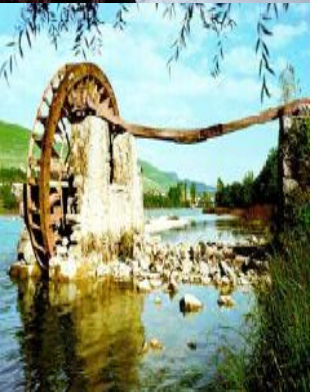




**Fakultet građevinarstva, arhitekture i
geodezije Sveučilište u Splitu**

VJEŽBE 2

**-PRIMJENA DARCY-evog
ZAKONA**



4. ZADATAK:

Postoje dva akvifera pod tlakom A i B debljine po 10 m svaki, međusobno odijeljeni slabo propusnim proslojkom gline C debljine 20 m. Nivo piezometarske linije je 10 m manji u gornjem akviferu.

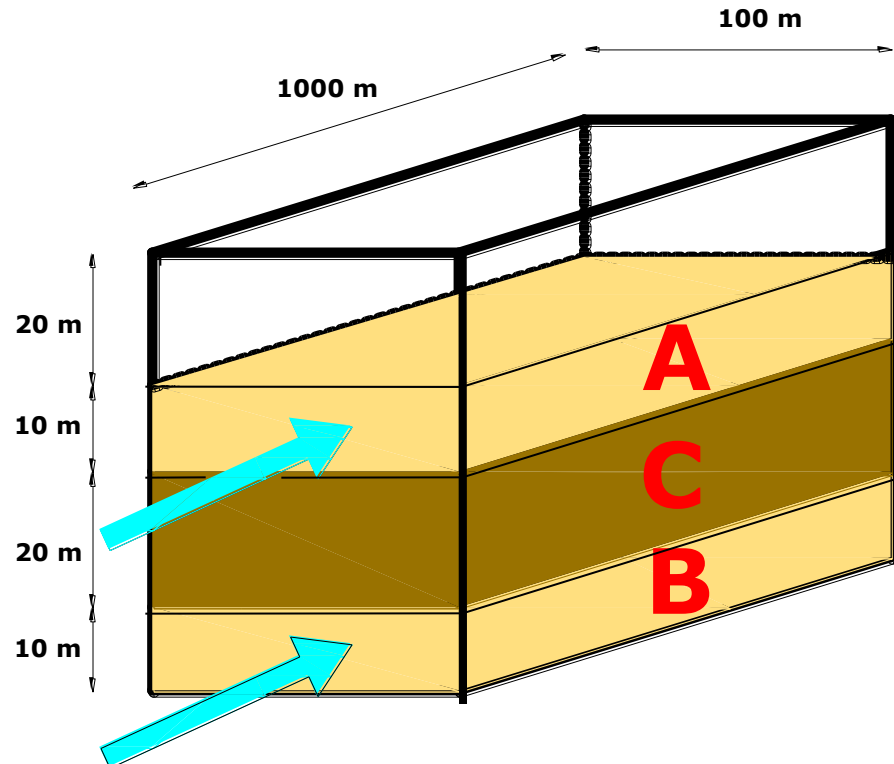
$$K_A = K_B = 10^{-6} \text{ (m/s)}$$

$$K_C = 10^{-9} \text{ (m/s)}$$

$$\Delta H = 10 \text{ (m)}$$

$$I_{ULAZ}^{A,B} = 0.1$$

- A) Nađi ulazni protok u oba akvifera?
- B) Nađi izlazni protok iz oba akvifera?
- C) Nađi gradijent u oba akvifera na izlaznom presjeku?



A)

$$Q_{ULAZ}^{A,B} = -K \cdot I \cdot A = 10^{-6} \cdot 10^{-1} \cdot 100 \cdot 10 = 10^{-4} (m^3 / s) = 8.64 (m^3 / dan)$$

B)

$$Q_{A,B} = 10^{-9} (m / s) \cdot \frac{10m}{20m} \cdot 1000m \cdot 100m = 0.5 \cdot 10^{-4} (m^3 / s) = 4.32 (m^3 / dan)$$

$$Q_{IZLAZ}^A = Q_{ULAZ}^A + Q_{A,B} = 12.97 (m^3 / dan)$$

$$Q_{IZLAZ}^B = Q_{ULAZ}^B - Q_{A,B} = 4.32 (m^3 / dan)$$

c)

$$Q = -K \cdot I \cdot A \Rightarrow I = \frac{-Q}{K \cdot A}$$

$$I_A = \frac{1.5 \cdot 10^{-4}}{10^{-6} \cdot 10^2 \cdot 10} = 0.15$$

$$I_B = \frac{0.5 \cdot 10^{-4}}{10^{-6} \cdot 10^2 \cdot 10} = 0.05$$

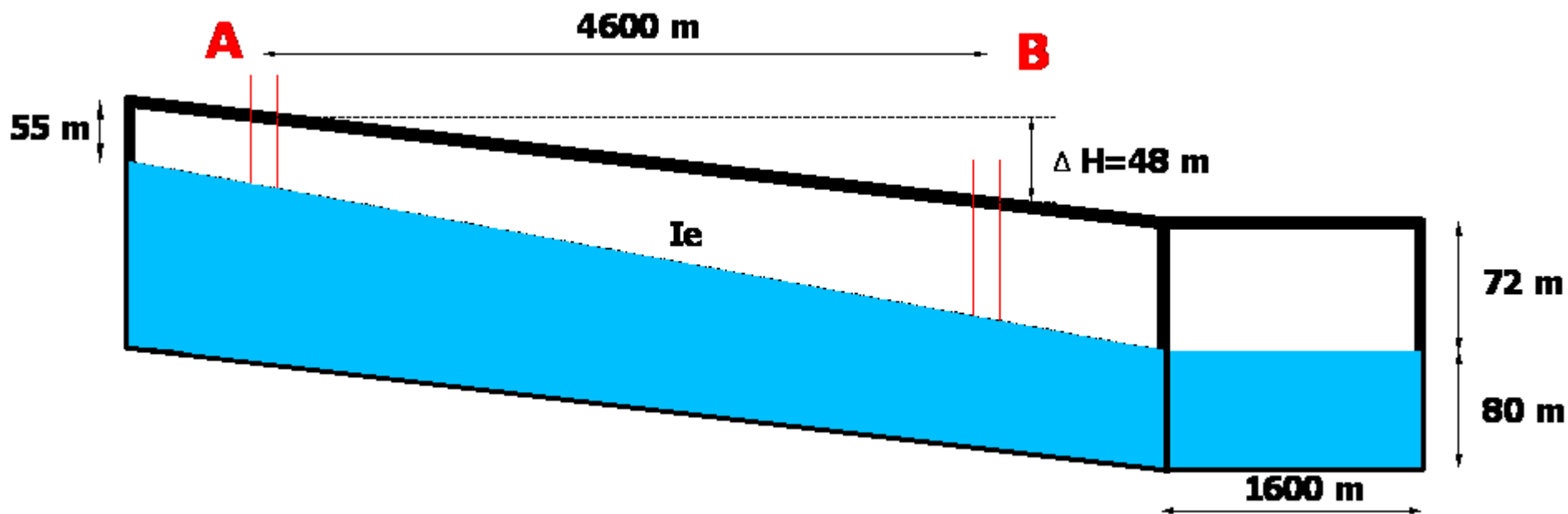
5. ZADATAK:

Za zadane parametre potrebno je izračunati vrijeme za koje voda u vodonosniku prijeđe put od A do B, protok kroz vodonosnik u najnižvodnijem poprečnom presjeku i volumen povezanih pora iznad vodnog lica!

$$W = 1.60 \text{ (km)}$$

$$n_e = 0.290$$

$$K = 83.0 \text{ m/dan} = 9.6 \cdot 10^{-4} \text{ (m/s)}$$



$$I_e = i = \frac{65m}{4600m} = \frac{\Delta H}{\Delta L} = 0.0141$$

$$v_{DARCY} = K \cdot I_e = 83(m/dan) \cdot 0.0141 = 1.173(m/dan)$$

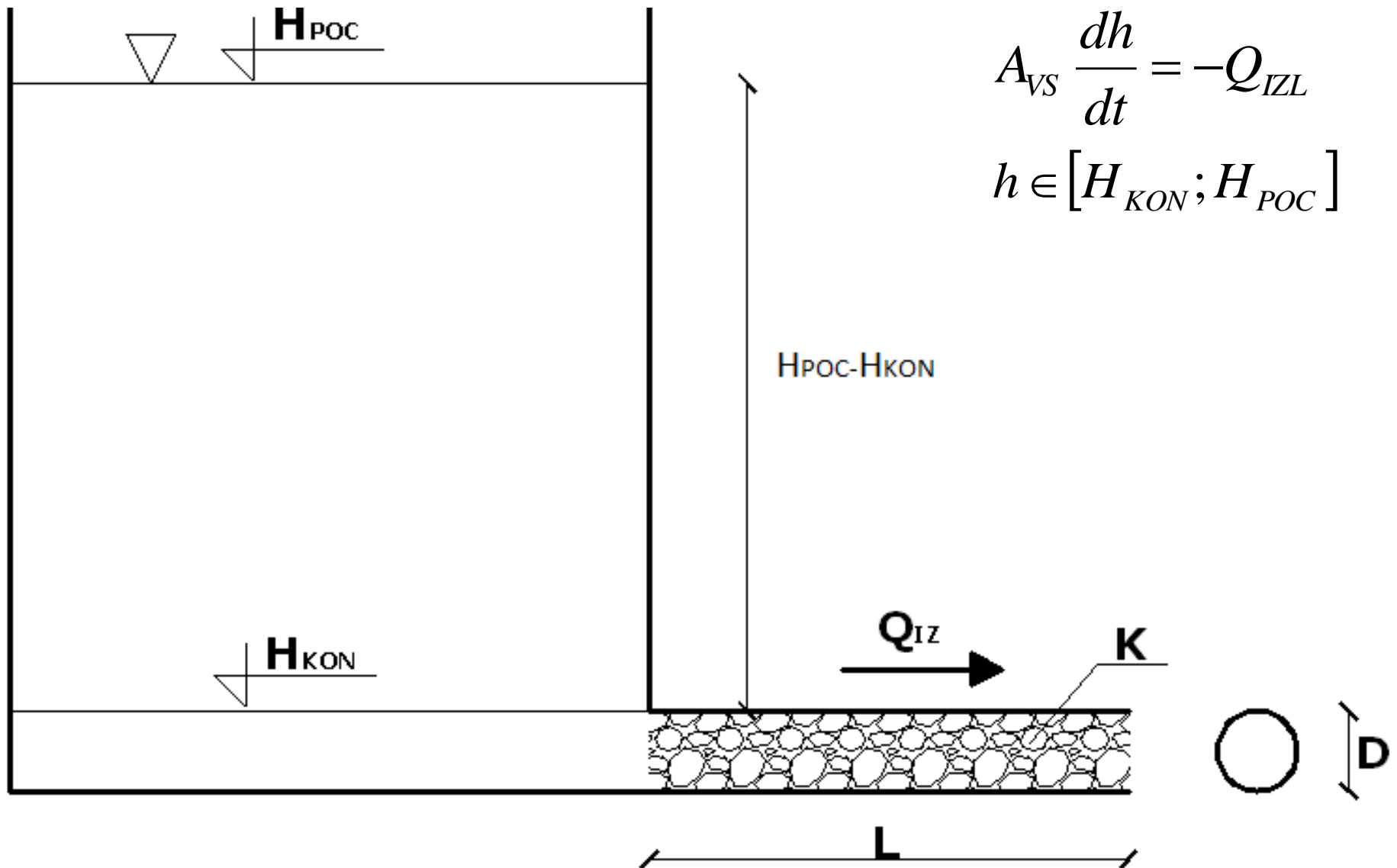
$$v = \frac{v_{DARCY}}{n_e} = \frac{1.173(m/dan)}{0.29} = 4.044(m/dan)$$

$$v = \frac{L}{t_{AB}} \Rightarrow t_{AB} = \frac{L}{v} = \frac{4600m}{4.044(m/dan)} = 1137.487dana = 3.11godina$$

$$Q = v \cdot A = v \cdot w \cdot h = 1.173(m/dan) \cdot 1600(m) \cdot 80(m) = 150144(m^3/dan)$$

$$V = n_e \cdot \frac{55 + 72}{2} \cdot 4600(m) \cdot 1600(m) = 1.3553 \cdot 10^8 (m^3)$$

PRIMJENA DARCY-evog ZAKONA



$$Q_{IZL} = v \cdot A_{CJ} = - \left(-K \cdot \frac{\Delta h}{\Delta L} \right) \cdot \frac{D^2 \pi}{4}$$

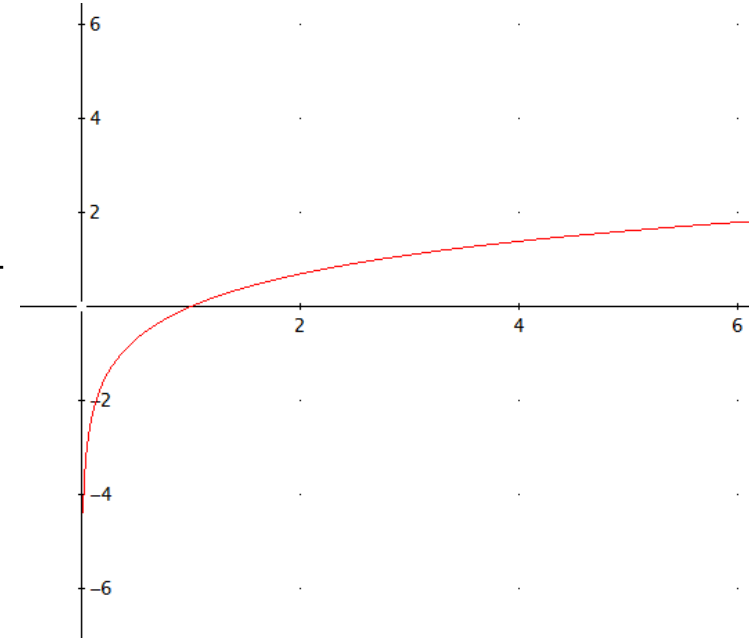
$$A_{VS} \frac{dh}{dt} = K \frac{h}{L} \frac{D^2 \pi}{4} = K \frac{h}{L} A_{CJ}$$

$$\frac{dh}{dt} = K \frac{h}{L} \frac{A_{CJ}}{A_{VS}}$$

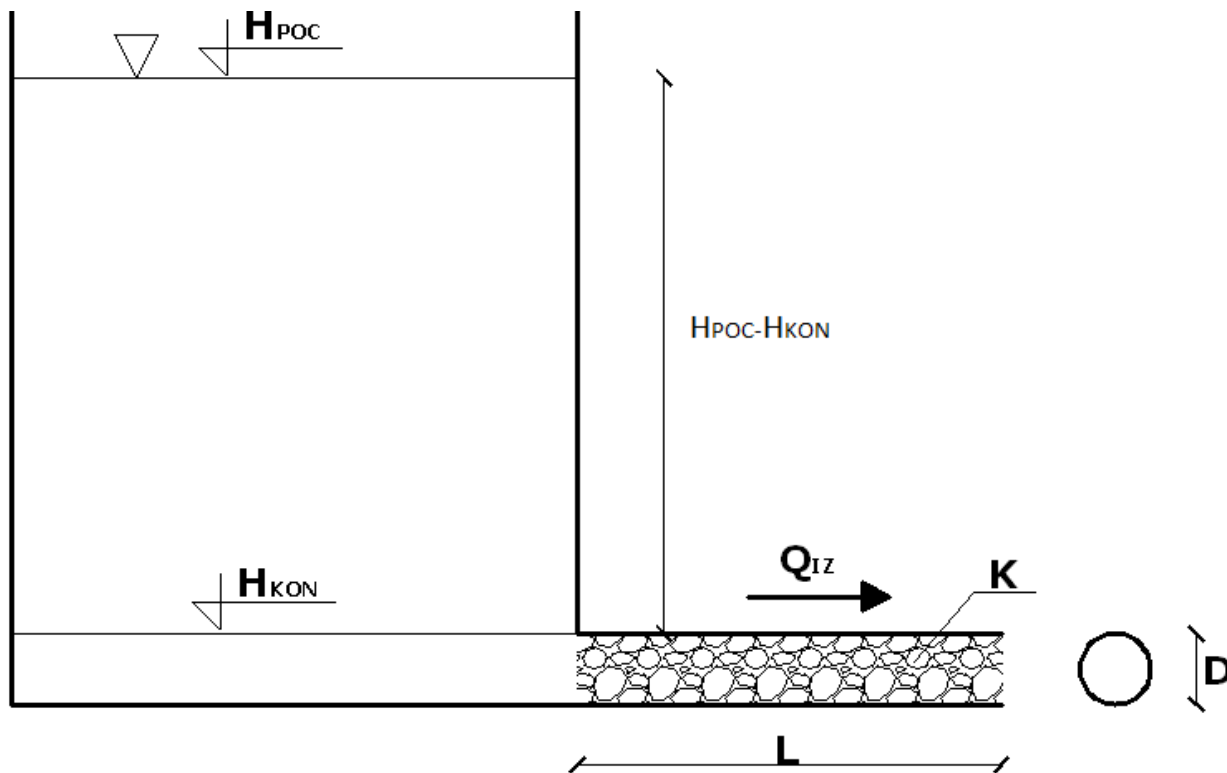
$$dt = \frac{L}{K} \frac{A_{VS}}{A_{CJ}} \frac{dh}{h}$$

$$\int_0^T dt = - \frac{L}{K} \frac{A_{VS}}{A_{CJ}} \int_{H_{KON}}^{H_{POC}} \frac{dh}{h} = \frac{L}{K} \frac{A_{VS}}{A_{CJ}} \int_{H_{KON}}^{H_{POC}} \frac{dh}{h}$$

$$T = \frac{L}{K} \frac{A_{VS}}{A_{CJ}} \left[LN(H_{POC}) - LN(H_{KON}) \right]$$



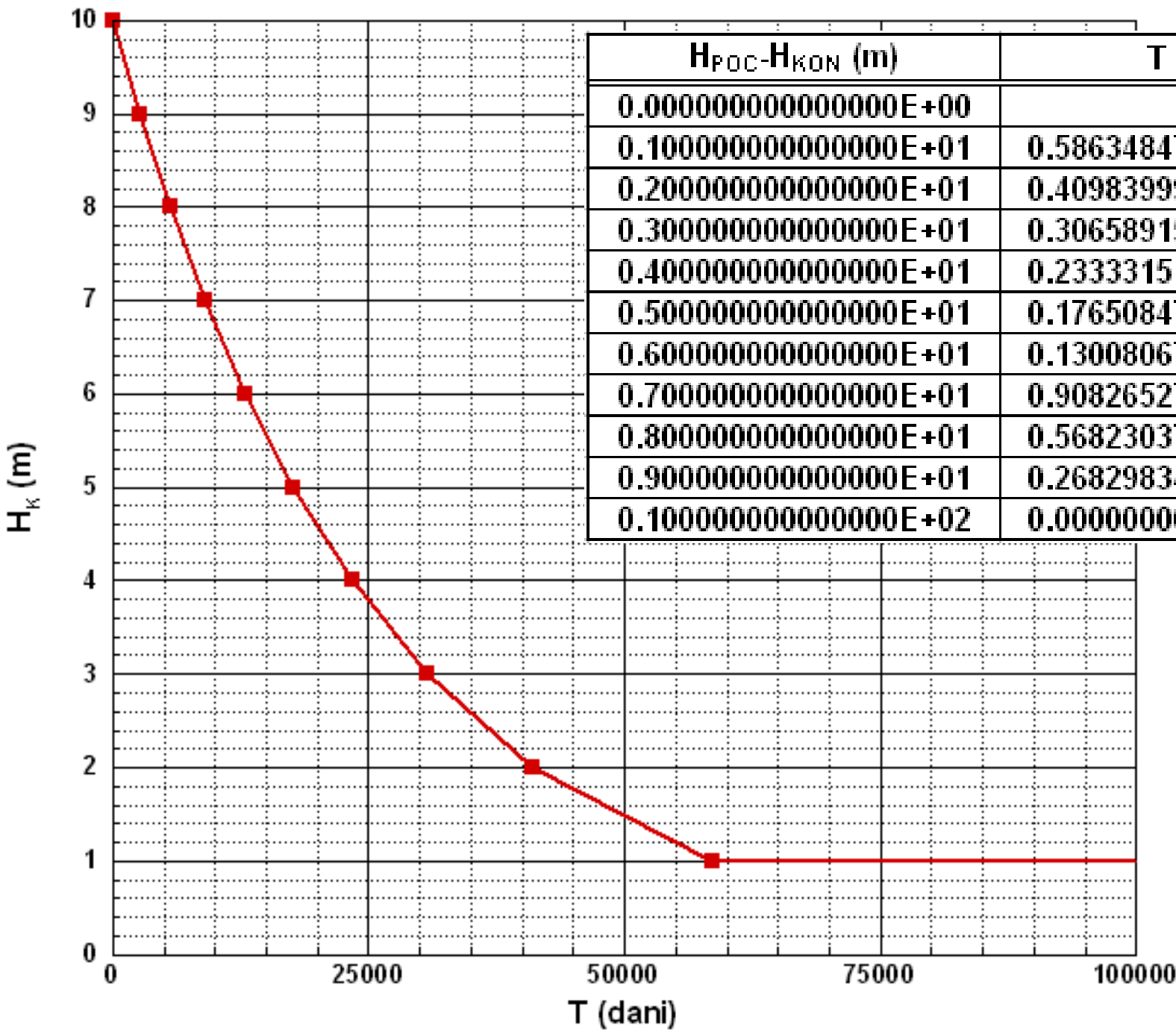
6. ZADATAK: Izračunati vrijeme pražnjenja vodospremišta na slici?



H_{POC} (m)	10,00
H_{KON} (m)	0,00
K (m/dan)	0,0050
L (m)	10,00
A_{VS} (m ²)	10,00
D (m)	1,00

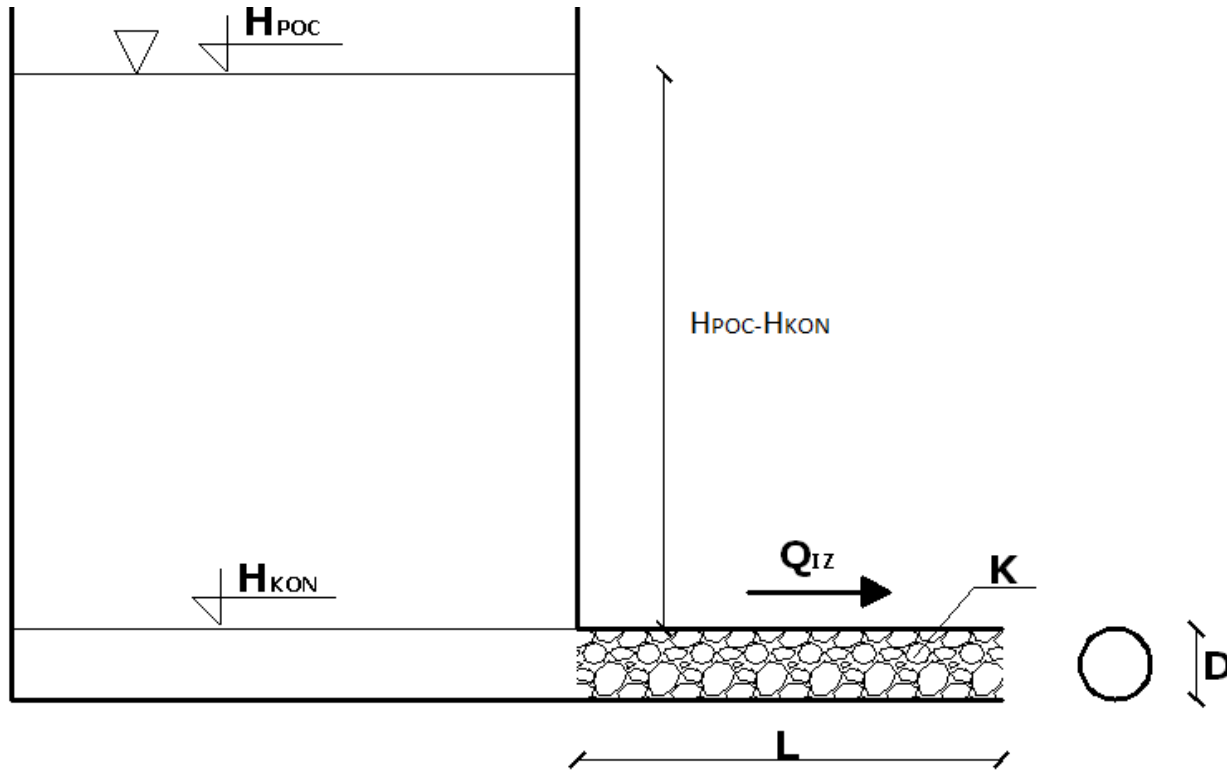
$$T = \frac{L}{K} \frac{A_{VS}}{A_{CJ}} [LN(H_{POC}) - LN(H_{KON})]$$

$$T_{PRAZNJENJA} = \frac{10m}{0.005m / dan} \frac{10m^2}{0.785398m^2} [LN(10) - LN(0)] = \infty$$



$H_{POC}-H_{KON}$ (m)	T (dani)
0.0000000000000000E+00	∞
0.1000000000000000E+01	0.586348470441517E+05
0.2000000000000000E+01	0.409839992926925E+05
0.3000000000000000E+01	0.306589152521506E+05
0.4000000000000000E+01	0.233331515412334E+05
0.5000000000000000E+01	0.176508477514592E+05
0.6000000000000000E+01	0.130080675006914E+05
0.7000000000000000E+01	0.908265273060337E+04
0.8000000000000000E+01	0.568230378977415E+04
0.9000000000000000E+01	0.268298346014940E+04
0.1000000000000000E+02	0.0000000000000000E+00

7. ZADATAK: Izračunati i grafički prikazati odnos promjena razine vode u vodospremištu za vremensko razdoblje od 300 dana za dva različita materijala u cijevi.



H_{POC} (m)	10,00
H_{KON} (m)	?
K_2 (m/dan)	0,0864
K_1 (m/dan)	0,8640
L (m)	10,00
A_{VS} (m ²)	10,00
D (m)	1,00

$$T = \frac{L}{K} \frac{A_{VS}}{A_{CJ}} \left[LN(H_{POC}) - LN(H_{KON}) \right]$$

$$LN(H_{KON}) = LN(H_{POC}) - \frac{TK}{L} \frac{A_{CJ}}{A_{VS}}$$

$$LN(H_{KON}) = LN(10) - \frac{300 \text{ dana} \cdot 0.0864 \text{ m / dana} \cdot 0.785398 \text{ m}^2}{10 \text{ m} \cdot 10 \text{ m}^2}$$

$$LN(H_{KON}) = X \Rightarrow H_{KON} = e^X$$

$$H_{KON}^2 = 8.158 \text{ m}$$

$$H_{KON}^1 = 1.306 \text{ m}$$

H _{KON} (m)	T ₁ (dani)	T ₂ (dani)
0.0000000000000000E+00	∞	∞
0.1000000000000000E+01	0.339322031505508E+03	0.339322031505508E+04
0.2000000000000000E+01	0.237175921832711E+03	0.237175921832711E+04
0.3000000000000000E+01	0.177424278079575E+03	0.177424278079575E+04
0.4000000000000000E+01	0.135029812159915E+03	0.135029812159915E+04
0.5000000000000000E+01	0.102146109672796E+03	0.102146109672796E+04
0.6000000000000000E+01	0.752781684067788E+02	0.752781684067788E+03
0.7000000000000000E+01	0.525616477465473E+02	0.525616477465473E+03
0.8000000000000000E+01	0.328837024871189E+02	0.328837024871189E+03
0.9000000000000000E+01	0.155265246536424E+02	0.155265246536424E+03
0.1000000000000000E+02	0.0000000000000000E+00	0.0000000000000000E+00

