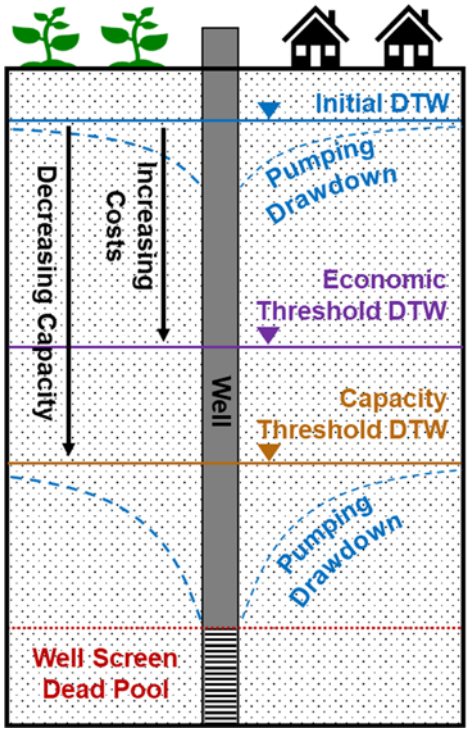
New Tools for Quantifying Groundwater Recoverability in Texas

MOTIVATION: The depth of potentiometric head, or depth-to-water (DTW), is a key metric by which many Texas aquifers are managed. As long-term groundwater extraction, drought, or other forces drive increasing DTW the costs of pumping rise and wells may fail. Understanding these recoverability impacts is critical for groundwater managers and stakeholders but a decision support system capable of analyzing a range of use, storage condition, and well design factors in order to fully capture them is not widely available or established. Texans currently have no way to know how much groundwater could be feasible to recover, how pumping costs may change in the future, or when wells may fail.



APPROACH: New methods recently developed at the Bureau of Economic Geology (BEG) quantify how recoverability changes with changes in DTW by assessing well responses. First, the physical capacity of a well and aquifer to meet pumping demand is determined by calculating drawdown within the pumping well. At some DTW the water level in the pumping well (the sum of the DTW and drawdown) is equivalent to the depth of the pump or the top of the well screen. This establishes a capacity threshold DTW, beyond this DTW the well fails. Novel well design optimization solutions then determine if the well can be remediated to restore capacity. Second, changes in pumping costs (lifting energy, pump equipment, and drilling costs) with changes in DTW are calculated from DTW, drawdown, and remediation. If pumping costs exceed a user's willingness-to-pay (WTP) an economic threshold is established, beyond this DTW pumping is not affordable. These methods integrate three types of input parameters: user-based data (such as pumping demand, WTP, and prices), aquifer-based data (such as geometries, hydraulic conductivity, and DTW), and well-based data (such as screen intervals, pump depths, and well efficiency). They can be applied to existing well infrastructure to evaluate recoverability impacts to existing uses or they can be applied to hypothetical, design-optimized infrastructure to estimate the very limits of recoverability.

OPPORTUNITY: The BEG is developing these new methods into a freely available decision support system for groundwater manager and stakeholder use. The ultimate goal is to establish a web-based platform of tools where users can generate recoverability results for a single well or for many wells, for existing wells or hypothetical wells. The tools are anticipated to accept input parameters entered manually or imported from user databases and the possibility of connecting to state datasets is being explored. In the first phase of this project the BEG is assembling a limited cohort of pilot program participants (such as groundwater conservation districts) to engage with and jointly test alpha-versions of the tools. The pilot program is grant financed and presents no cost to participants, only a limited investment of time and energy is needed. The objectives of the pilot program are to: (1) engage with groundwater managers and stakeholders to better understand their needs and how these tools may best address them, (2) assess the range of available input parameter datasets and ensure the tools can ingest them, (3) ascertain the form and content of model outputs that best meet user needs, (4) test and troubleshoot alpha-version tools, and (5) retain feedback.

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