Problem #1 (50%) At-a-Station Hydraulic Geometry (English Units)
Consider the cross-section of the Missouri River below and estimate Manning n. Assuming constant n, develop a spreadsheet to measure the hydraulic geometry as a function of flow depth every 1 ft until 12 ft. Plot these at-a-station hydraulic geometry relationships in English Units. Calculate the mean flow velocity and the floodwave celerity \( c = \frac{dQ}{dA} \) for these conditions. Discuss the results.

![Cross-section diagram](image)

Problem #2 (50%) Flow-duration/sediment-rating curves (SI Units)
Access the USGS web site and extract the data from the St-Vrain down the South Platte River. Let’s find 8 stations with lengthy water and sediment records between Lyons down and Lincoln. We’ll discuss in class which station you will specifically focus on. Extract the daily flow and sediment concentration at your station and analyze the following:

(a) Plot the hydrographs and concentrations for your period of record;
(b) Provide a flow duration curve on log-log scale;
(c) Use the method in Section 5.6 of River Mech. to find the exponent b “hat”;
(d) Define \( Q_s = aCQ \) and plot the sediment rating curve in metric tons per day;
(e) Determine the mean annual discharge (in \( \text{m}^3/\text{s} \)) and the mean annual sediment load (in metric tons per year) from the flow-duration/sediment-rating curve method.