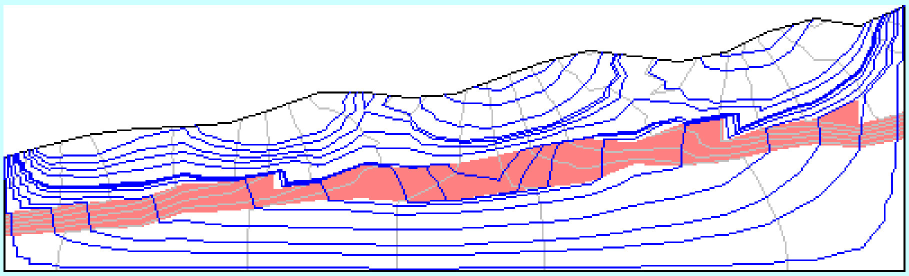
UPPER BOUNDARY IS

CONSTANT HEAD

EQUAL TO WATER TABLE ELEVATION

LIKE MANY RESERVOIRS PROVIDING AND RECEIVING WATER

no exaggeration -- head distribution
with aquitard

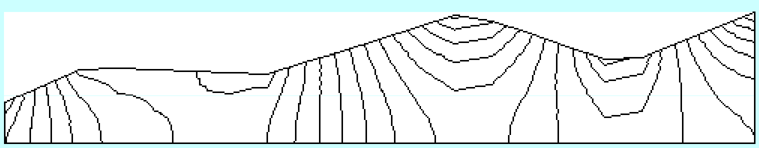


NOTE THAT

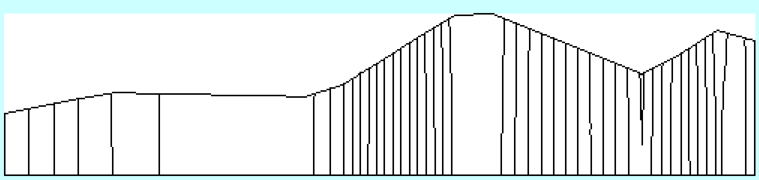
POROSITY DOES NOT EEFECT FLOW FIELD

IT ONLY CHANGES TRAVEL TIME

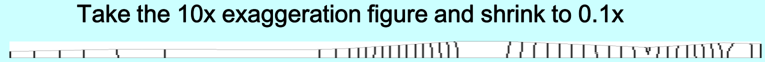
no exaggeration -- head distribution

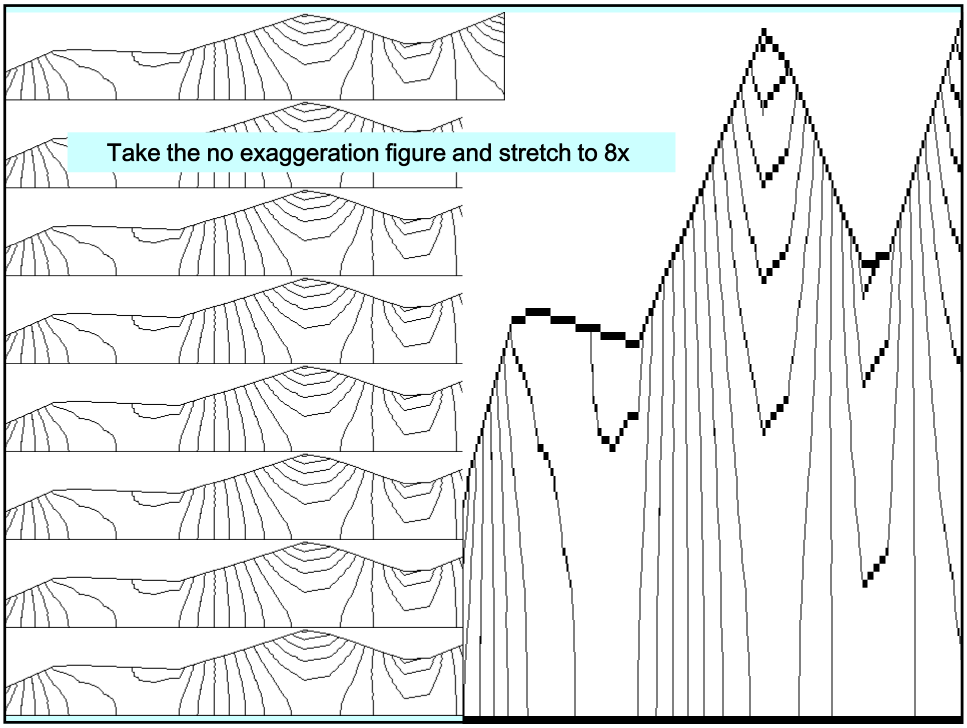


draw similar shape but under10x exaggeration – head distribution

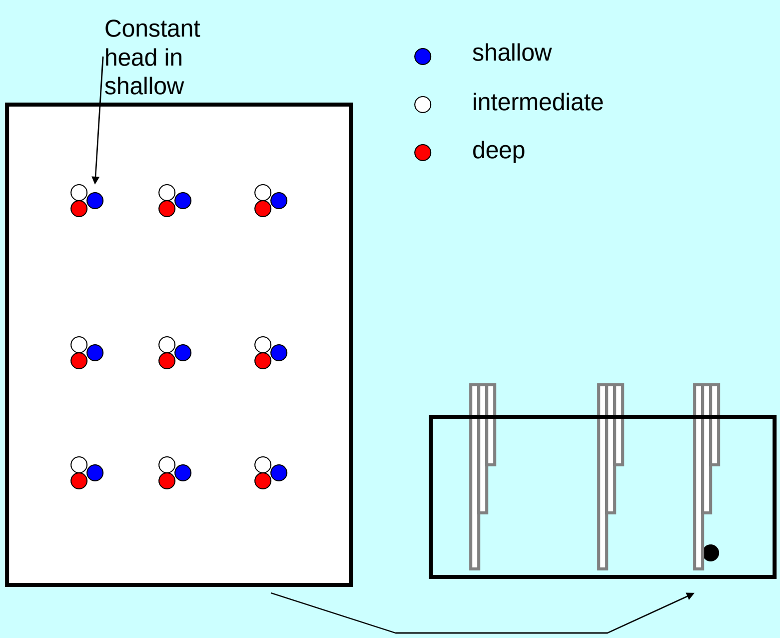


Take the 10x exaggeration figure and shrink to 0.1x

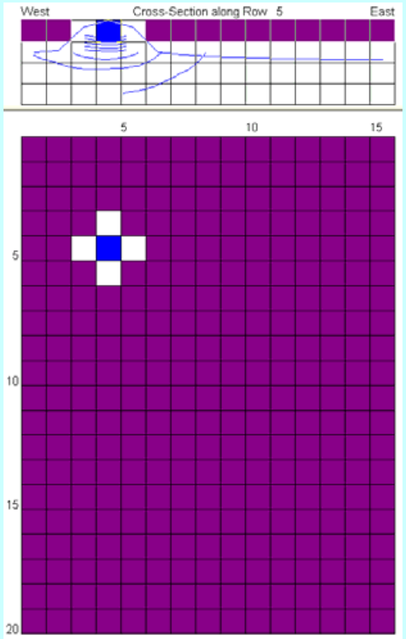




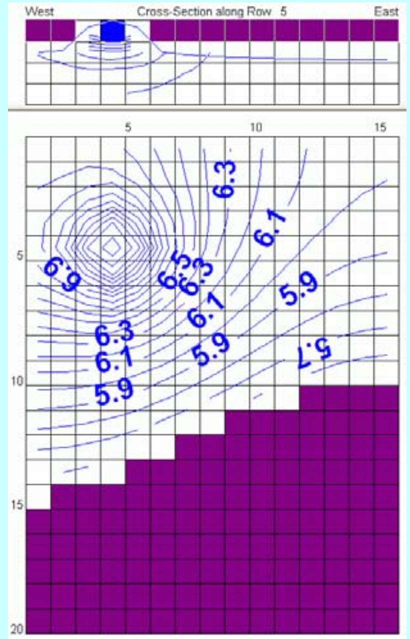
Map the 3D Flow Net



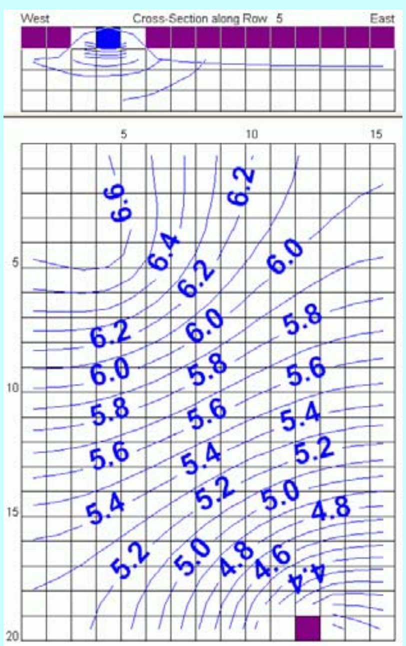
~2.5 inches down



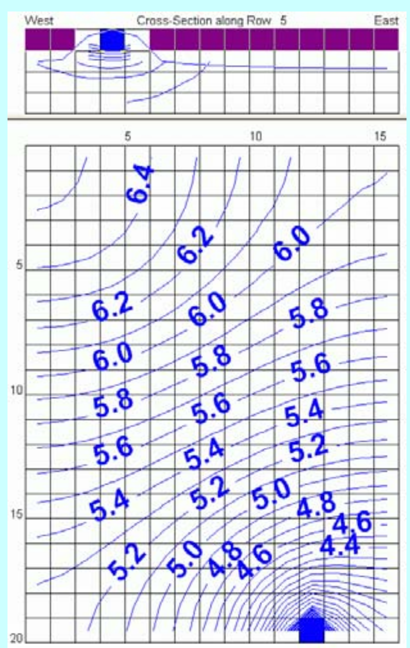
~5 inches down

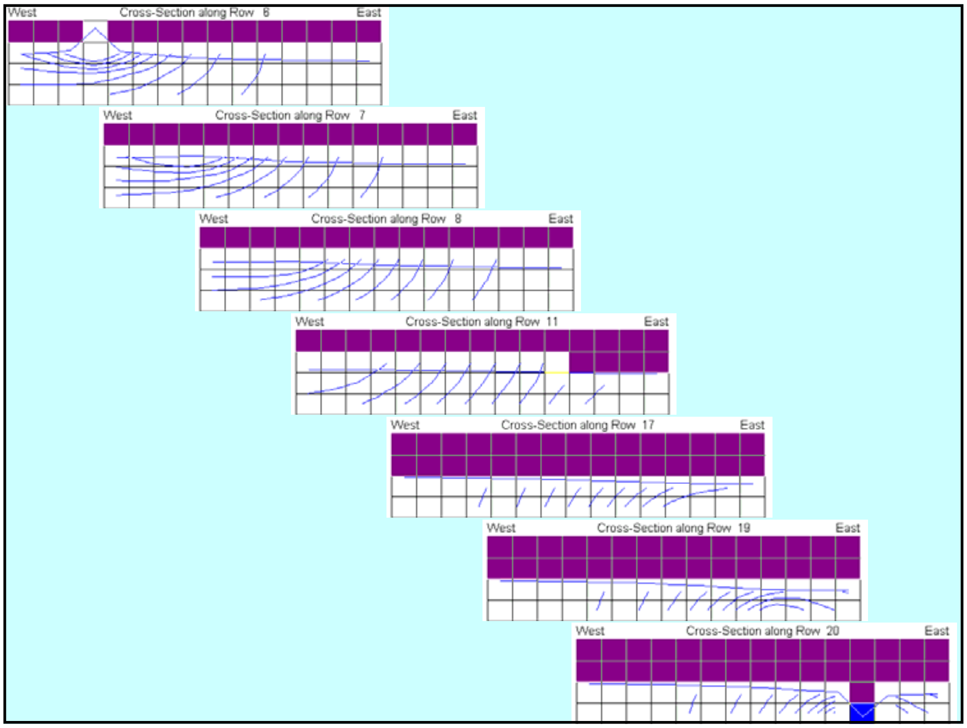


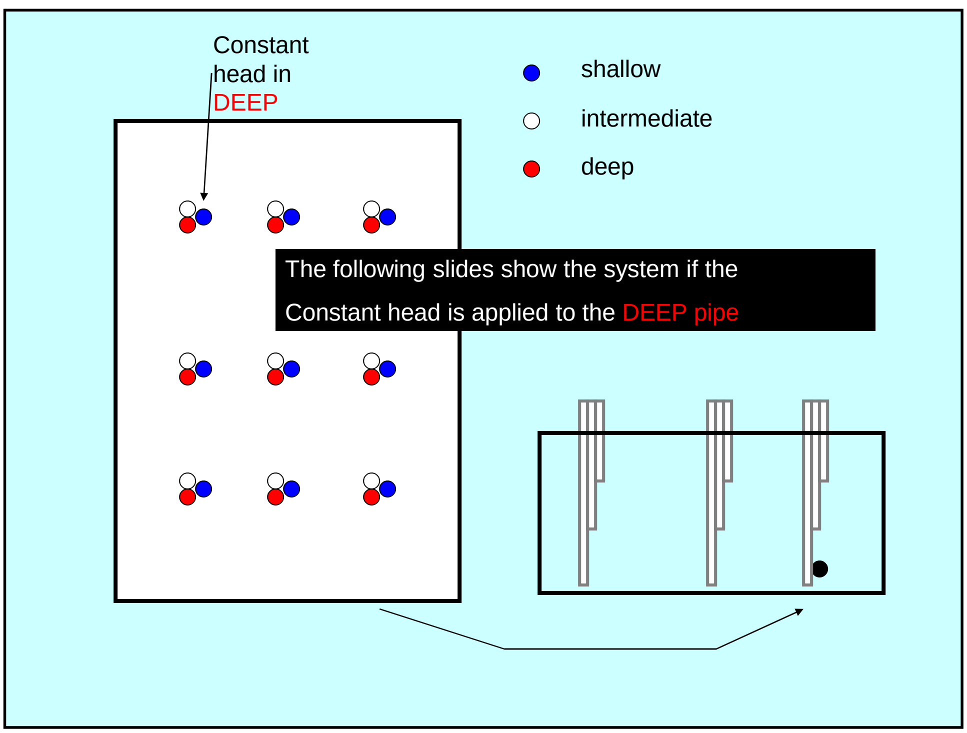
~7.5 inches down



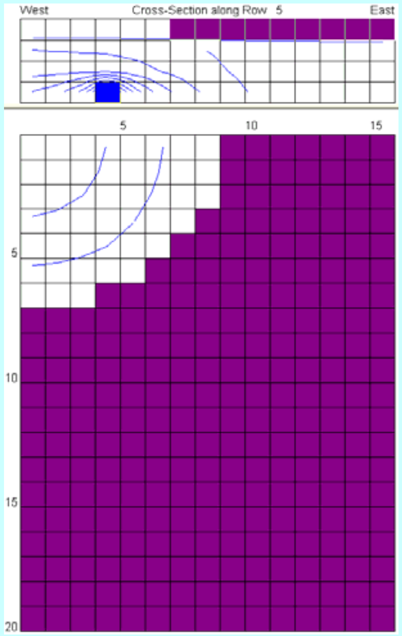
~10 inches down



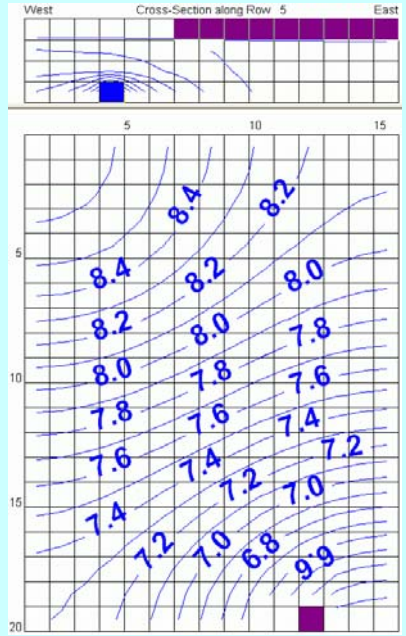

West
Cross-Section along Row 6
East
West
Cross-Section along Row 7
East
West
Cross-Section along Row 8
East
West
Cross-Section along Row 11
East
West
Cross-Section along Row 17
East
West
Cross-Section along Row 19
East
West
Cross-Section along Row 20
East


Constant head in DEEP
shallow
intermediate
deep
The following slides show the system if the Constant head is applied to the DEEP pipe

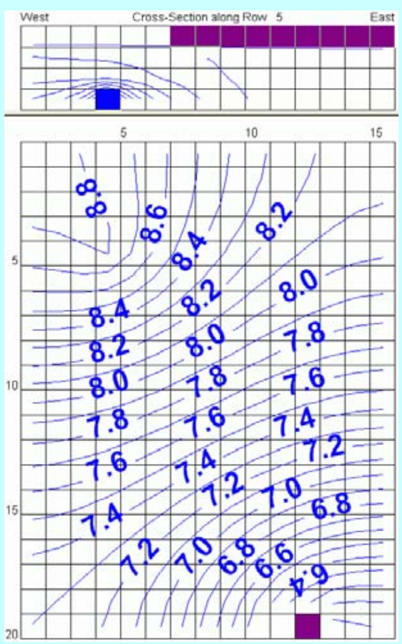
~2.5 inches down



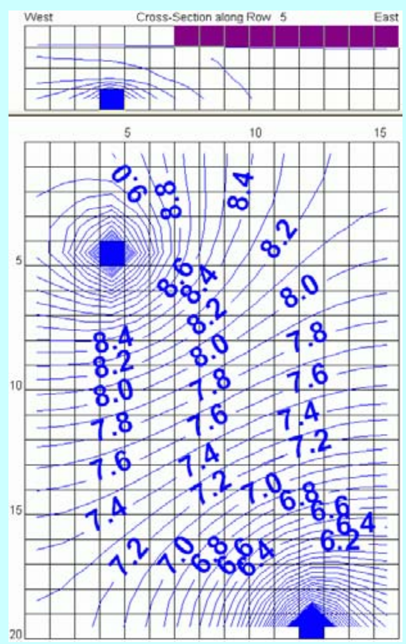
~5 inches down

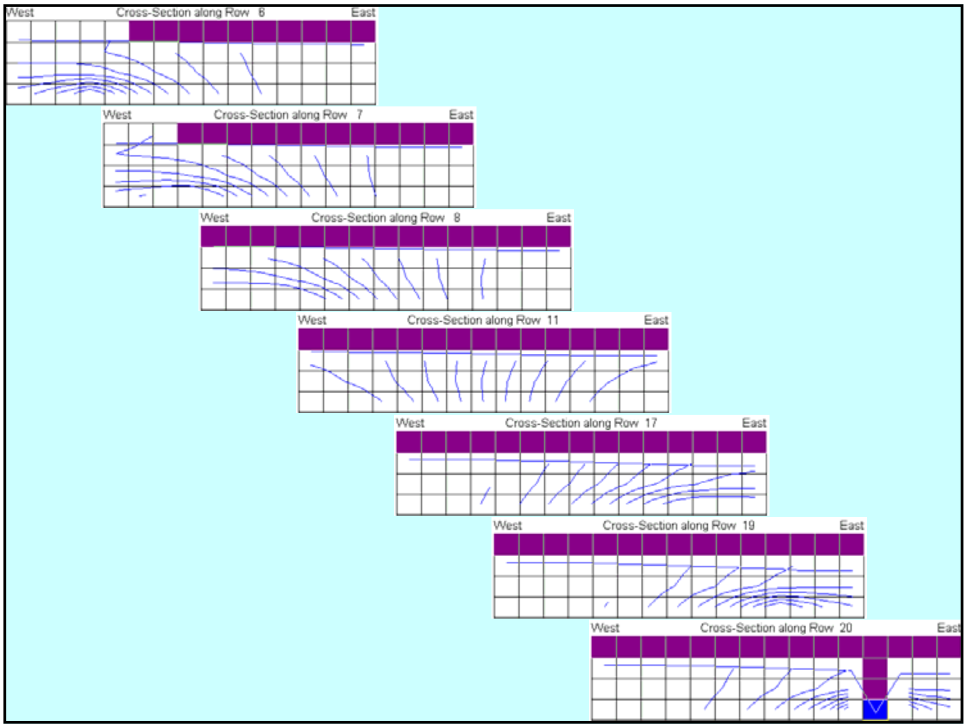


~7.5 inches down

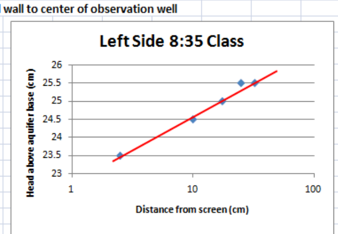


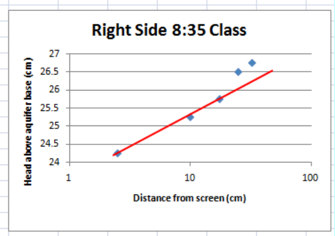
~10 inches down



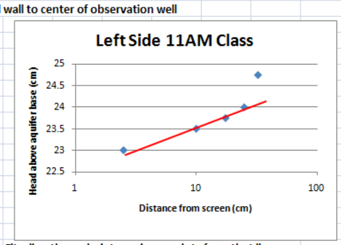


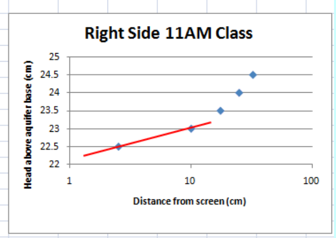
Q	510	ml	10	sec
	height of water level above base of sand			
	height		distance from well wall to center of observation well	
left	cm		cm	
1	23.5		2.5	
2	24.5		10	
3	25		17.5	
4	25.5		25	
5	25.5		32.5	
right	cm		cm	
1	24.25		2.5	
2	25.25		10	
3	25.75		17.5	
4	26.5		25	
5	26.75		32.5	





Q	491	ml	16	sec
	height of water level above base of sand			
	height		distance from well wall to center of observation well	
left	cm		cm	
1	23		2.5	
2	23.5		10	
3	23.75		17.5	
4	24		25	
5	24.75		32.5	
right	cm		cm	
1	22.5		2.5	
2	23		10	
3	23.5		17.5	
4	24		25	
5	24.5		32.5	





$$K=\frac{Q\ln(\frac{r_2}{r_1})}{\pi(h_2^2-h_1^2)}$$

Fit a line through data and use points from that line

If data points happen to fall on the lineyou can use those

EARLY LEFT	EARLY RIGHT
1st and last points fall on line	1st and 3rd points fall on line
1.69955 cm/sec	1.73688
LATE LEFT	LATE RIGHT
2nd and 3rd points fall on line	1st and 2nd points fall on line
1.85106 cm/sec	2.38092

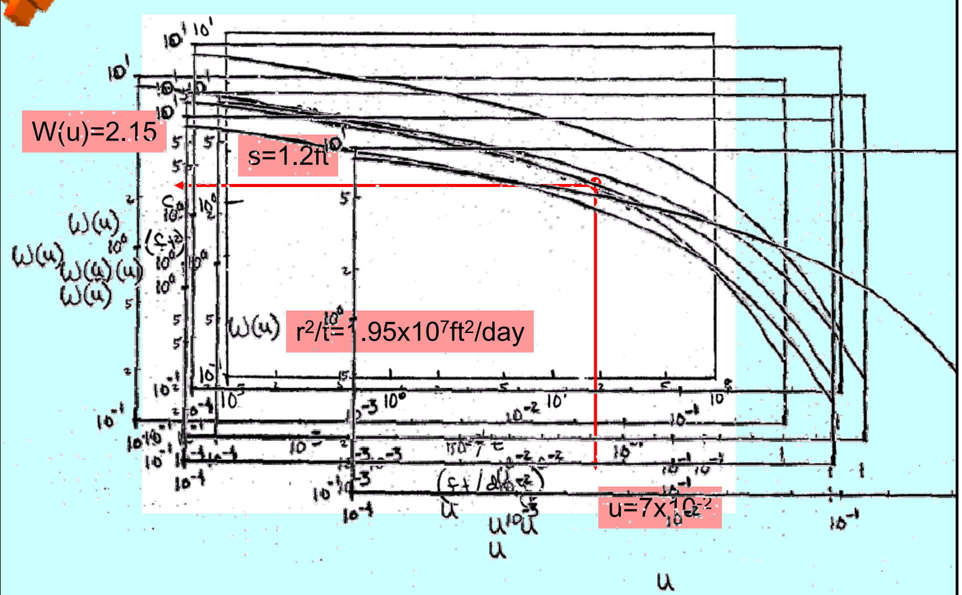
What are K? T?
Are they different on the left and right?

The Ks do not differ left and right. The affect of the boundaries leads to different K calculations because the equation assumes the aquifer stretches to infinity.

If there was not as much head loss across the screens then

Right side gradient would be steeper due to reservoir boundary
and K would be underestimated
Left side gradient would be shallower due to no-flow boundary
and K would be overestimated
More on this in a future lecture ….

$$K = \frac{Q \ln\left(\frac{r_2}{r_1}\right)}{\pi (h_2^2 - h_1^2)}$$



Work with a partner to calculate T, K, S, S_s

$$T = \frac{Q}{4\pi s} W(u) = \frac{500 \frac{gal}{min} \frac{1 ft^3}{7.48 gal} \frac{60(24) min}{day} 2.15}{4\pi 1.2 ft} = 13724 ft^2/day \approx 1.4x10^4 \frac{ft^2}{day}$$

K = T/b = 140 ft/day

$$S = \frac{4Tu}{(r^2/t)} = \frac{4(13724 ft^2/day)(7x10^{-2})}{1.95x10^7 ft^2/day} = 2x10^{-4}$$

specific storage = $\frac{S}{b} = 2x10^{-6} ft^{-1}$

Any point can be used. It need not be on the curve. Why?

(see next slide)

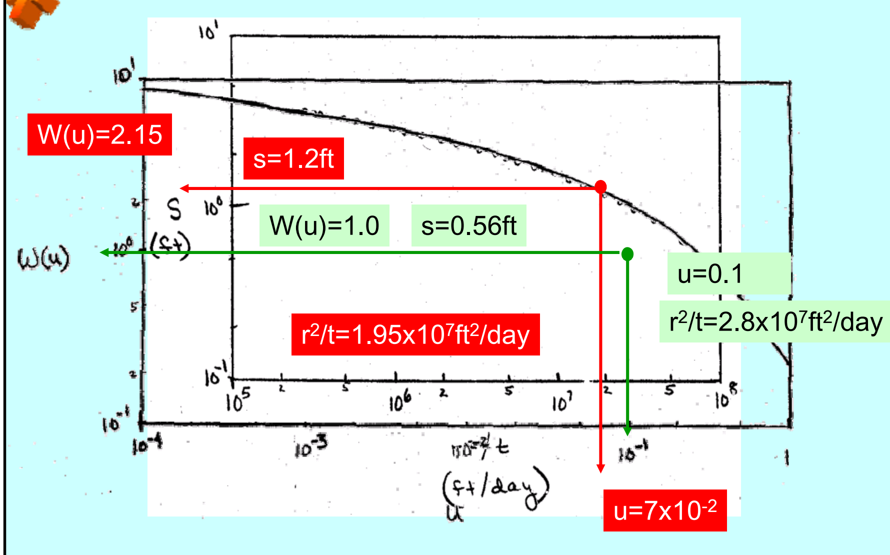
W(u) = 1 s = 0.56

u = 0.1 $r^2/t = 2.8x10^7$

The curve match identifies the appropriate relative values.

T = 13678 ft^2/day approx. 1.4 x 10^4 ft^2/day

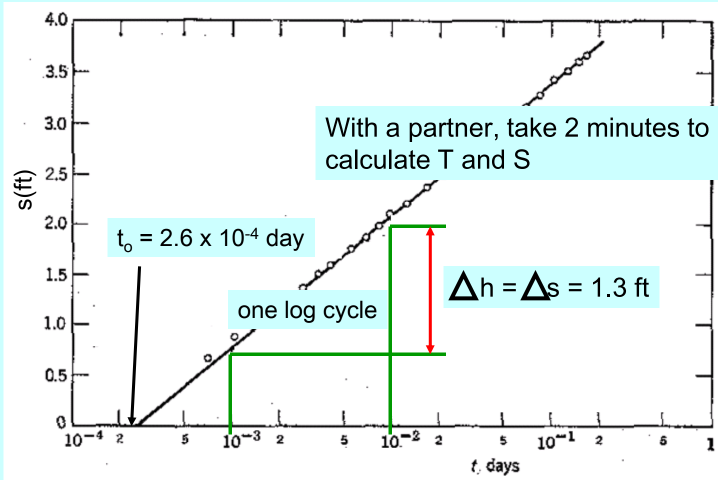
S = $1.95x10^{-4}$ approx. 2 x 10^{-4}



Alternatively, Plot s vs. t & match with W(u) vs. 1/u

For the Ohio example Q=500GPM, b=100ft, r=200ft

Plot s vs t



$$T = \frac{2.3Q}{4\pi\Delta h} \qquad S = \frac{2.25\,Tt_o}{r^2}$$

$$T = \frac{2.3Q}{4\pi\Delta h}$$

Δh = drawdown over 1 log cycle of time

$$= \frac{(2.3)\ 500\frac{gal}{\min}\frac{1ft^3}{7.48gal}\frac{60(24)\min}{day}}{4\pi\ 1.3\text{ft}}$$

= 13,552 ft^2/day ~ 1.4×10^4 ft^2/day

$$S = \frac{2.25\,Tt_o}{r^2}$$

t_o = time intercept for zero drawdown

$$= \frac{2.25 * 13{,}552\ ft^2/day * 2.6\times10^{-4}\ day}{(200ft)^2}$$

= ~ 1.98×10^{-4} ~ 2×10^{-4}

Match:

(there are many possible match points, this is just one)

s = 1ft

W(u) ~ 0.4

t = 100s

1/u ~ 0.6

Calculations:

T ~ 1.2×10^{-3} K ~ 1.4×10^{-5}
rounding T ~ 1x10-3 K ~ 1x10-5

S ~ 8.3×10^{-7} Ss ~ 9.4×10^{-9}
rounding S ~ 1×10^{-6} Ss ~ 1×10^{-8}