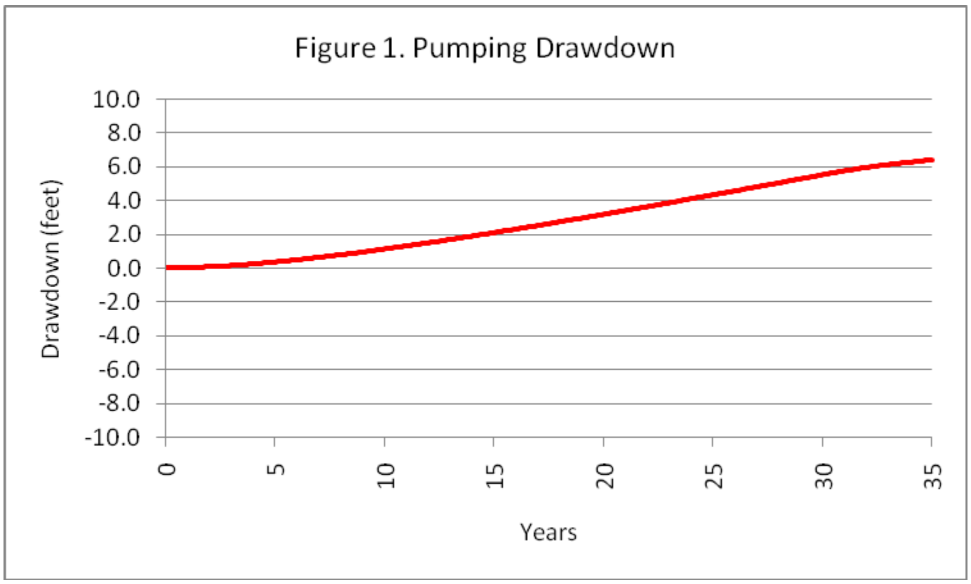
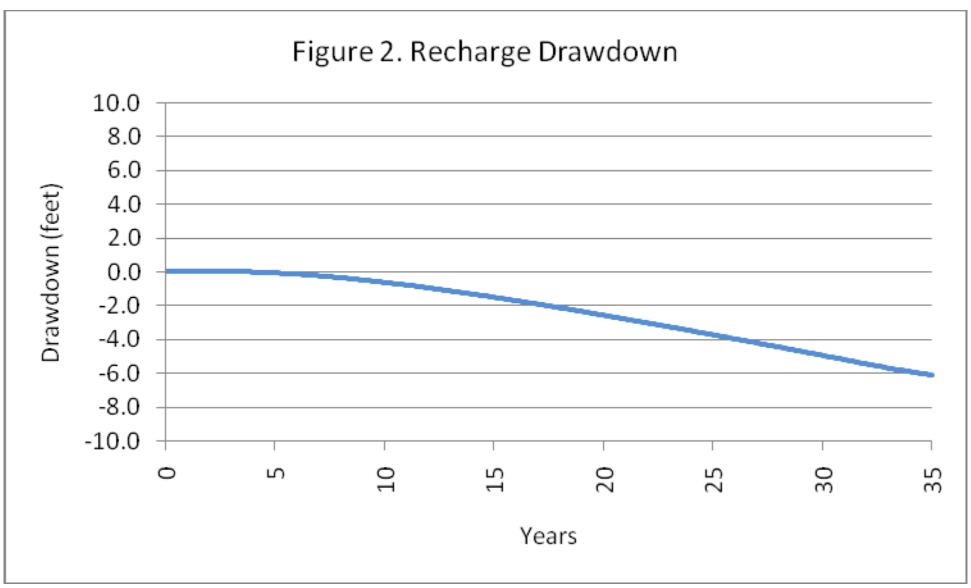
CPV Sentinel Energy Project (07-AFC-3)
Energy Commission Staff's Draft Summary of its Modeling to Analyze Lead Time Needed for Recharge Before Project Pumping to Avoid Significant Impacts to the Mesquite Hummocks Vegetative Community

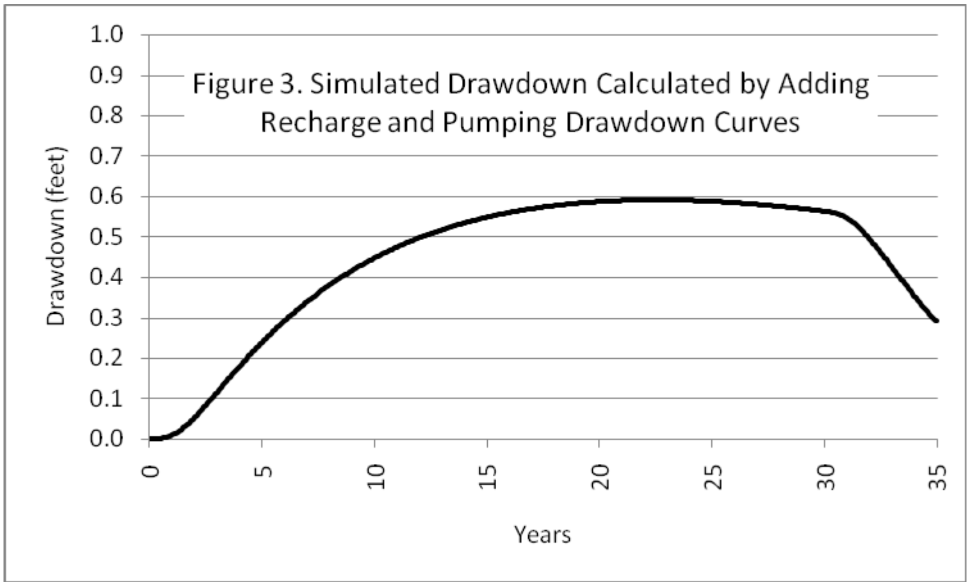
One of the principle advantages of superposition is that the effect of one stress can be isolated from the effects of all other stresses. Hence, parts of a complex problem can be added to derive the solution to a more complex problem. We utilized the URS model to isolate the recharge effect (i.e., the simulated monthly water level rise beneath the Hummocks) by running the model with recharge but without pumpage (Figure 1). Similarly, we isolated the pumping effect (i.e., the simulated monthly water level decline beneath the Hummocks) by running the model with pumping but without recharge (Figure 2).





Model results are for the following conditions: Tyley transmissivity distribution, anisotropy of 2, recharge for 30-yrs at an annual rate of 1,186 AF/yr (assumed to reach the water table one-year after application to the spreading ground), and pumping 30-yrs at an annual rate of 1,100 AF/yr. Results are average simulated water level changes at Mesquite Hummock locations.

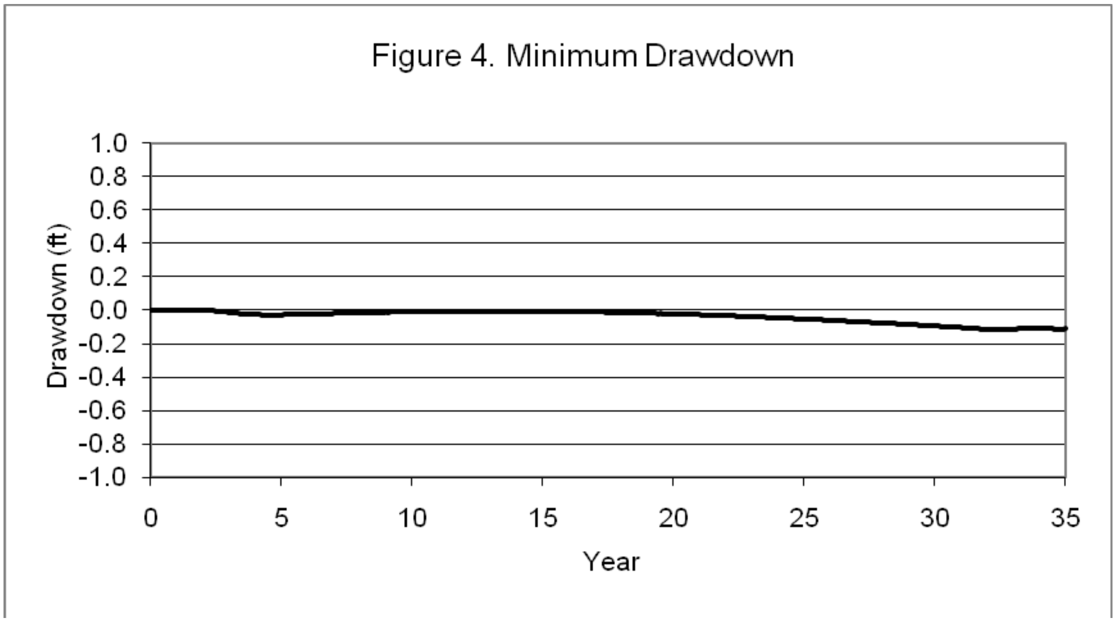
For the more complex problem of simultaneous recharge and pumping, the drawdown response is the sum of the two curves above (see Figure 3).



Note: In order to refine the optimal timing of stresses we consider monthly results. We modified the annual model to use 12 time steps per annual stress period, and specified that MODFLOW report the simulated water levels at approximately monthly intervals. Figures 1, 2 and 3 show the results using the shorter time steps.

Superposition theory further indicates that doubling an input doubles the magnitude of the response. For example, doubling the recharge or pumping rate doubles the magnitude of the water level increase or decrease, respectively. Similarly, halving the recharge or pumping rate halves the water level increase or decrease, respectively. However, these changes in the magnitude of recharge and pumping will not affect the timing of the response (i.e., the month where the maximum or minimum water level changes occur). The timing of the water level change is determined by the relative timing of the recharge and pumping stresses (i.e., when recharge and pumping start and end).

The influence of recharge schedule to the long-term drawdown response beneath the Hummocks can be assessed by shifting the recharge response curve in Figure 2 either forwards or backwards prior to adding it to the pumping response curve in Figure 1. Using this approach and the model results in Figures 1, 2 and 3, we determined recharge needs to begin 33 months prior to pumping to produce a minimum water level decline of 0.0 feet during the analysis period (Figure 4). The 33 months includes the assumed 12-month delay for percolating recharge to reach the water table. Hence, introduced recharge needs to intercept the water table 21 months prior to project pumping to produce no drawdown beneath the Hummocks wells (33 – 12 = 21). If the recharge delay is something other than 12-months (for example, if recharge actually reaches the water table 4-months after delivery to the percolation ponds), then the recharge operation needs to begin 25 months prior to pumping (33 – 8 = 25) and still needs to intercept the water table 21-months prior to pumping (25 – 4 = 21).



Note: negative drawdown corresponds to a water level increase.

We assessed the sensitivity of the recharge schedule to transmissivity and summarize the results below in Table 1.

Table 1: Recharge schedule in months before pumping that results in no net drawdown beneath the Mesquite Hummocks.

	Isotopic	Anisotropic
½ Tyley T	117	57
Tyley T	67	33
2x Tyley T	39	23

Note: Results include the assumed 12-month delay between the when water is delivered to the percolation ponds and when it is intercepted by the water table.