Exploring Groundwater Recoverability in Texas

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ABSTRACT

The 2022 Texas state water plan projects total supply deficits of 6.9 million acre-feet under drought-of-record conditions by the year 2070 driven by a growing population concurrent with declining water supplies. Groundwater supplies are projected to decrease by 32% and account for 95% of anticipated declines in total water supply over the same period. Groundwater availability and supply are constrained by management plans which are most frequently expressed as a change in depth-to-water over time and are required to consider an array of issues, including recoverability—the physical and economic impacts and limitations to production. However, Texas's current best estimates of recoverability do not sufficiently account for these constraints and may significantly overestimate feasible yield volumes. Therefore, we develop methods for scientifically quantifying groundwater recoverability, the Groundwater Recoverability Model (GRM), for user-specified and yield-optimized infrastructure and demonstrate an analysis of the Carrizo-Wilcox Aquifer within the extent of the Post Oak Savannah Groundwater Conservation District. Two key drivers of recoverability are simulated: (1) the value of water pumped relative to pumping costs and (2) the capacity of the aquifer and well to meet demand. Pumping costs incorporate drilling costs as well as pump power plant and lifting costs that vary with changes in depth-to-water. The capacity of the aquifer and well to meet demand, which varies with changes in depth-to-water, is simulated by calculating partially penetrating well drawdown under pumping. Our results indicate that recoverability decreases in all cases with increasing depth-to-water and that these constraints may significantly limit yields of certain uses. We suggest that Texas groundwater managers, stakeholders,

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and policymakers assessing groundwater availability need an alternate, scientific approach for estimating recoverability.