you build your house downstream from a bigger dam similar to this one on a larger creek? What is the basis for your decision? (4 pts) _____

26. Water Chemistry

Fill out the following table using the water quality testing equipment available at the station (10 pts).

Location	Smith Creek	Adjacent Drainage
a. Time/Date	(2)	N/A
b. Air Temperature	(2)	N/A
c. Water Temperature	(2)	N/A
d. PH	(2)	7.5
Dissolved Oxygen (DO)	8.3 ppm	8.3 ppm
e. Total Alkalinity	(2)	120 ppm
Nitrate	17.6 ppm	17.6 ppm

27. Based on the data provided in the above table what can you tell about the physical environment of the adjacent creek? (1 pt) _____.

- Nothing not enough data.
- Possibly has a similar environment.
- Completely different.

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28. Laid out on the table are some aquatic insects collected from Smith Creek. Using the identification cards, classify the insects and draw them below. (9 Pts)

Name	Drawing
a.	
b.	
c.	

29. What does the sensitivity of the insect populations you identified tell you about Smith Creek? (2 pts)

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