EXERCISE FOR WTR

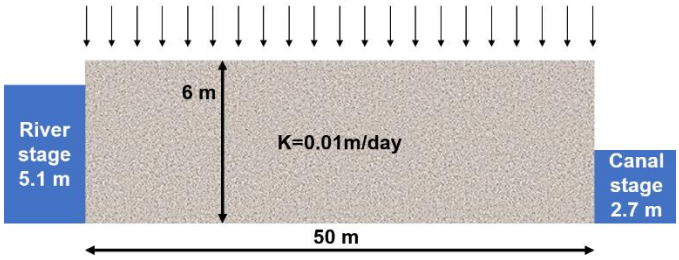
A canal parallels a river 50 m to its west. The bottom of the canal and river are at the top of a low hydraulic conductivity layer. The top of that layer is used as the elevation datum. The maximum ground surface elevation between them is 6 meters. Both the river and the canal fully penetrate to the base of an aquifer that has a hydraulic conductivity of 0.01 m/day. Precipitation is 500 mm/year, given the flat terrain there essentially no runoff, and evapotranspiration is 400 mm/year such that the net recharge is 100 mm/yr, which is 2.7397x10-4 m/d. The river is 5.1 m deep and the canal is 2.7 m deep. Given the top of the low K layer is used as the datum, the following parameters can be used for the calculations.

Recharge Rate =

Precipitation Rate – Runoff Rate – ET Rate =

$$\left(\frac{500\ \text{mm}}{\text{yr}} - \frac{0\ \text{mm}}{\text{yr}} - \frac{400\ \text{mm}}{\text{yr}}\right)\frac{1\text{m}}{1000\ \text{mm}}\ \frac{1\ \text{yr}}{365.25\ \text{days}} =$$

$$\frac{2.7397\text{x}10^{-4}\ \text{m}}{\text{day}}$$



The relevant equations are shown here for reference. These are the equations that WTR solves when you enter values on the input form.

$$h_x = \sqrt{h_{left}^2 - \frac{\left(h_{left}^2 - h_{right}^2\right)x}{\text{L}} + \frac{R}{\text{K}}(L-x)x}$$

$$q_x = \frac{K\left(h_{left}^2 - h_{right}^2\right)}{2\text{L}} - R\left(\frac{L}{2} - x\right)$$

$$d = \frac{L}{2} - \frac{K}{\text{R}}\frac{\left(h_{left}^2 - h_{right}^2\right)}{2\text{L}}$$

$$h_{max} = \sqrt{h_{left}^2 - \frac{\left(h_{left}^2 - h_{right}^2\right)d}{L} + \frac{R}{K}(L-d)d}$$

a) Calculate the x position of the divide, h_{max}, $h_{x=12.5}$, $h_{x=37.5}$, q at the river, and q at the canal. Sketch a diagram roughly illustrating the shape of the water table and indicating the discharges.
b) Repeat (a) except with K = 1 x 10^{-4} m/day
c) Repeat (a) except with K = 1 x 10^{0} m/day
d) Repeat (a, K = 0.01 m/day) except with ET = 550 mm/year
e) Repeat (a, K = 0.01 m/day) except with ET = 500 mm/year