store the thermal energy (heat in the summer and chill in the winter) in the disposed water and recover the energy for use in the opposite season. Again, the objective is to increase the heat pump COP.

Barry Thacker described the ground-water modeling activities and model status. With funding from Hummana Corp. (a health services company), as a contribution to the city, Geologic Associates, Inc. is developing a numerical model of the Louisville Aquifer. The model uses the USGS finite difference ground-water code, and is in the final stage of completion. Geologic Associates, Inc. has done a good job in model development, and the model should be a valuable tool in managing the ground-water resource. The model can be used to predict ground-water levels, water flow paths and velocities based on various water input/output scenarios, but it cannot predict the disposition of heat in the aquifer due to thermal energy injection (unless oversimplifying assumptions of "plug flow" are made).

I discussed my perception of the potential for ATES, based on the information presented at the meeting and my previous limited research on the geohydrology of the Louisville area. It is evident that ground-water source heat pumps could supply HVAC for most of the central Louisville business district, given proper distribution and management of ground-water withdrawal and injection. At least some of the water will have to be reinjected after use. However, it is not clear that recovery of the heated or chilled water (by a complex injection/recovery well pattern) will increase heat pump COP enough to be economic. The model should be used for piezometric surface, flow path and travel time definition in the area proposed for ground-water heat exchange to permit proper design of the well fields, and a transport code should be incorporated (or developed separately) to estimate heat and chill distribution. Detailed economic evaluations should be made of the various options for ground-water withdrawal, use and reinjection/disposal.

The plan to offset wells from the river to obtain a seasonal lag in water temperature at the point of use did not appear technically feasible. Prior to the meeting, I requested a simple model run with estimated parameters using the Areal Flow Code to simulate such a withdrawal scheme. Lance Vail applied the model to this case and made the model run. As was suspected, if the wells are located far enough from the river to obtain an approximate six month travel time, then the water derived from the river will be only a small portion of the total water produced from the well. Most of the water is ground water in transit to the river, and only a small difference will be achieved over normal ground-water temperature. Of course, water could be pumped from the river directly (or nearly so by means of Ranney Collectors) and stored in the aquifer for use in the off season. I pointed out that a detailed economic study would have to be made for this plan, because it is doubtful that the relatively small temperature gain/loss would increase heat pump COP enough to offset the pumping/transport costs.

The meeting attendees appeared to appreciate our assistance, and I expect that additional consultation will be requested as plans progress toward implementation of ground-water heat pump HVAC for the centeral Louisville business district.

JRR:ks