

## ES202 Lab 6: Fluvial Processes Lab Instructions (updated Winter 2009)

Uses AGI Lab Manual 8<sup>th</sup> Edition

Using your lab book, complete the following exercises:

### Questions 1-6 = page 220-221

Question 1, (answer questions a-h about Fig. 11.5 on p. 220) Remember: gradient = elevation difference / distance along line of profile; Refer to Fig. 11.4 to see how to calculate gradient. *Procedure:* Calculate stream gradient (rise / run) in ft / mile. Find points A and B, where the contour lines cross and you can determine the elevation. The change in elevation (relief) is the difference between the two elevations. Then determine the length of the straight line segment between the two points using the bar scale.

Question 2 – see figure 11.5.

Question 3 - *Focus of question:* determine drainage divides by thinking of water flowing downhill, perpendicular to contour lines. The drainage divide is the part of the watershed where water flows away from high points. Refer to Figure 11.1A on p. 215 to see what a drainage divide looks like and how it is drawn. To draw a drainage divide on Figure 11.3, pg 217, start your line at the mouth of the stream tributaries (where Battendorf and Garvin canyons it enters Timber Canyon), and draw it following the slope along the ridges and high points, perpendicular to the contour lines.

Question 4, (refer to figure 11.3 pg 217) *Hints:* The “upland surface” the lab manual refers to is the gently sloping area along the southern margin of the map with the word “BEAVER”. Remember water flows downhill, perpendicular to contour lines, gradient = rise / run, the Great Divide lies along the crest of the Rocky Mountains, drainage to the east flows into the Gulf of Mexico, drainage to the west flows into the Pacific.

Question 5, (refer to figure 11.3 and list of drainage types on p. 217)

Question 6, (refer to figure 11.6, map from Arkansas, p. 222) *Hint:* Look at the concentric, ring-shaped mountains separated by valleys in the area north and south of Waldron. The green map color represents forested mountain slopes. Compare the topographic patterns in Figure 11.2 (p. 216), which type of geologic feature / drainage pattern does the Waldron site most resemble?

### Questions 8-14 = p. 223.

Question 8 (NOTE: use the pocket stereoscopes from last week’s lab to view fig. 11.8 in 3-D). The map in Figure 11.7 is the same area as the photo pair in Fig. 11.8.(Hint: oxbow lakes form from cut off of meander bends via erosion; look at figure 11.1 C for a model)

Question 9-10 - (Hint: think about current meander loops that are so tightly closed that they may cut themselves off via erosion)

Question 11 *Focus of Question:* Floodplains are low-lying areas adjacent to stream channels that are frequently inundated with water. Something to think about: would you want to build your house or grow crops in an area that was constantly be flooded? Terraces are old, abandoned floodplains that are elevated above modern floodplains. Terraces result from down-cutting and erosion of the river channel into the valley, leaving the old floodplain high and dry in the form of a terrace. Question: would you want to grow crops or build a house on a terrace that is above the floodplain? Refer to p. 410 of your text book for a visualization of river terraces and floodplains.

Question 12-13 (*Hint*: think of what happens if a river channel is abandoned and water is pirated away to a new part of the drainage system)

Question 14,

*Ideas for Question*: Discharge is the measure of volume of water that flows through a river channel (for e.g. measured in gallons per day). 12,000 years ago, the climate was dramatically different than it is today. It was the end of the last major glacial “ice age”, particularly in the northern Midwest states (e.g. north Dakota)... glaciers were rapidly melting and retreating. Look at the map on p. 514 of your text book, Fig. 18.33... this will give you an idea of how much glacial ice covered Canada and the upper Midwest of the U.S. 20,000 years ago. Think about where the melt water would have been flowing 12,000 years ago, and compare to the climate and hydrologic conditions present in North Dakota today.

### **Questions 15-27 page 226**

Question 15, (*NOTE*: use the pocket stereoscopes to view the alluvial fan in 3-D on Figure 11.10; this air photo pair matches the map area on Figure 11.9) Refer to p. 405 and Figure 14.22 in your text book for a visualization of alluvial fans and their environments of formation.

Question 16,

*Procedure*: Calculate stream gradient (rise / run) in ft / mile. Find two points on the stream channel where the contour lines cross and you can determine the elevation of the channel. Pick two points on the alluvial fan separated by a distance of approximately 2-3 miles. The change in elevation is the difference between the two lines. Then determine the length of the stream channel between the two points using the “paper-segment” method and the bar scale.

Question 17, *hint*: compare the air photo and map pattern of the stream channels to the patterns shown on Figure 11.1 of the lab manual.

Question 18-19

Questions 20-27 (*focus of questions*: compare the 1936 river shape to the 1992 shape; think of meandering, cutbank erosion, and point bar deposition. The goal is to see historic changes in the river position over about 60 years)

### **Questions 28-35 = page 230-231**

Question 28 (*hint*: use the distance from the Escarpment to the present falls position as the distance of erosion over the past 11,000 years: Rate of erosion = erosion distance / time of erosion. This problem is discussed in detail on p. 404 of your text book, Figure 14.21)

Questions 29-31

Question 32

(*hint*: think of the water surface forming as a horizontal plane, with floods forming a bath-tub ring parallel to contour lines. Since water seeks an equal elevation under the influence of gravity, high-water marks will tend to form parallel to contour lines) Using colored pencils, draw the high water line around the valley and shade in the flooded area.

Question 33-35, p.231.

Computers are available in NS218A (back lab room) for internet connections and web-site browsing. Print out your search results and include in your lab portfolio.