4.

a) the head loss between the pump and the "T" is given by the loss in pressure head only since there is no change in elevation or pipe size from the pump to the "T".

$$h_f = (50\ \text{psi} - 46\ \text{psi})(0.70\ \text{m H}_2\text{O/psi}) = \underline{\underline{2.8\ \text{m}}}$$

b) the total head loss from the center (mainline) to the ends of the lateral (300 m) is 46 psi - 30 psi = 16 psi × 0.70 = 11.2 m. This head loss is a result of the sprinklers and the 10cm pipe + fixtures

$$H_L = 11.2\ \text{m} = f\frac{L}{D}\frac{\bar{V}_p^2}{2g} + 4K_{sp}\frac{\bar{V}_{sp}^2}{2g}$$

$$\bar{V}_{sp} = \frac{\frac{1}{4}(1 + 1.05 + 1.12 + 1.26)/1000}{\Uparrow (0.005\ \text{m})^2} = 14.1\ \text{m/s} \Rightarrow \frac{\bar{V}_{sp}^2}{2g} = 10.14\ \text{m}$$

Pipe sections ($L = 200$ m, $D = 0.10$ m) $\quad \frac{\epsilon}{D} = \frac{0.004\ \text{cm}}{10\ \text{cm}} = 0.0004$

$V_1 = \frac{(10\ \text{l/s})/1000}{\Uparrow (0.05)^2} = 1.27\ \text{m/s}$	$\frac{V_1^2}{2g} = 0.083\ \text{m}$	$R = \frac{(1000)(V)(0.1)}{10^{-3}} = V \times 1.27 \times 10^5$	
$V_2 = \frac{9}{10}V_1 = 1.146\ \text{m/s}$	$\frac{V^2}{2g} = 0.067\ \text{m}$	$R = 1.15 \times 10^5$	
$V_3 = \frac{7.95}{9}V_2 = 1.012\ \text{m/s}$	$\frac{V^2}{2g} = 0.052\ \text{m}$	$R = 1.01 \times 10^5$	
$V_4 = \frac{6.83}{7.95}V_3 = 0.869\ \text{m/s}$	$\frac{V^2}{2g} = 0.0386\ \text{m}$	$R = 0.9 \times 10^5$	

$f = 0.020$ → assume $\bar{R} \simeq 10^5$, $\frac{\epsilon}{D} = 0.0004$

$$11.2 = 0.020\frac{200}{0.1}(0.083 + 0.067 + 0.052 + 0.039) + 4(10.14)K_{sp}$$

$$K_{sp} = \frac{1}{4(10.14)}(11.2 - 9.64) = 0.039 \simeq \underline{\underline{0.04}}$$