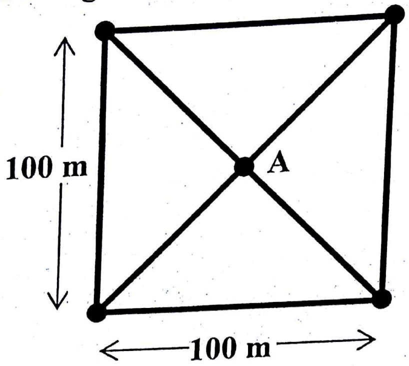
CE 535 /423 – Groundwater Engineering

TUTORIAL – 6

Q1. Consider the following battery of wells tapping a confined aquifer



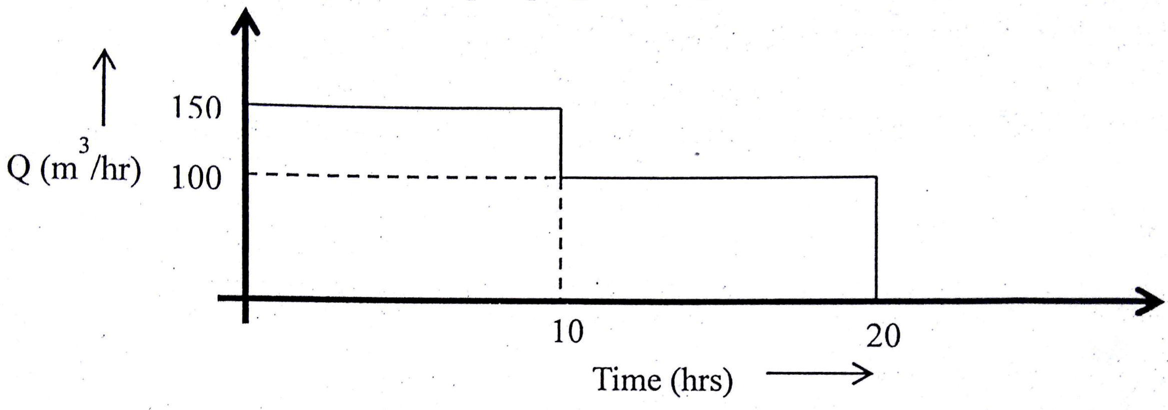
Compute the necessary discharge from each well to produce a drawdown of 10 metres at point 'A' in 24 hours, given

$T = 1000\ m^2/day$

$S = 10^{-4}$

P.T.O.

Q2. Consider the following series of pumping discharge from a well tapping confined aquifer



Compute the drawdown at r = 10 m and at time t = 10, 20 & 25 hours,

Consider T = 1000 m^2/day & S = 10^{-4}.

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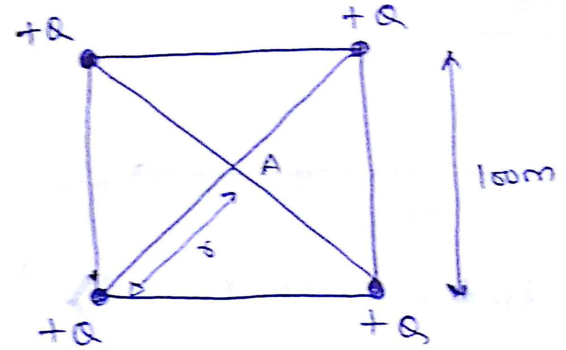
Tutorial-6

CE-423 Ground water Engineering

(1)



$r = \frac{100\sqrt{2}}{2} = 50\sqrt{2}$

Given, $S_A = 10$ m (drawdown) in 24 hours (1 day)

$T = 1000\ m^2/day$

$S = 10^{-4}$

Drawdown due to each well will be same because Point A is equidistant from each well.

So, $u = \frac{r^2 S_t}{4Tt} = \frac{(50\sqrt{2})^2 \times 10^{-4}}{4 \times 1000 \times 1} = 1.25 \times 10^{-4} < 0.05$

Since $u < 0.05$ so, we can use Cooper Jacob equation

So, $W(u) = -0.5772 - \ln u \Rightarrow 8.4099$

So, $S = \frac{Q}{4\pi T} W(u)$

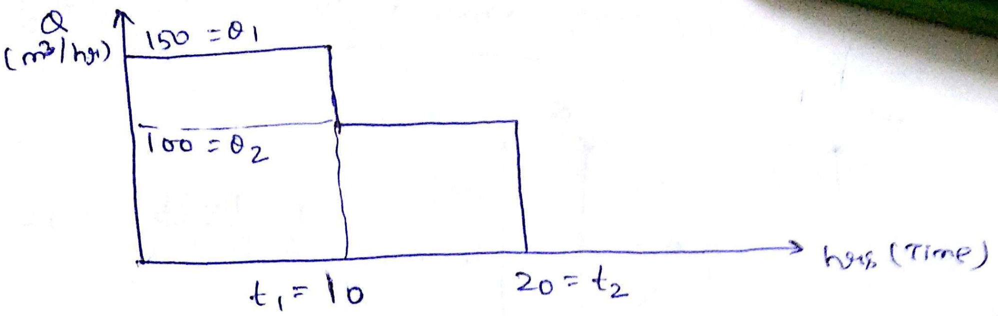
So, drawdown at Point A

$4S = S_A = \frac{4Q\,W(u)}{4\pi T}$

$\Rightarrow 10 = \frac{4Q}{4\pi \times 1000}(8.4099)$

$Q = 3735.54\ m^3/day$

② Confined Aquifer is given



We have to calculate drawdown at $r = 10\,m$ for different time

given $T = 1000\,m^2/d$, $S = 10^{-4}$

at $t_1 = 10$ hours

Applying Cooper Jacob equation $r = 10m$

$$S = \frac{Q}{4\pi T} W(u)$$

$$S = \frac{2.303Q}{4\pi T} \log\left(\frac{2.2456\,Tt}{r^2 S_t}\right)$$

$$S = \frac{2.303 \times 150 \times 24}{4\pi \times 1000} \log\left(\frac{2.2456 \times 1000 \times \frac{10}{24}}{10^2 \times 10^{-4}}\right)$$

$$\boxed{S = 3.279\,m}$$

at $t_2 = 20$ hours

$$S = \frac{Q_1}{4\pi T} W\left(\frac{r^2 S_t}{4Tt_2}\right) - \frac{Q_1}{4\pi T} W\left[\frac{r^2 S_t}{4T(t_2 - t_1)}\right] + \frac{Q_2}{4\pi T} W\left(\frac{r^2 S_t}{4T(t_2 - t_1)}\right)$$

$$S = \frac{2.303Q_1}{4\pi T}\left[\log\left(\frac{2.2456\,Tt_2}{r^2 S_t} \div \frac{2.2456\,T(t_2 - t_1)}{r^2 S_t}\right)\right] + \frac{2.303Q_2}{4\pi T} \log\left(\frac{2.2456\,T(t_2 - t_1)}{r^2 S_t}\right)$$

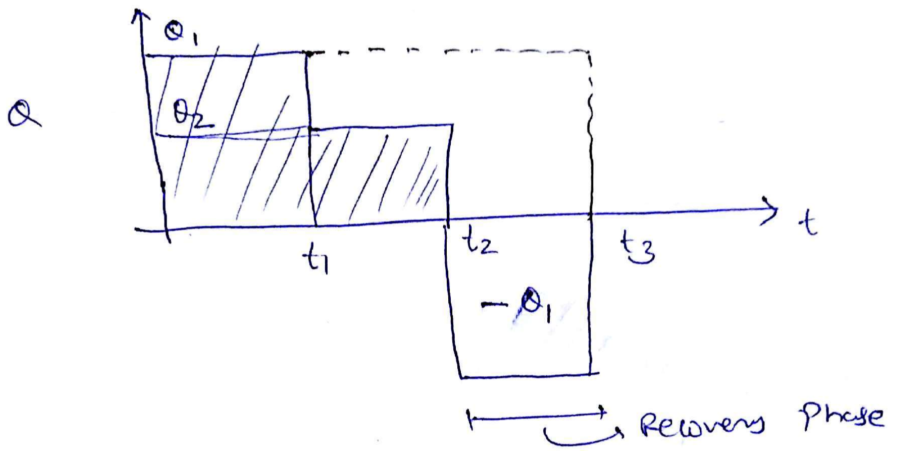
$$S = \frac{2.303 \times 150 \times 24}{4\pi \times 1000}\left[\log\left(\frac{20}{20-10}\right)\right]$$

$$+ \frac{2.303 \times 100 \times 24}{4\pi \times 1000}\log\left(\frac{2.2456 \times 1000\,(20-10)/24}{10^2 \times 10^{-4}}\right)$$

$$S = 0.1986 + 2.1865 \Rightarrow 2.385$$

$$\boxed{S = 2.385\,m}$$

at $t_3 = 25$ hours



$$S = \frac{Q_1}{4\pi T} W\left(\frac{r^2 S_t}{4Tt_3}\right) - \frac{Q_1}{4\pi T} W\left[\frac{r^2 S_t}{4T(t_3-t_1)}\right] + \frac{Q_2}{4\pi T} W\left[\frac{r^2 S_t}{4T(t_2-t_1)}\right]$$

$$S = \frac{2.303\, Q_1}{4\pi T}\log\left(\frac{t_3}{t_3-t_1}\right) + \frac{2.303\, Q_2}{4\pi T}\log\left(\frac{2.2456\, T\,(t_2-t_1)}{r^2 S_t}\right)$$

$$S = \frac{2.303 \times 150 \times 24}{4\pi \times 1000}\log\left(\frac{25}{25-10}\right) + \frac{2.303 \times 100 \times 24}{4\pi \times 1000}\log\left[\frac{2.2456 \times 1000 \times (20-10)/24}{10^2 \times 10^{-4}}\right]$$

$$S = 0.1463 + 2.1865$$

$$\boxed{S = 2.332}$$