

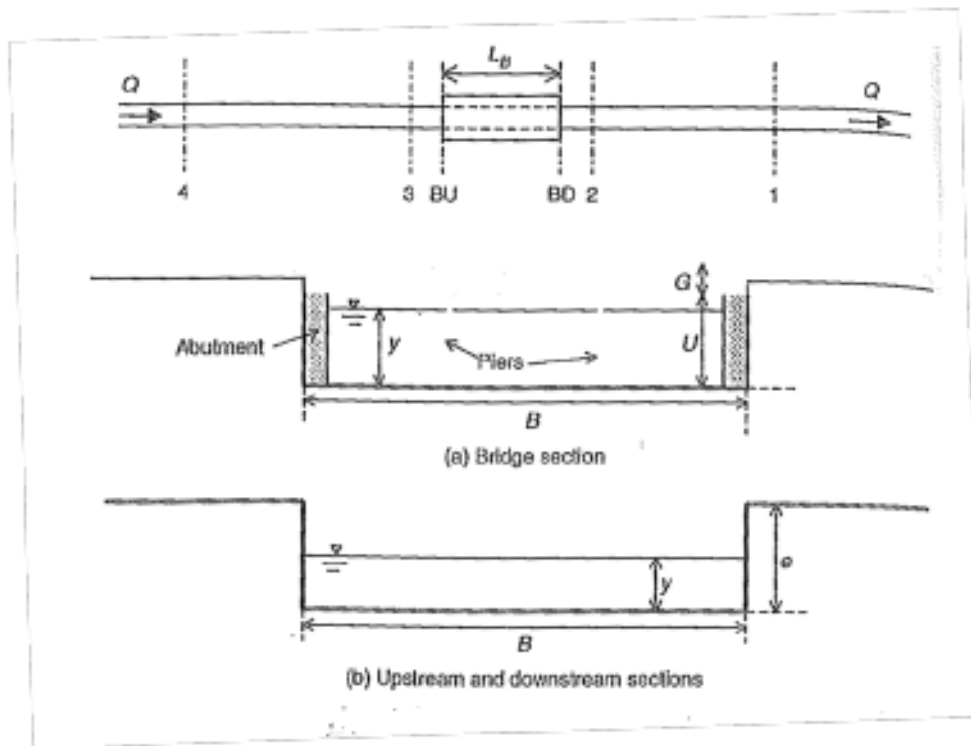


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To solve the problems in this assignment, consider a reach of river shown in the diagram below, carrying a discharge of 12,000 cfs. Results of the water surface profile calculations for select cross-sections are tabulated in the table below.



Description of the diagrams – The distance between sections 1 and 2 and that between 3 and 4 is 100 ft. There is a bridge placed between sections 2 and 3. The bridge is 38 ft long. The distance between sections 2 and BD and that between BU and 3 is 6 ft. The cross-section of the river at sections 1, 2, 3, and 4 is approximated by a rectangle shown in (b), with $B = 120$ ft and $e = 15$ ft. The channel is nearly horizontal between sections 4 and 1. The Manning roughness factor is 0.02. The channel geometry at the bridge sections BU and BD is shown in (a) with $U = 13$ ft and $G = 3$ ft. The abutments are each 3 ft wide, and the piers are each 3 ft wide. The piers extend the entire length of the bridge, and have semicircular ends. Assume that the Manning roughness factor at the bridge sections is also 0.02.

Section	S_f	W (ft)	V (fps)	y (ft)
4	0.000813	120	9.26	10.79
3	0.000841	120	9.36	10.68
BU	0.001819	108	11.00	10.10

Problem #1

Determine the contraction scour for the above situation, assuming that the median size of the bed material is 0.2 inches and the temperature is 68 F.

Problem #2

Suppose the piers are each 3 ft wide and have a round nose. The angle of attack is 0° . The median size of the bed material is 0.2 inches and $D_{50} = 0.3$ inches. Determine the pier scour depth using the CSU equation.

Problem #3

Assume the bridge has vertical wall abutments with an angle of attack of 90° . Assume the length of embankment on each side is equal to the width of the abutment, and determine the abutment scour by using the (a) HIRE and (b) Froehlich equations. Interpret your results and determine which of the two methods is appropriate for your site (c).



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