Developing Deep Brackish Groundwater Resources in New Mexico

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New Mexico and the American Southwest are facing the most severe water resource crisis in history, a result of ongoing climate change/drought, as well as overuse and overallocation of an ever-decreasing supply of conventional surface and groundwater.

Fortunately, New Mexico has a "hidden" unconventional water resource in the form of almost limitless quantities of deep brackish groundwater (DBG) which were deposited and stored far beneath the surface during past Ice Ages--which can now be extracted, treated, and turned into useful freshwater or to meet other water resource needs.

DBG is defined as water deeper than 2500 feet below the ground surface which contains between 1000-10,000 ppm Total Dissolved Solids (TDS); by comparison, seawater has approximately 35,000 ppm TDS. The U.S. Geological Survey's Office of Saline Water has estimated that New Mexico has as much as 3-5 billion acre-feet of DBG, which would constitute a 1000-1500 year water supply at current rates of use.

Developing this DBG resource in New Mexico involves a multi-step process that includes defining aquifer boundaries, assessing hydrogeology and water quality, determining sustainable use, and obtaining necessary permits, as well as treating the DBG for its intended use. The Office of the State Engineer (OSE) plays a key role in regulating this process, particularly in relation to existing water rights and potential impacts on existing shallow water resources (i.e., less than 2500 feet deep.)

Use of DBG doesn't require obtaining water-rights and can be pursued simply by filing a Notice of Intent with the OSE and publicly posting the location and results of drilling investigations and water quality characterization. Here's a brief description of the process:

Determine Aquifer Magnitude and Assess Mineral/Chemical Characteristics:

- The NM Bureau of Geology and OSE are working to define the boundaries of deep brackish water aquifers throughout New Mexico using existing and newly developed hydrogeologic information. This involves evaluating the volume of the aquifer below 2,500 feet, investigating potential connectivity to shallow surface and groundwater, and determining the overall quality of DBG and its suitability for various treatment technologies (collectively known as desalination) to make it "fit-for-use."
- Detailed hydrogeological surveys using test wells are crucial to understanding any aquifer's characteristics, such as: quantitative extent, transmissivity, recharge rate, dissolved mineral and chemical content, suitability for treatment, and to determine the feasibility and sustainability of DBG resource development.

Ascertain Aquifer Recharge/Sustainability and Legal Considerations:

- Ensuring sustainable use of deep brackish water resources is essential, since recharge may be limited in many basins; most DBG was emplaced many millennia ago and is not subject to recharge from surface or shallow groundwater.
- The OSE, after receiving a Notice of Intent, considers the hydrologic and legal implications of the NOI filing for development of DBG within the aquifer and potential effects on other water development proposals, as well as possible interference with prior surface and shallow water right entitlements.
- Protecting existing water rights and compliance with the terms of interstate water compacts are also critical considerations of the OSE review process.

Regulation of Well Construction, Operation, and Treatment Facilities:

- Regulation of well drilling/construction, operation, fluid transport, and treatment is closely monitored by the New Mexico Environment Department and OSE.
- Brackish water requires treatment to remove dissolved minerals and solids using various proven desalination technologies--reverse osmosis, ion exchange, and distillation being the most common methods, all of which require significant energy. Fortunately, New Mexico has ample surplus renewable solar and wind energy resources which makes desalination economically and environmentally feasible.
- Treatment technologies may also include nanofiltration, oxidation, and other processes to meet even higher water-quality standards than potable water.

Disposal of Treatment Concentrate and Other Environmental Considerations:

- Brackish water treatment involves separating water (known as "permeate") from the naturally-occurring dissolved minerals and solids (called "concentrate"). In addition to yielding useful water, this process produces concentrated “brine” residual that requires proper disposal or can be subject to additional treatment to yield useful minerals and by-products.
- Brine disposal options include evaporation in shallow ponds, with remaining solids buried in legal landfill sites, or deep-well injection into geologically isolated strata.
- Environmental issues related to accidental leaks or spills of brackish water and disposal of residual concentrate need to be considered to prevent possible contamination of surface water, groundwater, soil, and vegetation.
- Monitoring and spill detection systems for DBG pipelines is needed during transfer of fluid product to treatment facilities to prevent surface environmental damage.
- Pumping fluids from DBG aquifers has the potential to affect adjoining aquifers and existing shallow water rights, as well as the possibility of ground-surface subsidence, so monitoring during the removal and recharge process is essential.