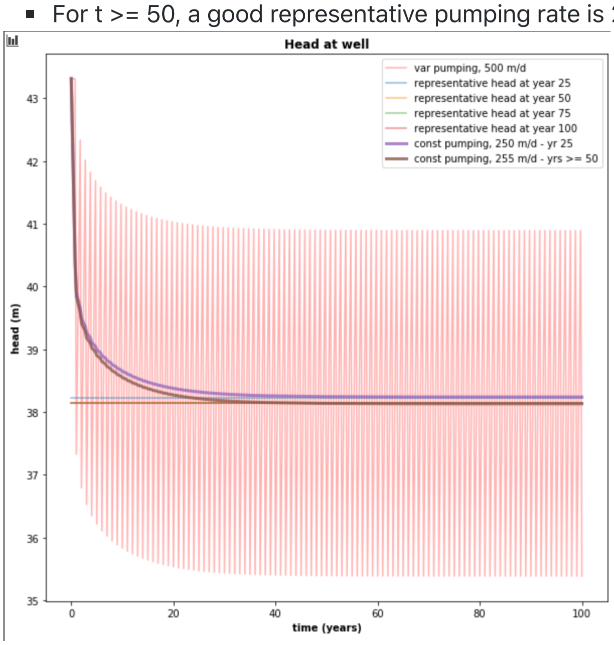
Hull-Robert-HW8.md

The Challenges

a) How does the capture zone evolve in time? Where does the early time capture zone get its water?

- An important note is that it is easiest to observe the capture zone at different times (25, 50, 75, 100) not by doing particle tracking with transient flow conditions, but by setting pumping rates to equivalent head conditions in and around the well at t = 25, 50, 75, and 100).
- This is a bit of a project, because I'm not 100% certain how to calculate flow lines using a transient condition
- So instead, I chose to figure out the capture zone at each time using the steady pumping rate equivalent of the transient condition for each time step. Pseudocode below:
  - Calculate moving average of head at well for transient (25% pumping, 75% recovery) condition
  - Derive representative head from moving average at each t = 25, 50, 75, 100. This is simply a matter of pulling out the head as a scaler at each of these time steps.
  - Plot the representative head on the plot for each time step. Note that the representative head for yrs 50, 75, and 100 are approximately equal because the system is at cyclical steady state. As such, there are only two conditions we need to consider the capture zone for, t = 25, and t >= 50
  - Match (via trial and error) a constant pumping rate that generates steady head at well equivalent to the representative head for each condition t = 25, and t >= 50.
    - Constant pumping rate results:
      - For t = 25, a good representative pumping rate is 250 m^3 /d.
      - For t >= 50, a good representative pumping rate is 255 m^3 / d.



  - Use these equivalent constant pumping rates to do particle tracking with the one layer model.
  - However, I am not certain that we can use the same exact approach with the three layer model. @Ty can we discuss this in class? I'm still a bit confused about how to approximate the capture zone in a transient system using steady state tools. I have to admit the results I get don't match my expectations, namely with a capture zone that is very limited in space around the well.

b) Where does the 'infinite time' capture zone get its water?

c) How does the extent of the capture zone change when layers are considered? Can you still define a 2D capture zone??

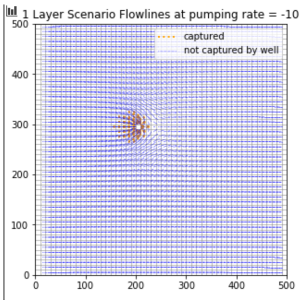
d) How does the extent of the 'infinite time' capture zone change when layers are added? Explain any difference in the lateral extent of the capture zone along the left boundary.

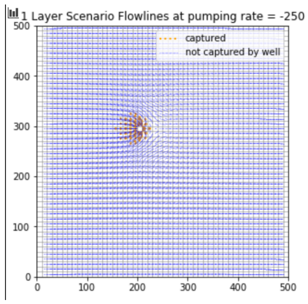
Correct Key Figures

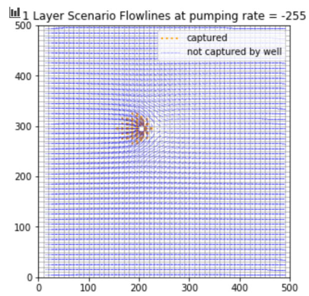
In my opinion, there are two key figures.

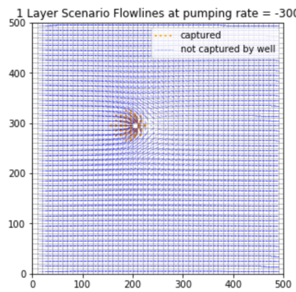
a) Time capture zone for four times and and infinite capture zone without layers. You can combine these into one figure or show a separate figure for each time.

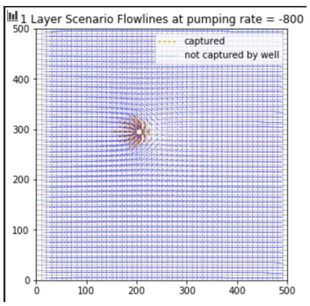
- The following figures show flowline scenarios at different steady state pumping rates for the one layer model. We know that **Q = 255** is approximately equivalent to capture zone at **t >= 50**, and **Q = 250** is appoximately equivalent to capture zone at **t = 25**
- These results (of course) don't make sense! Everything seems insensitive to pumping rate. Perhaps there is a bug in my code?











b) Time capture zone for four times and and infinite capture zone with layers. You can combine these into one figure or show a separate figure for each time.

- I haven't been able to add layers yet.