CWR 5235 Open Channel Hydraulics
Homework 4, Spring 2021
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1. (Taken from Apsley, **10 points**) Assuming a friction coefficient c_f = 0.005, estimate the velocities V at which:
   (a) incipient motion;
   (b) incipient suspended load;

occur in water for sand particles of density 2650 kg/m^3 and diameter 1 mm.

2. (Taken from Apsley, **30 points**) A long rectangular channel contracts smoothly from 5 m width to 3 m width. The bed is composed of gravel with a median grain size of 10 mm and a density of 2650 kg/m^3. The friction coefficient c_f is 0.01 and the critical Shields parameter is 0.05. If the flow rate is 5 m^3/s and the upstream depth is 1 m:
   (a) show that the bed is stationary in the 5 m width and mobile in the 3 m width by assuming that the bed is initially flat;
   (b) determine the depth of the scour hole that results just after the contraction.

3. (Taken from Apsley, **60 points**) A wide channel of slope 1:800 has a fine sandy bed with d_{50} = 0.5 mm. The discharge is 5 m^3/s per meter width. The specific gravity of the bed material is 2.65.
   (a) Estimate Manning's n using Strickler's formula.
   (b) Find the depth of flow; (assume normal flow).
   (c) Find the bed shear stress.
   (d) Show that the bed is mobile and calculate the bed-load flux (per meter width) using:
      (i) Meyer-Peter and Müller; (ii) Nielsen models.
   (e) Find the particle settling velocity and show that suspended load will occur.
   (f) Estimate the suspended-load flux (per meter width), explaining your method and stating any assumptions made.