a = Cross-sectional area of waterway
p = wetted perimeter
R = a/p = Hydraulic radius

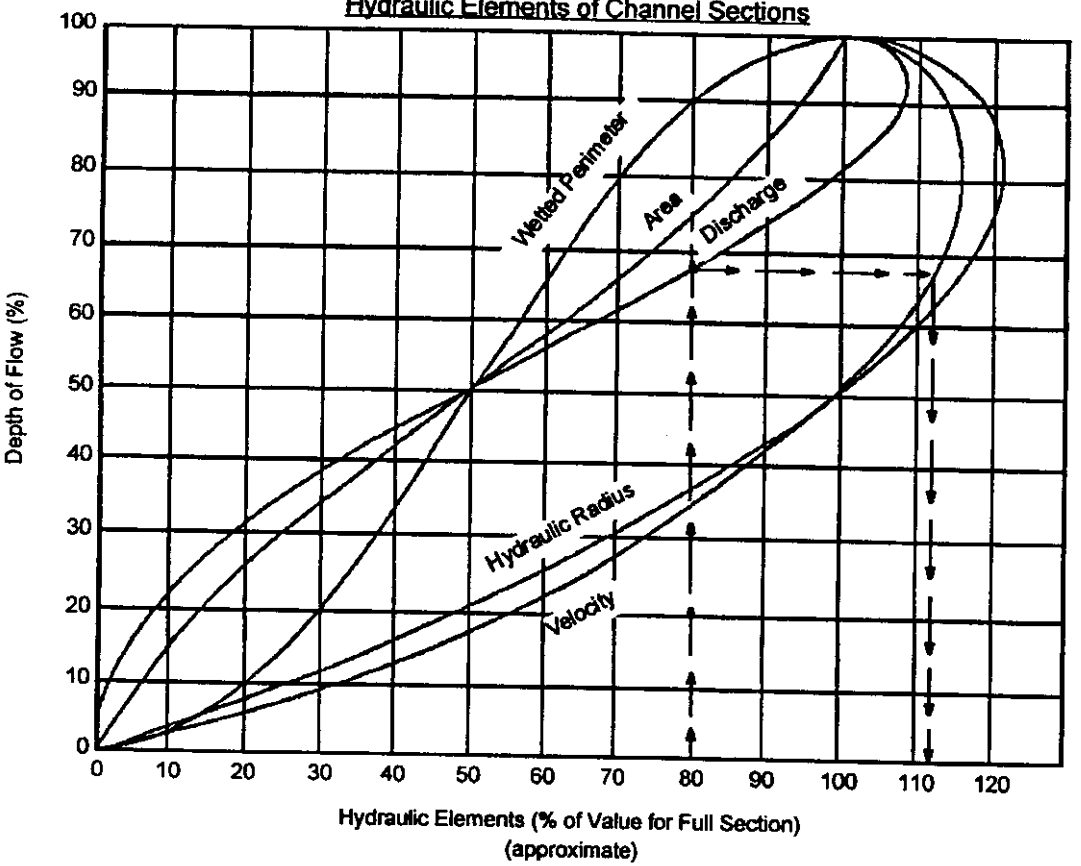
Section of Any Channel

For pipes full or half full
R = D/4

Section of Circular Pipe

V = Average or mean velocity in m/s
Q = a V = Discharge of pipe or channel in m³/s
n = Coefficient of roughness of pipe or channel surface
S = Slope of hydraulic gradient (water surface in open channels or pipes not under pressure, same as slope of channel or pipe invert only when flow is uniform in constant section)

Hydraulic Elements of Channel Sections



VALUES OF HYDRAULIC ELEMENTS OF CIRCULAR SECTION FOR VARIOUS DEPTHS OF FLOW

Figure 36-12D