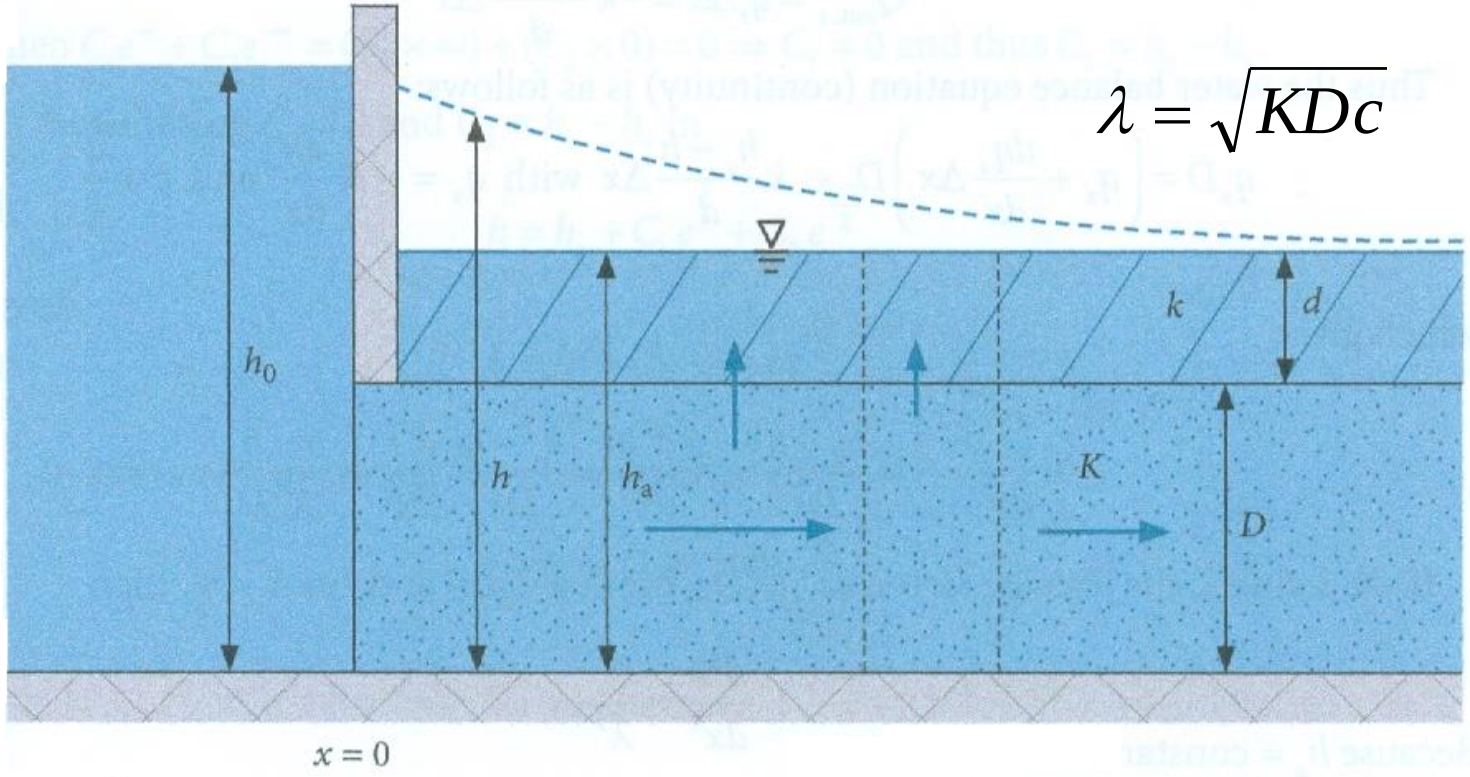
Leaky aquifer

https://www.youtube.com/user/MartinRHendriks/videos



$$\lambda = \sqrt{KDc}$$

$$h = h_a + C_1 e^{\frac{x}{\lambda}} + C_2 e^{\frac{-x}{\lambda}}$$

Leaky aquifer

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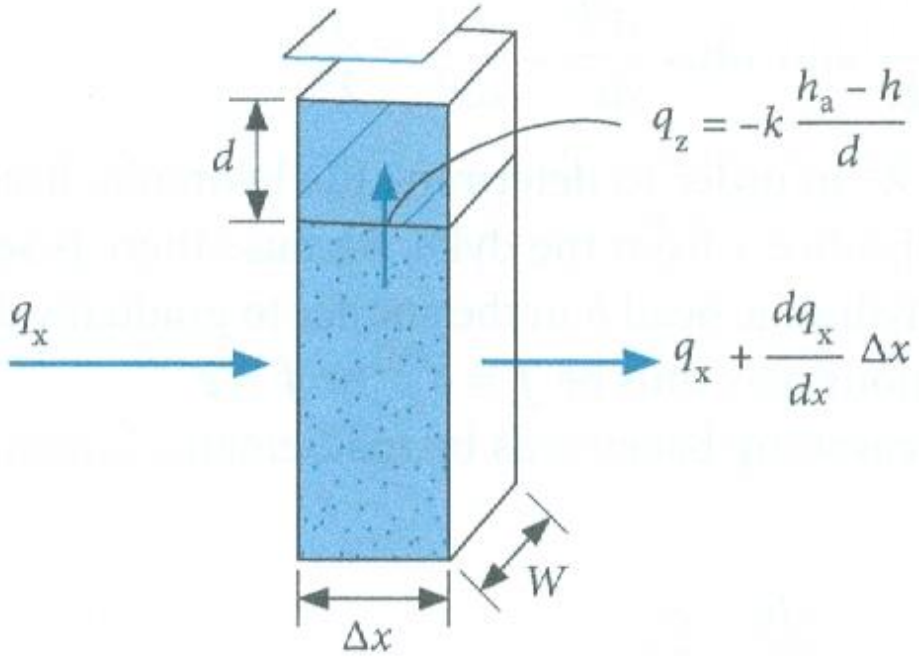
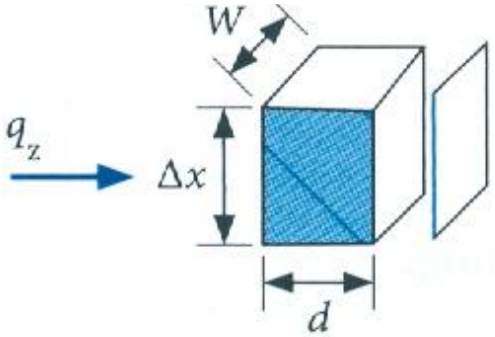


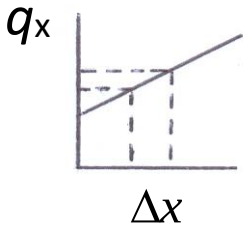


$$q_z = -k\frac{h_a - h}{d}$$

$$Q'_{in,\,x} = Q'_{out,\,x} + Q'_{out,\,z}$$

$$Q'_{in,\,x} = q_x D$$

$$Q'_{out,\,x} = \left(q_x + \frac{dq_x}{dx}\Delta x\right) D$$



$$Q'_{out,\,z} = q_z \Delta x = -k\frac{h_a - h}{d}\Delta x$$

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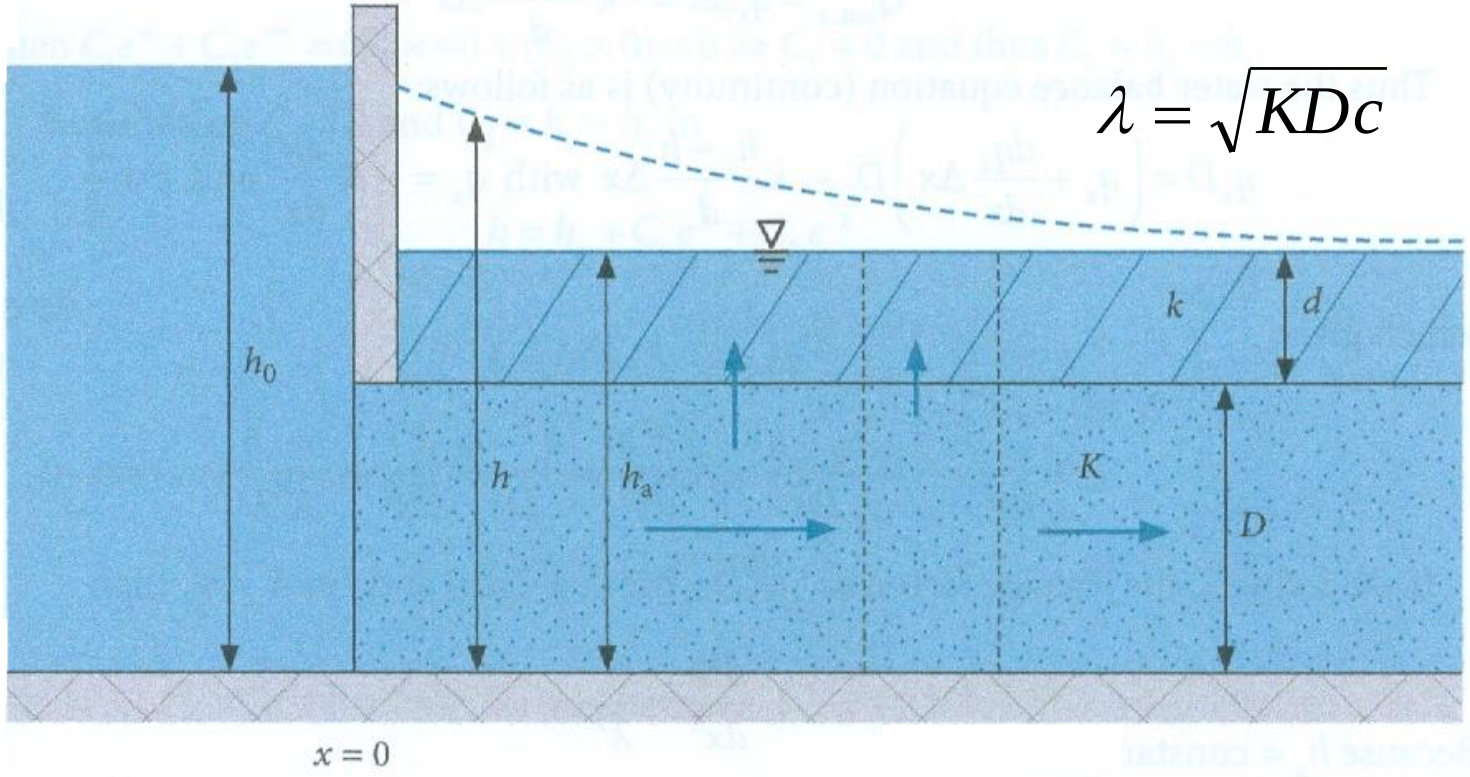

$$\lambda = \sqrt{KDc}$$

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Finite polder

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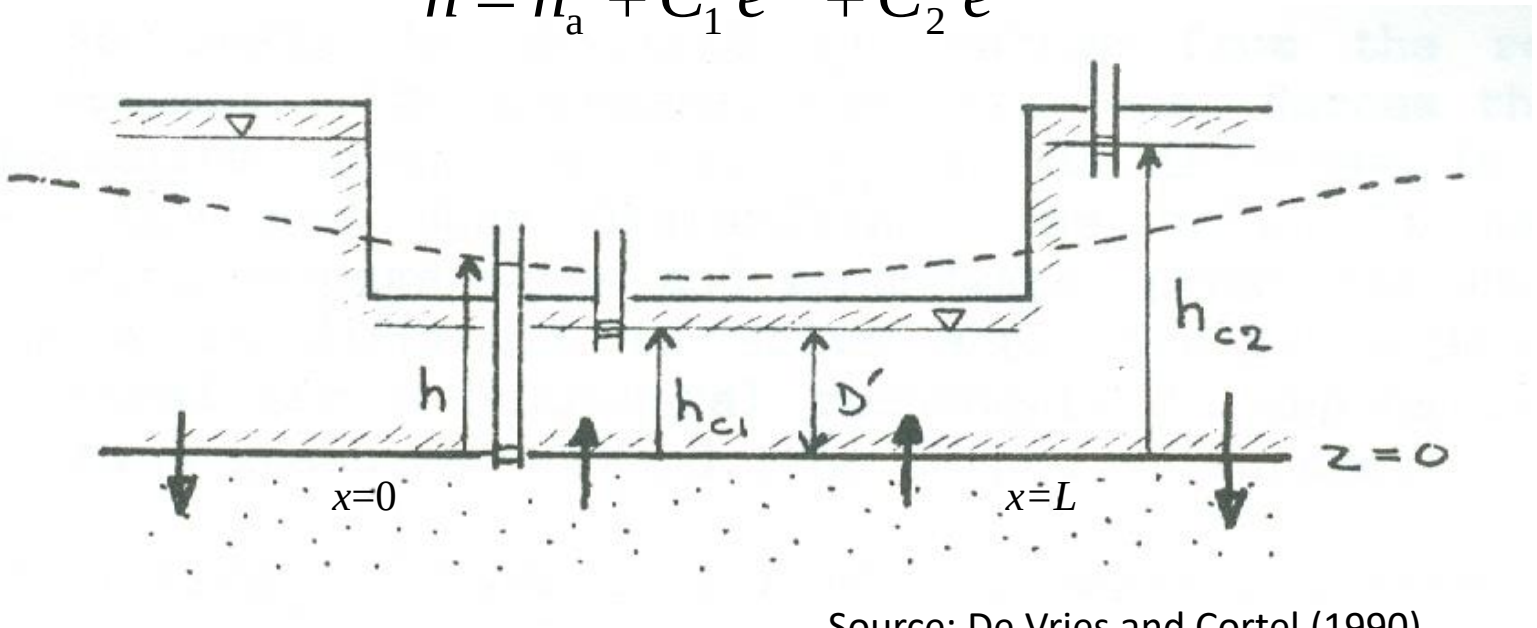
$$h = h_a + C_1 e^{\frac{x}{\lambda}} + C_2 e^{\frac{-x}{\lambda}}$$



Source: De Vries and Cortel (1990)

$x = 0$, then $h = h_0$: $h_0 = h_a + C_1 e^0 + C_2 e^0 = h_a + C_1 + C_2$; thus $C_1 + C_2 = h_0 - h_a$

$x = L$, then $h = h_L$: $h_L = h_a + C_1 e^{L/\lambda} + C_2 e^{-L/\lambda}$; thus $C_1 e^{L/\lambda} + C_2 e^{-L/\lambda} = h_L - h_a$

Infinite polder

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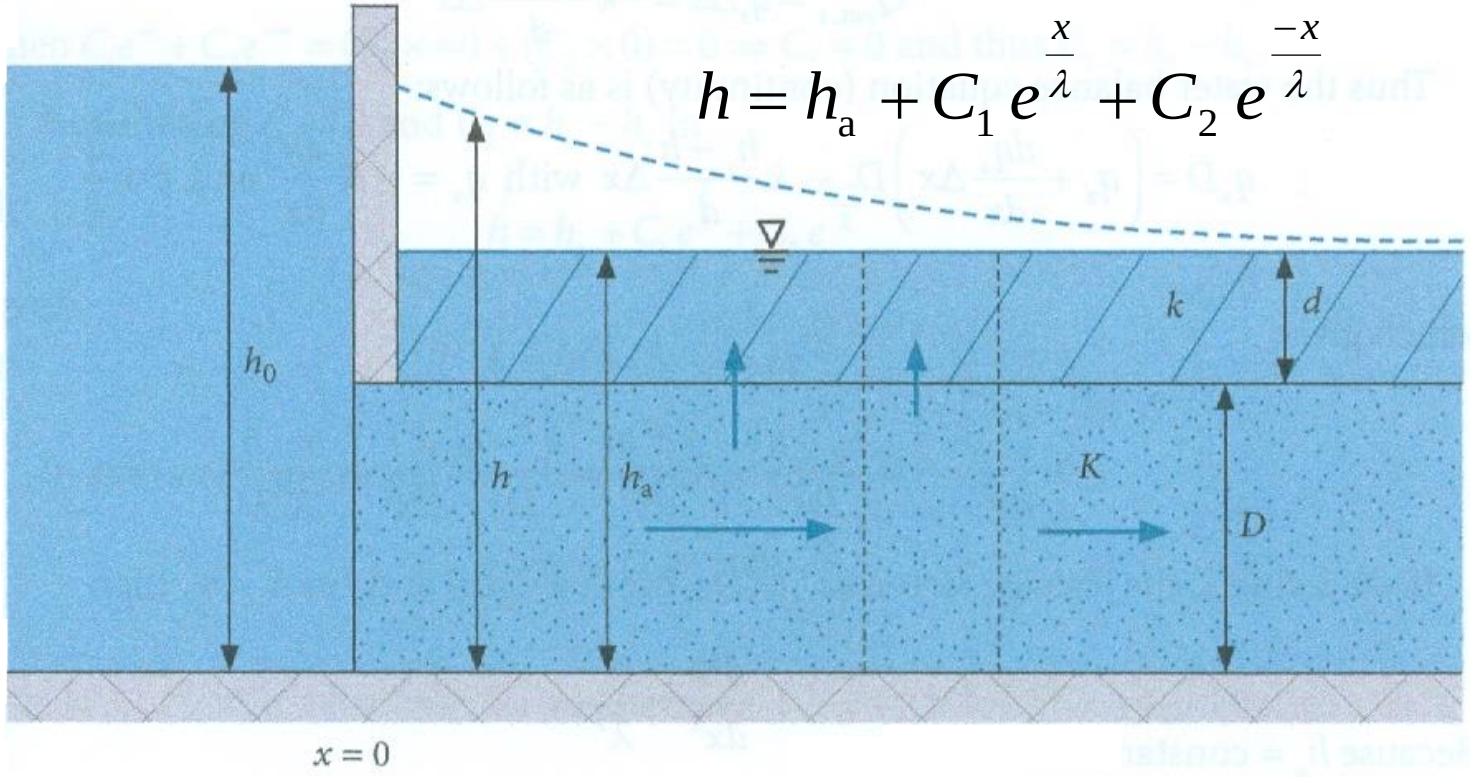

$x = 0$, then $h = h_0 : h_0 = h_a + C_1 e^0 + C_2 e^0 = h_a + C_1 + C_2$; thus $C_1 + C_2 = h_0 - h_a$

$x = \infty$, then $h = h_a : h_a = h_a + C_1 e^{\infty} + C_2 e^{-\infty}$; thus $C_1 e^{\infty} + C_2 e^{-\infty} = h_a - h_a = 0$

$C_1 e^{\infty} + C_2 e^{-\infty} = (C_1 \times \infty) + (C_2 \times 0) = 0 \Rightarrow C_1 = 0$ and thus $C_2 = h_0 - h_a$

Infinite polder

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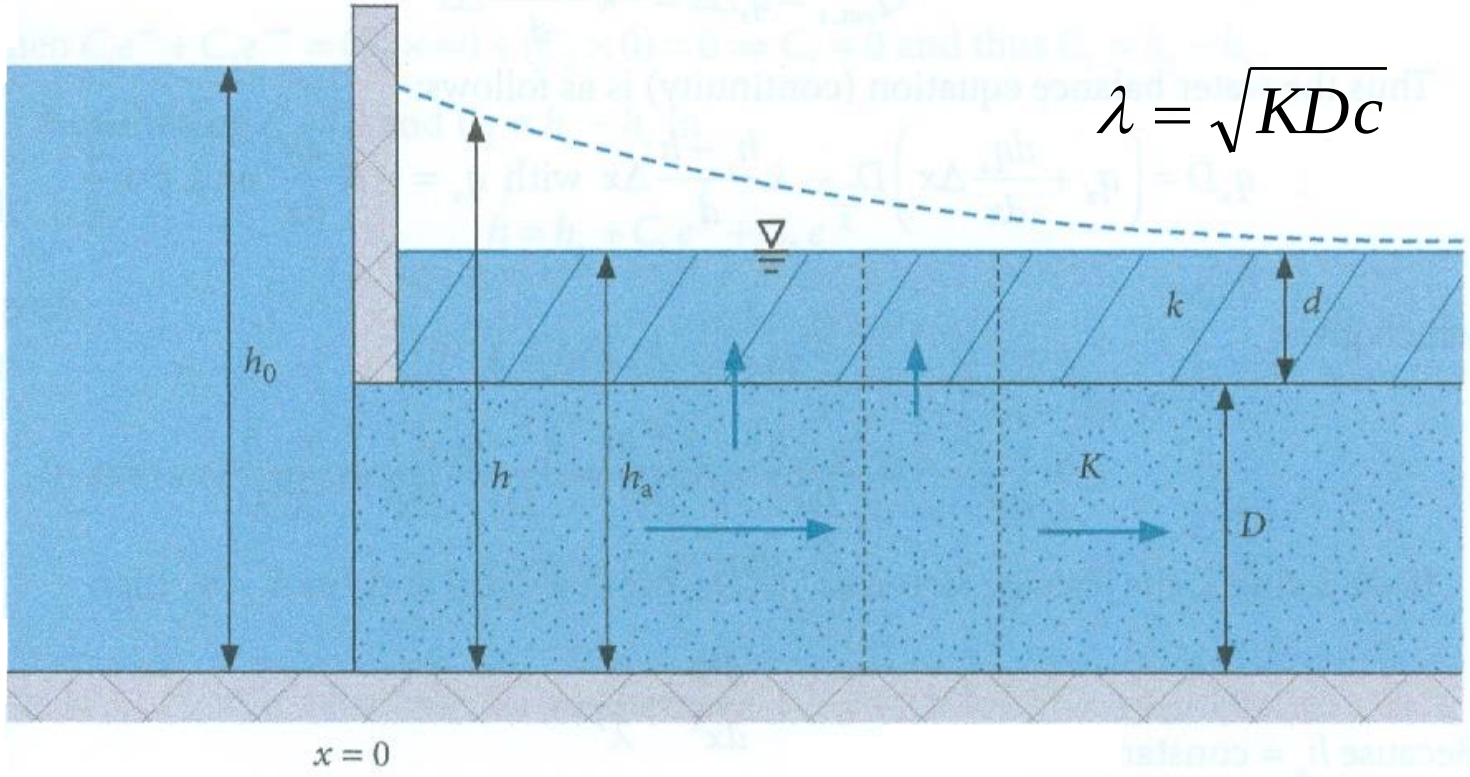

$$h = h_a + C_1 e^{\frac{x}{\lambda}} + C_2 e^{\frac{-x}{\lambda}}$$

$$x = 0 \rightarrow \infty, \text{ then } h = h_a + (h_0 - h_a) e^{\frac{-x}{\lambda}}$$

References

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De Vries, J.J. and Cortel, E.A. (1990). Introduction to Hydrogeology. Lecture notes. Institute of Earth Sciences, VU University Amsterdam, The Netherlands.

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