$$h_1+\left(\frac{V_1^2}{2g}\right)=h_2+\left(\frac{V_2^2}{2g}\right)+h_L \qquad (5\text{-}7)$$

Where:
- h_1 = upstream water surface elevation, (ft)
- h_2 = downstream water surface elevation, (ft)
- V_1 = mean velocity upstream, (ft/s)
- V_2 = mean velocity downstream, (ft/s)
- h_L = head loss due to local cross sectional changes and friction loss, (ft)
- g = acceleration due to gravity, (32.2 ft/sec^2)

Figure 5-3 illustrates the terms in the Energy equation. The equation states that the total energy head at the upstream location of a channel is equal to the sum of the energy head at the next downstream location plus the energy head losses between the two consecutive sections. To apply the energy equation, streamlines must be approximately straight and parallel so that vertical acceleration can be neglected.

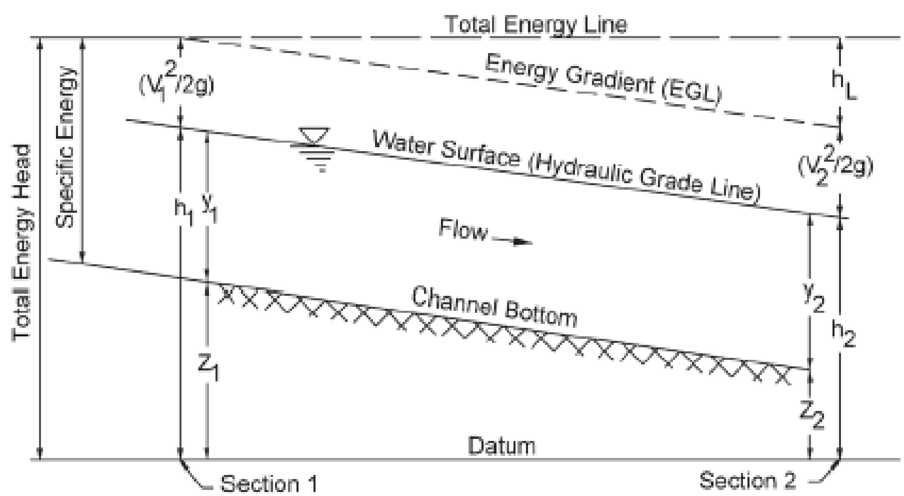

Figure 5-3
Total Energy in Open Channel Flow

5.03.3 MANNING'S CHANNEL ROUGHNESS COEFFICIENTS

Manning's equation is an empirical relationship in which the roughness coefficient, n, is used to quantitatively express the degree of retardation of flow. The selection of a Manning's channel roughness coefficient is usually based on consideration of many factors, including the depth of flow, the season, the height of any obstructions, and the types of vegetation. Further, the selection of a coefficient for a natural stream channel is more dependent on engineering