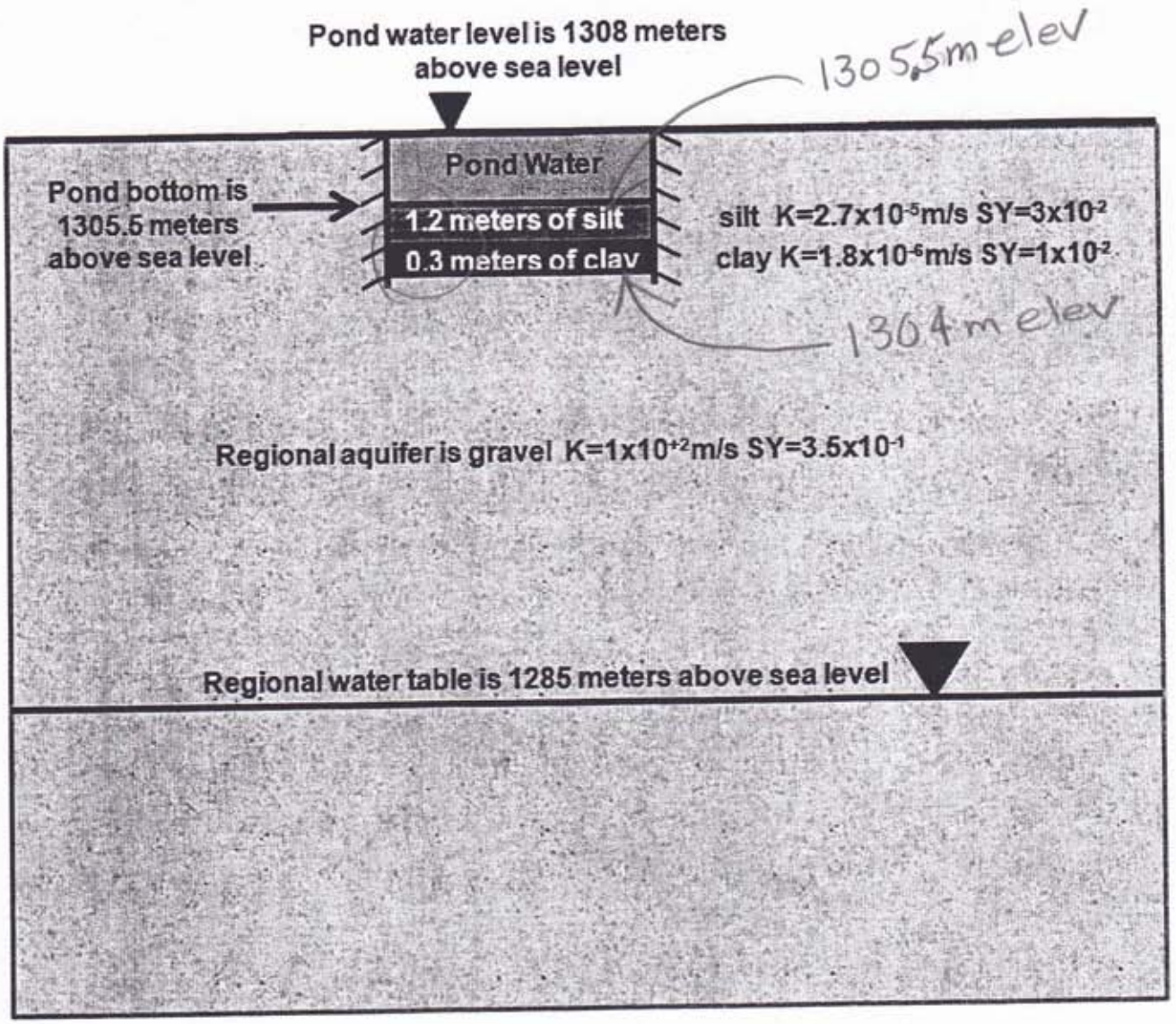
PROBLEM #3 – 25 points **USE UNITS of METERS SECONDS and GRAMS**

A 40 meter long by 36 meter wide man-made pond has impermeable steel walls to the bottom of the silt and clay lining as illustrated in the cross-sectional view below.

The system is at a steady state.

The regional water table is 23 meters below the pond surface.

ANSWER THE QUESTIONS ON THE FOLLOWING PAGE, SHOW YOUR WORK



PROVIDE CALCULATIONS AND ANSWERS TO PROBLEM 3 HERE

USE UNITS of METERS SECONDS and GRAMS

3a) What is the volumetric discharge from the base of the pond?

$$Q = K_{eq} i A = 7.1\times10^{-6}\frac{m}{s}\ 2.67\ (1440 m^2) = 2.7\times10^{-2}\frac{m^3}{sec}$$

$$K_{eq} = \frac{1.5m}{\frac{1.2m}{2.7\times10^{-5}\frac{m}{s}} + \frac{0.3m}{1.8\times10^{-6}\frac{m}{s}}} = 7.1\times10^{-6}\frac{m}{s} \qquad i = \frac{1308-1304}{1.5} = 2.67$$

$$A = 40m\times36m = 1440m^2$$

3b) What percentage of the pond volume is seeping through the bottom each day?

$$100\times\frac{2.7\times10^{-2}\frac{m^3}{sec}\ 86400\frac{sec}{day}}{2.5m\times40m\times36m} = 4.8\%$$

3c) Using sea level as your datum, what is the head at the contact between the silt and clay?

$$V = K_{eq}\, i = 7.1\times10^{-6}\frac{m}{s}\ 2.67 = 1.89\times10^{-5}\frac{m}{s}$$

$$\Delta h = \frac{V\ell}{K} = \frac{1.89\times10^{-5}\frac{m}{s}\ 1.2m}{2.7\times10^{-5}\ m/s} = 0.842m$$

$$1308_m - 0.842_m = 1307.16m$$

3d) What is the pressure at the same location that you calculated head for in 5 above?

$$h_p = h_T - h_e = 1307.16m - (1305.5 - 1.2) = 2.86m$$

3e) If we pumped the pond out and then allowed the silt and clay to drain completely, how much water would drain from the silt and clay?

$$(1.2m * 0.03 + 0.3m * 0.01)\ 36m\ 40m = 56m^3$$