33.55 A $2000 ft^3$ above ground swimming pool springs a leak through a small hole in the side wall, $4ft$ below the surface of the water. Treating the hole as a sharp exit, what is the velocity of water leaking from the pool?

A. $8.0 \frac{ft}{s}$

B. $11.3 \frac{ft}{s}$

C. $13.1 \frac{ft}{s}$

D. $16.0 \frac{ft}{s}$

Write the Bernoulli Equation where State 1 is the top of the water level and State 2 is the location of the hole. By establishing the datum at State 2, $z_2 = 0ft$ and $z_1 = 4ft$. Since both states are exposed to the atmosphere, $P_1 = P_2$ and the static pressure terms cancel out. The velocity at State 1 is negligible, $v_1 = 0\frac{ft}{s}$. Simplify the equation.

$$\frac{P_1}{\gamma} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{v_2^2}{2g} + z_2 + h_f$$

$$z_1 = \frac{v_2^2}{2g} + h_f$$

The only source of losses is the hole itself, which is considered a Sharp Exit for which the K-value is 1. Substitute for h_f, then solve for v_2.

$$z_1 = \frac{v_2^2}{2g} + K\frac{v_2^2}{2g}$$

$$4ft = \frac{v_2^2}{2g} + (1)\frac{v_2^2}{2g} = \frac{2v_2^2}{2g} = \frac{v_2^2}{g}$$

$$v_2 = \sqrt{(4ft)\left(32.2\frac{ft}{s^2}\right)} = 11.3\frac{ft}{s}$$

Answer B