Name: _____

CVEN 339 – Water Resources Engineering
Summer Semester 2010
Dr. Kelly Brumbelow, Texas A&M University

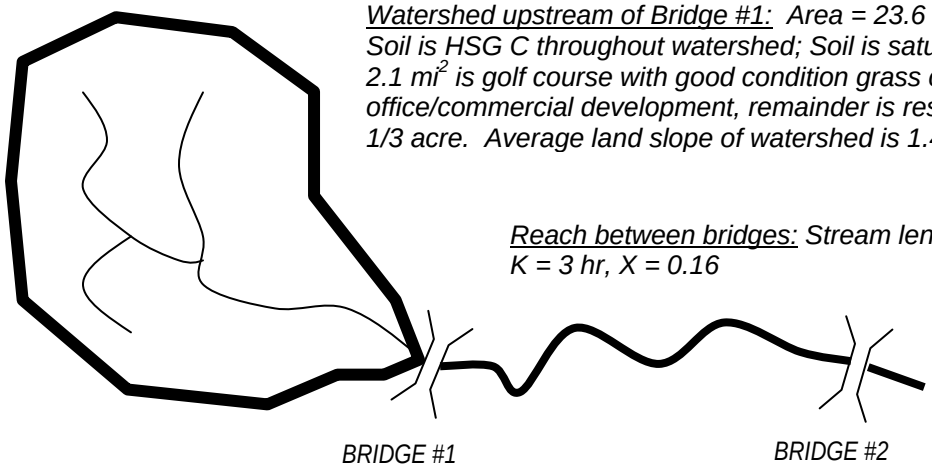
Exam #2

Open-book, Open-notes (8 pages front-and-back, 3 questions); Time allowed: 120 minutes

1. Jamis Creek is crossed by bridges at two locations as shown in the sketch below. The watershed above the first bridge has properties as given below. The creek reach between the two bridges has Muskingum routing parameters as shown in the sketch. Base flow in the stream can be assumed to be 17 cfs at both bridges.

If a thunderstorm occurs only on the watershed above the first bridge and rains 6.3 inches over a period of 6 hours, *what will be the peak streamflow to occur at Bridge #2?*

(35 points)



Watershed upstream of Bridge #1: Area = 23.6 mi^2, Hydraulic length = 8.1 mi. Soil is HSG C throughout watershed; Soil is saturated at beginning of storm; 2.1 mi^2 is golf course with good condition grass cover, 14.9 mi^2 is office/commercial development, remainder is residential with average lot size of 1/3 acre. Average land slope of watershed is 1.4%.

Reach between bridges: Stream length = 16.2 mi
K = 3 hr, X = 0.16

{Work space for #1}

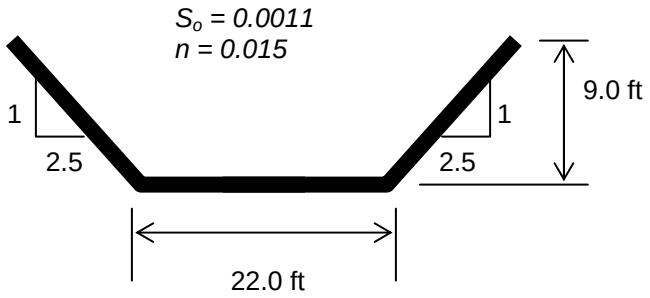
2. A flood control district is in the process of conceptual design to "re-naturalize" streams that had been channelized (i.e., straightened and lined with concrete) several decades ago. The channel cross-sections and characteristics for both the existing and proposed conditions are given below. Note that floodplain vegetation growth will result in changes in channel roughness over a 25 year span until vegetation maturity.

(a) Determine the maximum flowrate, width of inundated area (i.e., the flow topwidth), and mean flow velocity for (a) the existing channel, (b) the re-naturalized channel immediately after construction, and (c) the re-naturalized channel at vegetation maturity.

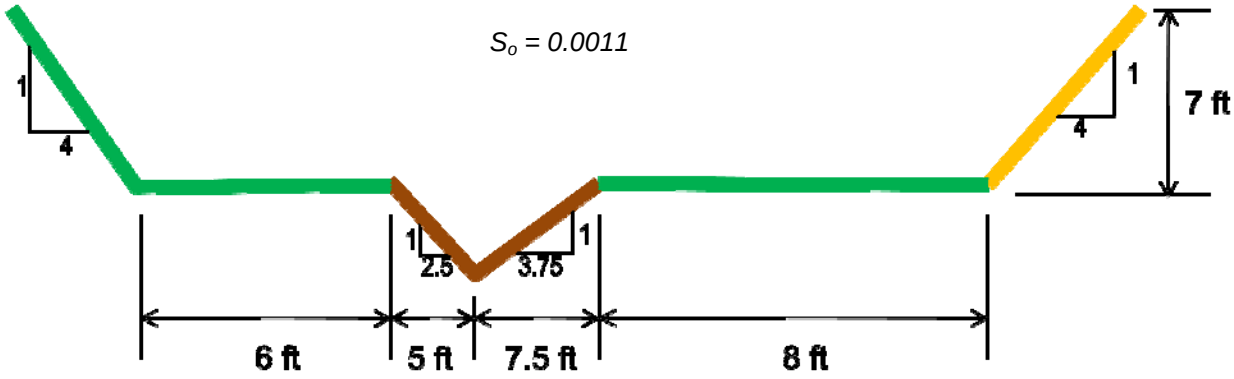
(b) Determine mean shear stress in the re-naturalized channel immediately after construction and at vegetation maturity. Compare these values to permissible values for the clay main channel as given in Fig. 5.12 (p. 277) in the course textbook and interpret your comparison (i.e., say what it means that one value is greater than another). Is the mean shear stress the appropriate quantity to compare to permissible tractive force? Why or why not?

(30 points)

EXISTING SECTION



PROPOSED SECTION



Channel perimeter surface is color coded.
Brown = Bare clay (void ratio=0.6); n = 0.027 (for all times)
Green = Buffalo grass; n = 0.035 (initial), n = 0.041 (vegetation maturity)
Yellow = Cypress trees; n = 0.060 (initial), n = 0.200 (vegetation maturity)

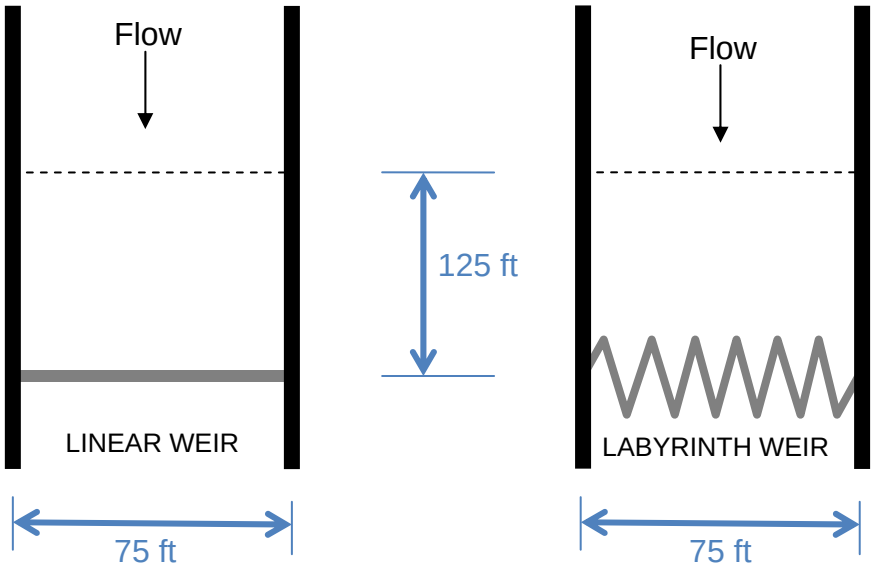
(Work space for #2)

3. You are working on the design of a flood control reservoir to be constructed on a large creek and are evaluating 2 alternatives for the outfall structure: (i) a simple linear weir with low elevation orifices, and (ii) a labyrinth weir with low elevation orifices (see sketches below). The reservoir to be formed by the weir will have vertical sides on the left and right sides. The upstream side will have the slope indicated on the sketch, which will lead to more flooded surface area as water surface elevation increases.

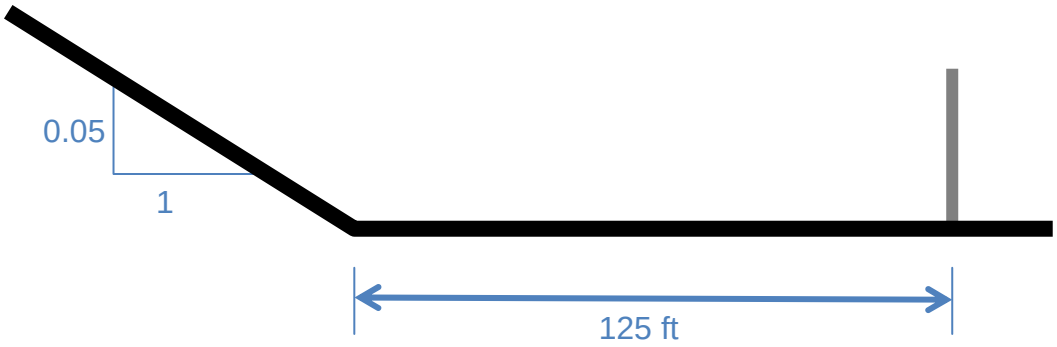
(a) Determine the reservoir routing curve for each design alternative.
(b) Calculate the reservoir outflow hydrograph that would result for each design alternative as a result of the reservoir design inflow hydrograph given below.
(c) Discuss the advantages and disadvantages of choosing the labyrinth weir over the linear weir design.

(35 points)

PLAN



ELEVATION



Additional notes on weir and reservoir designs

Linear weir length = 75 ft
Labyrinth weir length = 225 ft
Weir crest height = 4.5 ft above reservoir bottom for both weir designs
Weir discharge coefficient = 3 for both weirs

Both weirs include 10 low level orifices: 6 inch diameter, centerline at 1 ft above reservoir bottom

The two weirs are designed so that the volume of water stored in the reservoir is the same at any given water surface elevation for the two alternatives.

Design Inflow Hydrograph

t (hrs)	Q (cfs)
0	12
2	5,000
4	16,750
6	21,200
8	19,730
10	14,250
12	10,100
14	6,200
16	2,800
18	1,350
20	660
22	140
24	12

(Work space for #3)