GroMore: Scenario Three and Four Report

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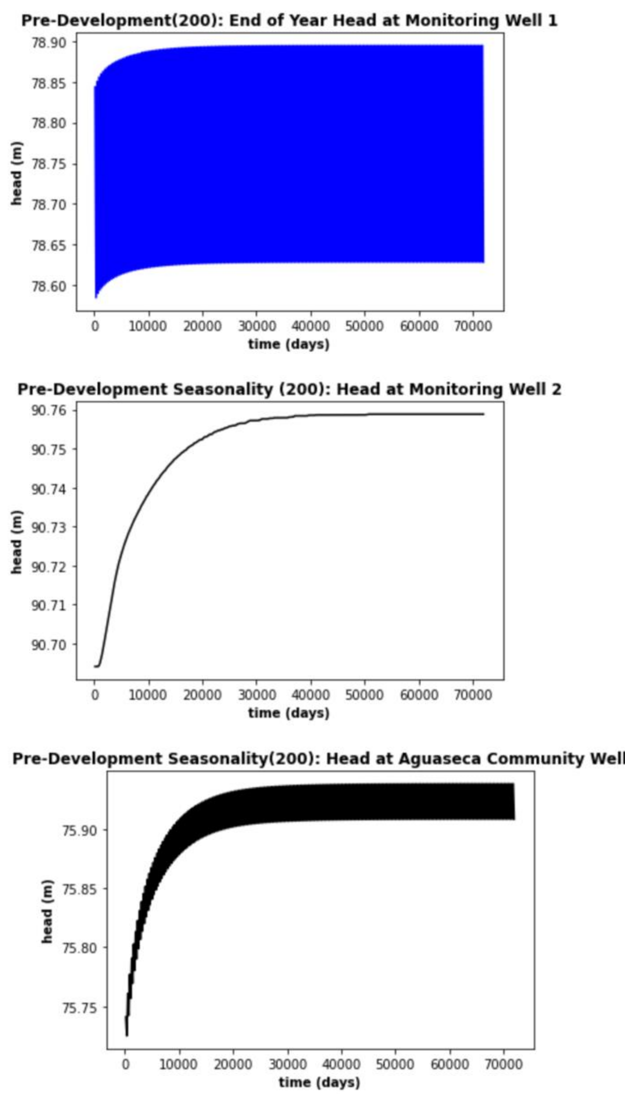
Scenario 3: Post Development with Seasonality

For scenario three, the model was the same as for scenario two except that we are now adding pumping from the town's water supply well. The demand from the town is simulated by growing exponentially according to the equation Q = 1.5 * t^1.5, where t is the time at the end of the 10 year time period. The starting pumping rate is 47 m^3/day and by the end of the 100 years of simulated time, it is 1500 m^3/day. As the town has been pumping for 100 years, the state of the model at the end of this scenario is in theory, the current hydrology of the study area.

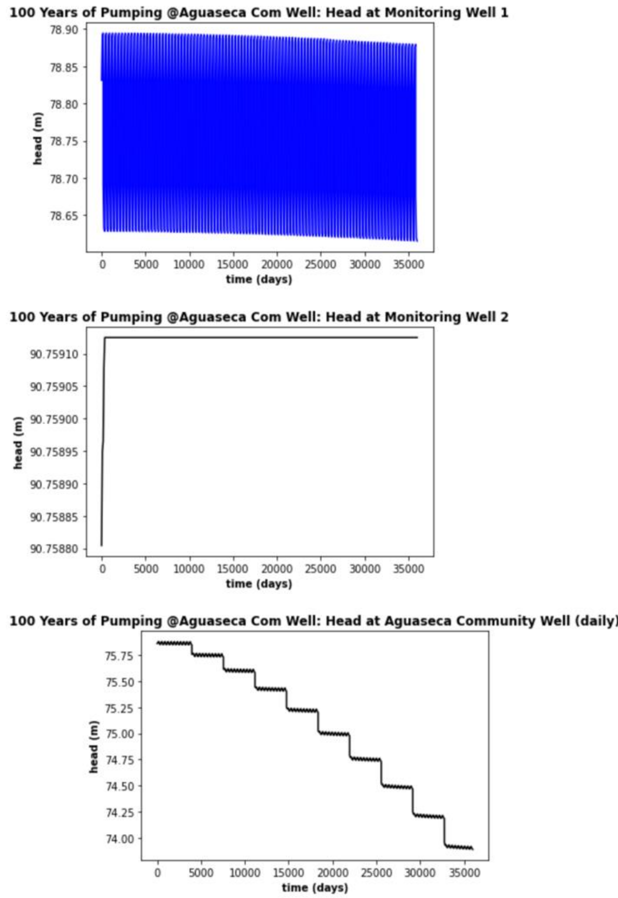
In figure one, we show the end of spin up graphs from scenario two, as the final head profiles from that scenario are read in as the initial head values for scenario three. We changed scenario two from an initial burn in of 25 years to a burn in of 200 years to assure that all inter year storage patterns were eliminated and that only seasonal patterns remained.

Figure 1: Heads at the three wells in pre-development stage



In figure 2, we see the graphs of the heads of the two monitoring wells and the community well over time, beginning at the initial head profile from the end of scenario 2.

Figure 2: Heads at the three wells during past 100 years of pumping



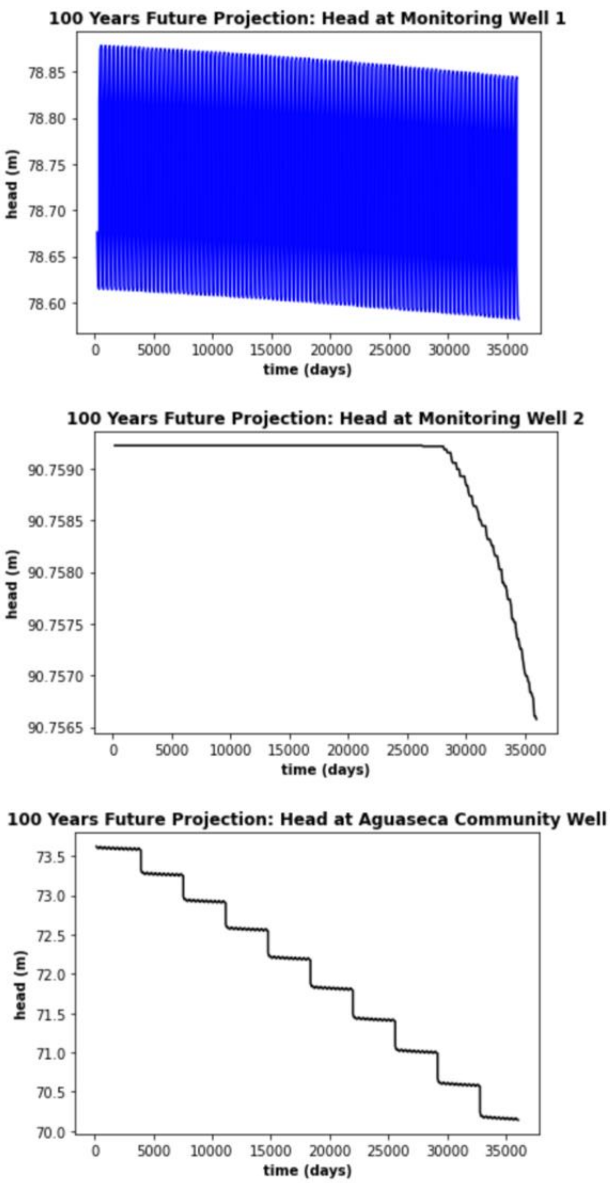
As can be seen, the head at the community well responds as a step function mimicking the increase in pumping, every 10 years. There are slight variations on the head because of the fluctuation in ET.

The head at the monitoring well is showing two patterns: firstly it is oscillating because of the seasonality and secondly it is slowly decreasing because of the influence of the pumping well and its increasing values. It can be imagined that the zone of influence or cone of depression is increasing and as the edge of the zone increases in size, the head at MW1 is decreasing.

Monitoring Well 2 is located much farther from the Community well (as compared to Monitoring Well 1). There is no decrease in the head values of MW1 and therefore it
Can be inferred that it is outside the zone of influence or cone of depression being formed due to the pumping well.

Scenario 4: Post Development with Seasonality - Future Projection

Figure 3: Projected Heads at the three wells for the next 100 years of pumping



To account for the impact of the town's water extraction on the hydrologic system, we reckon that the most accessible metric would be the groundwater head in the two monitoring wells. Therefore, "the reduction of head at the monitoring well due to pumping well should not exceed X meters" is chosen as the metric to evaluate the impact.

For scenario 4, the towns water demand was projected into the future using the same equation as scenario 3 while maintaining seasonality. The pumping rate ranged from 1730 m3/day at the start to 4242 m3/day at the end of the future projection period. Figure 3 shows the head values at both monitoring wells and the community well over time.

As can be observed, the head at the pumping/community well is decreasing in steps. It is notable that in the previous 100 years, the head decreased by ~2 meters, but in the future 100 years the head would decrease by over ~3.5 meters. This would primarily be because of the increase in absolute quantity of pumping. It would be interesting to check if this increase is partially because of any other reason like zone of influence reaching a no-flow boundary. Compared to the pre-development state, over the 200 years the head dropped by 5-6 meters.

At the MW1, the head is decreasing in a way like before, but with a slightly increased rate due to increased pumping. Compared to the pre-development times, the head has decreased by about 0.05 meters, a negligible considering 200-year timeframe

At MW2, the head remained stable for 180 years of pumping and then starts to decrease slowly. This would probably be because the zone of influence of the pumping well has reached this relatively far-away well. The start of head decrease is projected 80 years in the future and the rate of decrease is ~0.0002 m/year. Though this is negligible it can be argued by stakeholders that the community well has started influencing the head at this far-away location.