Name _____ 28 Points

1. Stream Channel Geometry

Learning Outcomes

By the end of this assignment you should be able to:

- Calculate the geometric characteristics of stream channels;
- Calculate stream flow velocity and discharge for a given channel geometry; and,
- Describe potential relationships between stream channel geometry, flow velocity and discharge.

Symbols

$\overline{d}$ = average channel depth (ft) w = channel width (ft) A = cross-sectional area (ft^2) Q = discharge (ft^3/s)
P_w = wetted perimeter (ft) r = hydraulic radius (ft) $\overline{v}$ = average cross-sectional flow velocity (ft/s)

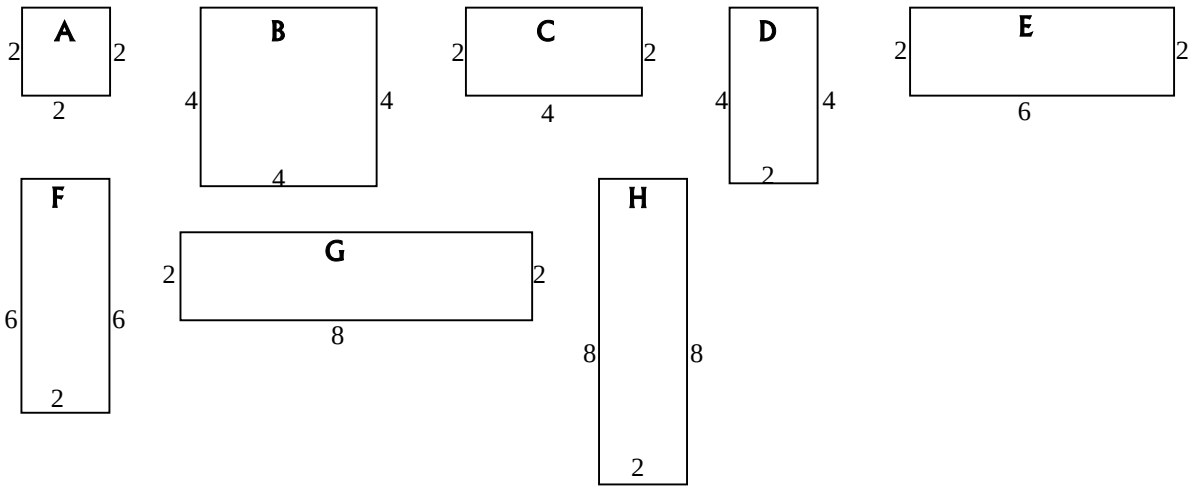
Equations

$A = w \times \overline{d}$ $P_w = w + 2\overline{d}$ $r = A/P_w$ $Q = w \times \overline{d} \times \overline{v} = A \times \overline{v}$

Questions

1. Calculate the following geometric values for channels A through H, diagrammed below. [6]

	A	B	C	D	E	F	G	H
$\overline{d}$	2	4	2	4	2	6	2	8
w	2	4	4	2	6	2	8	2
A								
P_w								
r								



2 a. Calculate the discharge (Q) for the following channels assuming average flow velocity, $\bar{v}$, is 2 ft/s. [4]

Channel A _____ Channel C _____

Channel B _____ Channel E _____

b. At a constant velocity, what impact does a change in cross-sectional area have on discharge? Why? [2]

3. a. Calculate the average flow velocity, $\bar{v}$, for the following channels assuming discharge, Q, is 30 ft^3/s. [4]

Channel A _____ Channel F _____

Channel D _____ Channel H _____

b. At a constant discharge, what impact does a change in channel cross-sectional area have on flow velocity? Why? [2]

4. If the depth of a channel decreases but discharge stays the same, what must change? Why? [2]

5. a. Channels A, C, E, and G all have the ***same depth*** but ***different widths***, while channels A, D, F, and H have the ***same width*** but ***different depths.*** Based on your calculations for Question 1, what causes the wetted perimeter to increase faster? [1]

   a. Increases in channel width.

   b. Increases in channel depth.

   b. Should wide shallow channels or narrow deep channels provide more resistance to flow based on wetted perimeter? Why? [2]

6. a. Again, channels A, C, E, and G all have the ***same depth*** but ***different widths,*** while channels A, D, F, and H have the ***same width*** but ***different depths.*** What causes the hydraulic radius to increase faster? [1]

   a. Increases in channel width.

   b. Increases in channel depth.

   b. Should wide shallow channels or narrow deep channels provide more resistance to flow based on hydraulic radius? Why? [2]

7. In general, for a given cross-sectional area, should flow velocity be faster in wide shallow channels or narrow deep channels? Why? [2]