

Name: _____

CVEN 458 – Hydraulic Engineering
Spring Semester 2008
Dr. Kelly Brumbelow, Texas A&M University

Exam #1

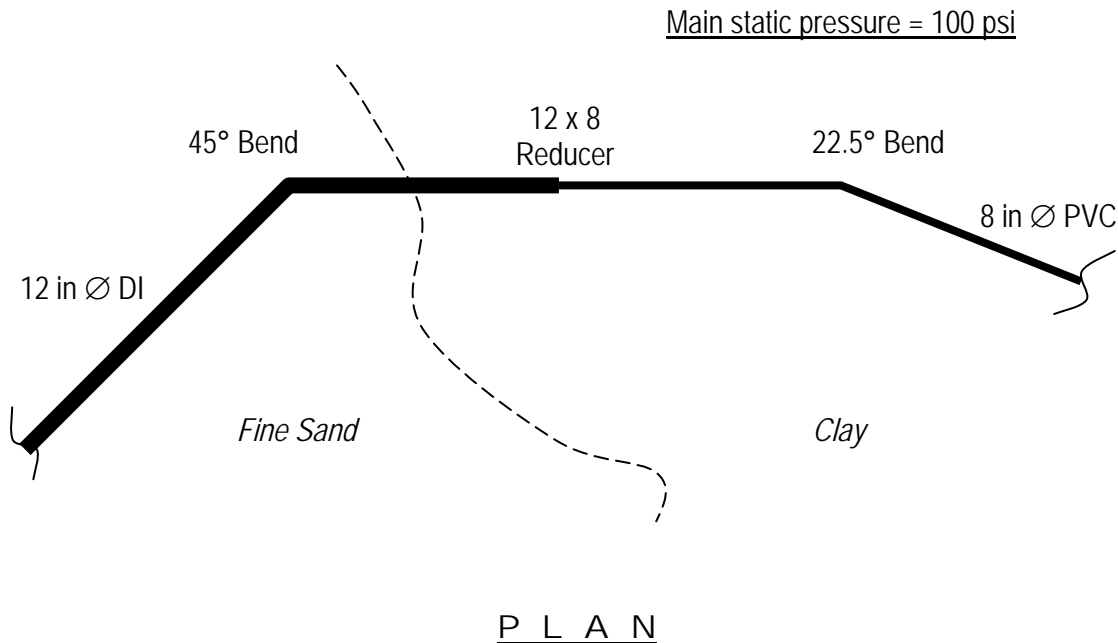
Open-book, Open-notes (5 pages, 3 questions); Time allowed: 90 minutes

1. Drawn below is a section of a water main extension under design. Soil type is also indicated, and soil bearing capacities are given in the table below. You are to design thrust blocks for all appropriate fittings on the main. For each block:

- Specify the surface area of the block face in contact with undisturbed soil (the bearing face), and specify the dimensions of this face (e.g., 2 ft horiz x 1 ft vertical).
- Sketch the block to show its orientation to the fitting, and indicate the angle of the bearing face relative to the fitting.

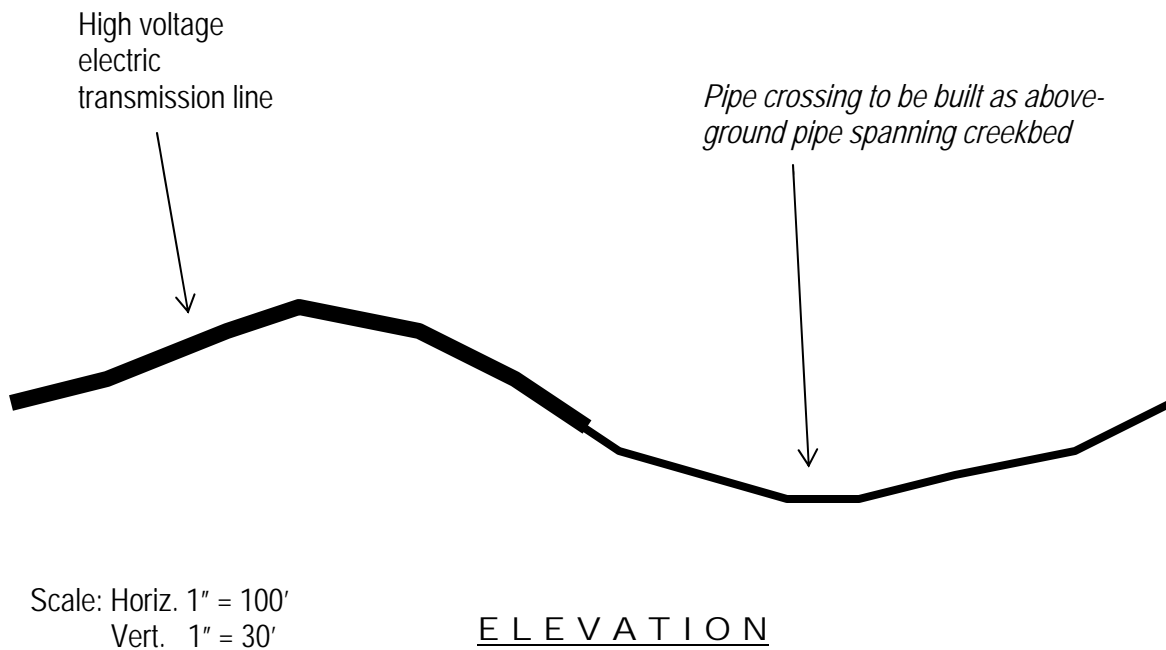
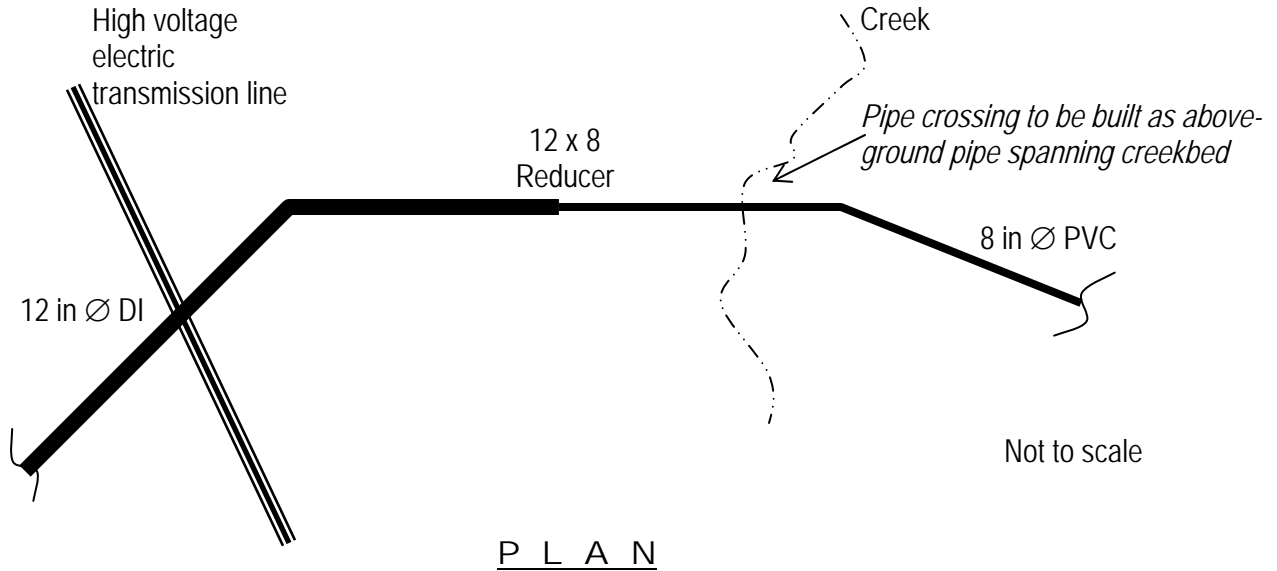
You may neglect momentum transfer forces (i.e., ρQV terms) and include only static pressure forces in your calculations. You should use a safety factor of 1.8 in your calculations.

(45 points)



Soil	Soil Normal Bearing Capacity (lb/ft²)	Soil Shear Strength (lb/ft²)
Fine Sand	1000	190
Clay	750	225

2. Drawn below is the same main as problem 1 but with an elevation view and additional information included. Comment on the current design with particular attention to: (1) choice of pipe materials, and (2) necessary or desirable hydraulic appliances. (20 points)



(Work space for #2)

3. Diagrammed below is a portion of a pipe network leading to an elevated storage tank. Pressure at Node 1 is fixed at the value given below. Using the Hazen-Williams equation in your calculations, determine the flows in pipes A and B.

(35 points)

$$Z_r = 700 \text{ ft}$$

$$Z_1 = 625 \text{ ft}$$

$$Z_2 = 635 \text{ ft}$$

$$p_1 = 95 \text{ psi}$$

Pipe A: 700 ft, cast iron, 36 in, $C = 110$

Pipe B: 400 ft, PVC, 12 in, $C = 150$

$$Dem_1 = 0 \text{ gpm}$$

$$Dem_2 = 50 \text{ gpm}$$

Hazen-Williams Eqn:

$$Q = 0.285 C D^{2.63} \left(\frac{H_f}{L} \right)^{0.54}, \text{ for } [Q] = \text{gpm}, [D] = \text{in}, [H_f, L] = \text{ft}$$

