GY-260 Geomorphology
Block 1, 2007

Monument Creek Hydraulics Project

Project Outline

This is a multi-part lab/field project. The overall goal is to examine the character of bankfull flows along Monument Creek near the campus and to determine the recurrence interval of bankfull discharge. This afternoon (Wednesday) we will be going down to Monument Creek to conduct (1) a survey of bankfull channel geometry and (2) measurements of modern channel geometry and flow in an attempt to determine the Manning's n value for the modern stream. Tomorrow morning (Thursday) we will (3) use data from the USGS website to construct a flood frequency graph for the Creek. Each part of the project will make use of different tools/instruments/methods/equations, and everyone will be involved in each part.

You will need to divide up into teams of 3 or 4 (not the same teams as in Horseshoe Cirque). You will do all of your work together as a team and turn it your lab write-up as a team.

Data collected in the first two parts of the project should allow you to determine bankfull velocity, discharge, and competence (assuming that the modern Manning's n is also appropriate for bankfull conditions). Results of the third project should then allow you to determine the recurrence interval al of bankfull discharge on the Creek.

Bankfull Stage – A Little Background

Bankfull stage is the water depth at which a stream completely fills its channel (to the top of the banks) and begins to overflow onto its floodplain. Many workers feel that bankfull flows are the critical flows in determining character and geometry of the stream channel. Others have argued (perhaps less convincingly) that due to their relatively high magnitude and frequency, bankfull flows may be responsible for accomplishing the largest amount of geomorphic work (bank erosion, sediment transport, etc.)

It has long been suspected that bankfull discharge is a fairly common occurrence. The work of Leopold, Wolman, and Miller (1957) suggested that bankfull discharges occur with a recurrence interval of 1 to 2 years in "a variety of rivers in diverse physiographic settings and differing greatly in size". A value of 1.58 years is frequently cited in the literature (Richards, 1982). Other workers have suggested either a slightly longer recurrence interval (2-3 years) or a wide range of recurrence intervals for bankfull flows on different streams.

How Are We Supposed To Do This, Anyway?

That is a good question, but one you will, unfortunately have to answer yourselves. We've now discussed things quite a bit in class – what the appropriate equations are, what you are going to have to measure. For those of you who are going into the field, you will need to determine where to measure things (just how can you identify "bankfull" stage anyway? are the opposite banks actually the same height?) and how to go about making the appropriate measurements. Phil, Steve, and I will be out in the field and will give you some help (particularly on instrument use), but for each field project, you'll need to work out, and agree on, your methodology.

I have attached a detailed set of directions on how to download and process historical flood data from the USGS website and how to construct a flood-frequency curve from those data using Excel. You will be doing this work tomorrow morning and then will have the afternoon free to complete your calculations and write up the lab.

Write-Up – What to Turn In

This will be a group write-up (one per research team) and will take the form of a traditional lab write-up, rather than a complete scientific paper. That said, you should make sure that your answers are clearly written, any tables and figures well labeled, etc. Your write-up should include:

a) Field data from both field projects organized (in figure and/or table form) and presented in a way that is comprehensible to a reader. You will probably be including some channel cross sections in this part of the write-up.

b) All calculations (show appropriate formulae and explain terms in each formula) you have made to determine Manning's n, and bankfull velocity, and discharge. Highlight your results here so we can find them easily.

c) You may not have realized this, but at this point you also have enough data to compute stream competence, at today's flow and at bankfull discharge, using the Shields criterion. Include that calculation (for the deepest part of the channel) at each stage, showing the formulae you used and your work.

c) Your flood-frequency data (spreadsheet format is fine as long as the spreadsheet is well labeled), a flood-frequency (recurrence interval vs. discharge) graph.

d) Your conclusions regarding the frequency of bankfull discharge

e) A brief discussion/assessment of the sources of error and how they affect your confidence in your results.

The write up will be due Friday morning at 9:00.