Name: _____

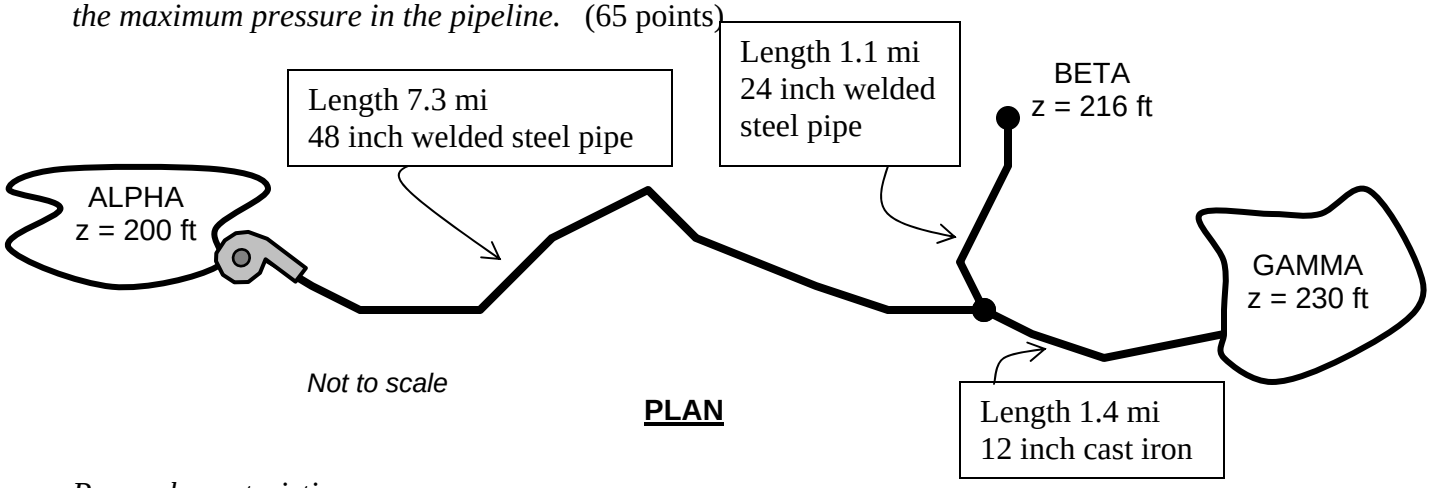
CVEN 339 – Water Resources Engineering
Summer Semester 2007
Dr. Kelly Brumbelow, Texas A&M University

Exam #1

Open-book, Open-notes (4 pages, 2 questions); Time allowed: 80 minutes

1. A pump station inputs water to a long pipeline that has two branches as shown in the map below. Water is withdrawn from point Beta at a constant demand of 12.2 cfs (note that point Beta is not a reservoir). Point Gamma is a reservoir, and inflow to this reservoir is determined by the hydraulics of the pipe system (i.e., whatever will flow in is a function of the pump energy and head losses in the pipeline). The characteristic curve for the pump is given below as well as the pipe properties.

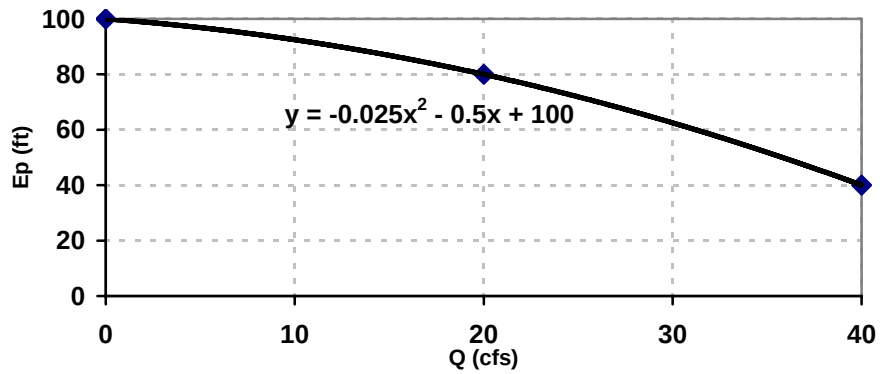
Determine the following: (i) flowrate into reservoir Gamma; (ii) pressure at point Beta; and (iii) the maximum pressure in the pipeline. (65 points)



Not to scale

PLAN

Pump characteristic curve:

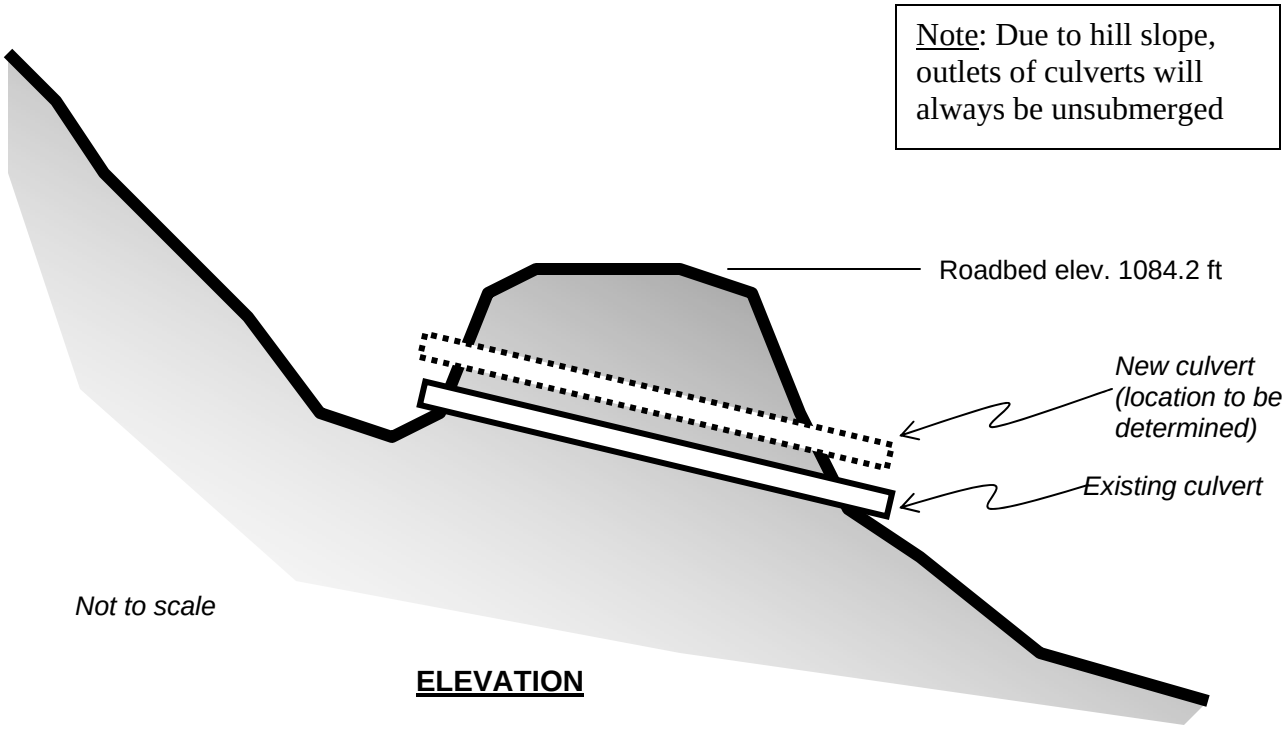


(Work space for #1)

2. A roadway traverses a hillside as shown in the figure below. A recent storm produced a runoff flow down the hill that collected in the upstream ditch and then overtopped the roadway. Consequently, you are designing an additional culvert to be installed under the road to prevent future overtopping.

Your task is made more difficult by the constraint that the flow down the hill below the road should not exceed 172.0 cfs due to erosion concerns.

What should be the entrance invert elevation of the new culvert to maximize flow under the roadway while not violating the erosion design constraint? (35 points)



ELEVATION

Existing culvert: 24 in diameter reinforced concrete pipe (ε = 3 mm)
127 ft long
projecting entrance, invert elevation 1076.3 ft
projecting exit, invert elevation 1073.9 ft

New culvert : 36 in diameter corrugated metal pipe (ε = 5 mm)
135 ft long
projecting entrance, invert elevation to be determined
projecting exit, invert elevation to be determined

(Work space for #2)