1 & 2.

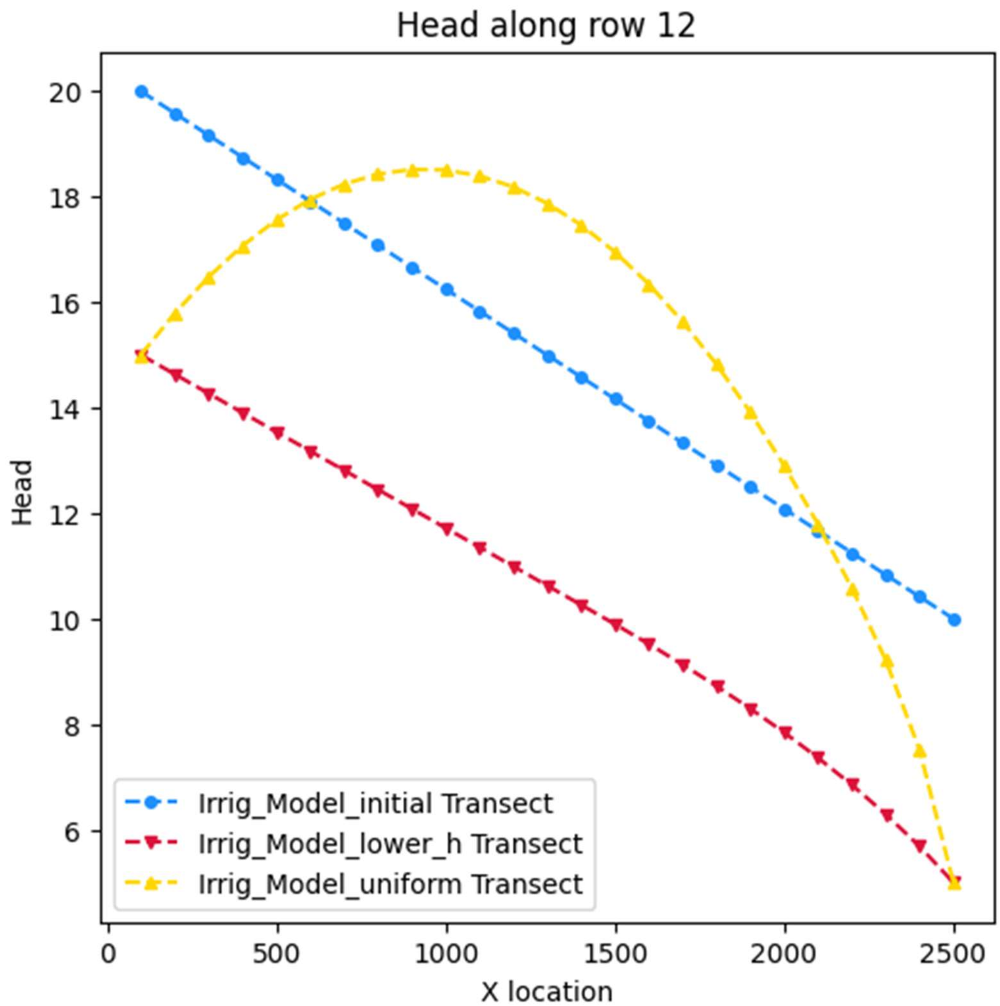


Figure 1: Head values along row 12 of the model for the initial conditions (Irrig_Model_initial; h_{left}=20, h_{right}=10), the lower head conditions (Irrig_Model_lower_h; h_{left} = 15, h_{right}=5), and for the uniform irrigation at the lower head conditions (Irrig_Model_uniform; Recharge = 1e-4 m/d).

For the first two transects (initial and lower_h), while the overall gradient remains the same, there is a difference in flow with the lower head conditions. As the head drops below the top of the domain of the model (at 10 m) we are limiting the amount of area for flow within the model (flow is "easier" within saturated zones; by lowering the head, we have essentially created an unsaturated zone with reduced area for flow). This can be seen in the lower_h model towards around 1500 m along the x-axis, where the transect shows a slight dip in slope towards the final boundary condition on the right-side of the model. Comparing the slopes of both transects before x = 1500 shows that the lower_h model slope is slightly less than the initial model, indicating a build-up of water towards the left side of the system as it tries to move into the unsaturated area.

For the uniform irrigation model, the head transect indicates a buildup of water more towards the left-boundary of the domain. Within a real, physical model, flow would likely be 3D, with water moving away from the head "boundary" generated by the irrigation (could possibly be reduced to 2D considering it is uniform irrigation over a "confined" aquifer, but if you account for tortuosity and non-homogenous pore space, it would have some degree of 3D movement; real-life is complicated!). However, for the purpose of our model flow can be generalized in this case as 2D to 1D, seeing as the domain is uniform (K, initial head gradient, layer thickness, and irrigation are all constant) and symmetric; flow along one row should mimic flow along all rows, with flow moving in two directions along a line (flow to the left from x = [0,1000) and right from x = (1000,2500]).

3.

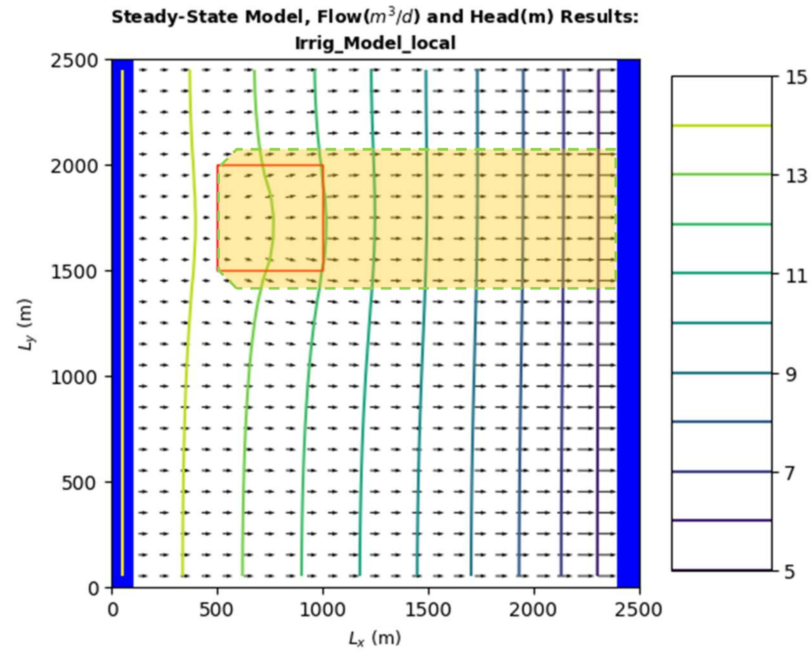
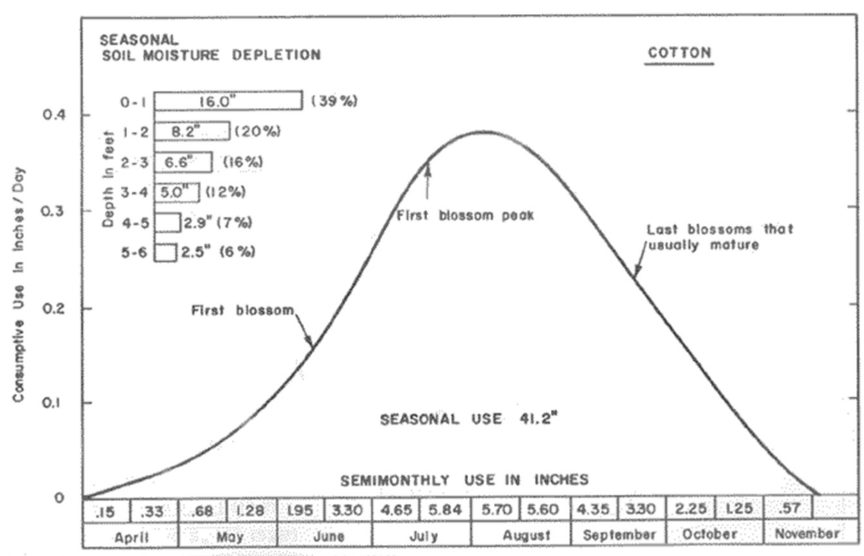


Figure 2: Flow vectors/equipotential for the localized irrigation model. The red box indicates the area of recharge from the farm, with the orange shade being used to illustrate the potential region of contamination due to the excess irrigation.



	Irrigation
Cotton (in/yr)	41.200
Cotton (m/yr)	1.046
Excess (m/yr)	0.037
Total (m/yr)	1.083

Figure 3: Consumptive use/water demand for cotton taken from above figure to calculate total amount of irrigation at the site that would result in the excess irrigation seen in the model; table to the right shows the values calculated.

4.

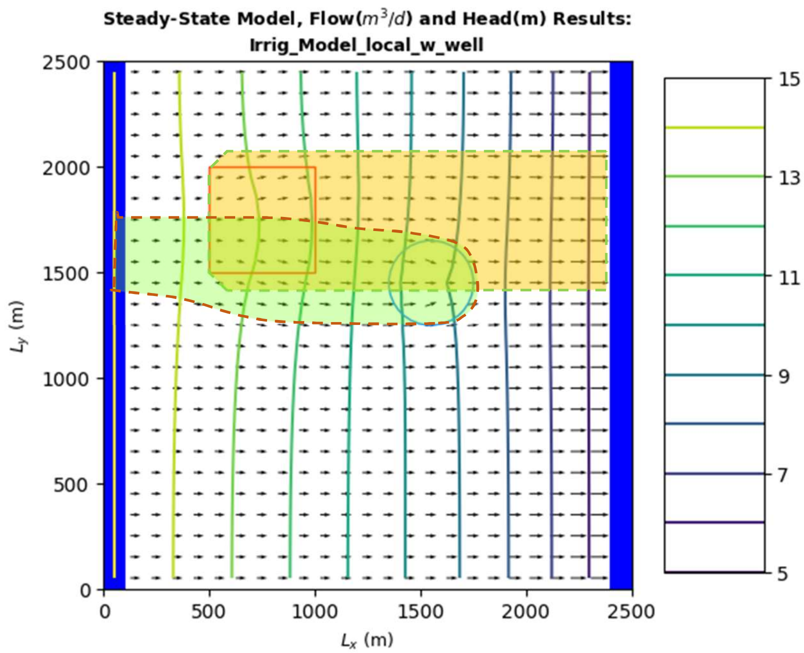


Figure 4: Flow vectors/equipotential for the localized irrigation with well model (well pumping rate = - 8 m/d). The orange area highlights the area of potential contamination from the local irrigation of cotton, and the green area highlights, roughly, the capture zone of the well.

From the above figure it can be observed that the well would likely be impacted by potential contamination at the localized irrigation site. The concentration of the contaminant reaching the well would never reach the max level of concentration applied to the irrigation site, due to the extent of the wells capture zone, which would draw non-contaminated as well as contaminated water in, and also the characteristics of the contaminant, which is highly variable. Now, if the contaminant was only released on the top half of the irrigation site, you may not see any contaminant reach the well as long as the well pumps at the initial rate (no higher) and if we have a "perfect" contaminant (that is there is no lateral dispersion beyond the initial contaminant zone, except in the direction of flow within the system).