QUANTITATIVE, QUALITATIVE, AND SPATIAL EVALUATION OF GROUNDWATER RECHARGE IN THE SALT BASIN, NM/ TX

Beth Ann Eberle¹ and Daniel Cadol¹

¹New Mexico Tech, 801 Leroy Place, Socorro, NM, 87801, US

The Salt Basin is a 13,034 square kilometer (5,033 mi²) hydrologically closed basin shared between southeastern New Mexico and western Texas. Due to the semi-arid nature of the Salt Basin, the local water resources are vital to the future of the basin, and potentially, of surrounding areas as well. The ongoing, two-year, three-part project is intended to evaluate the groundwater availability in the Salt Basin, help assess the local sustainability of current groundwater usage, and indicate the implications for future development. In doing so, the project aims to fill data gaps with geophysical analysis and new data collection, expand and update a groundwater model, and improve the understanding of the regional water budget. The water budget in this semi-arid context is strongly connected to the amount of groundwater recharging the local aquifer. Throughout the past sixty years, there have been numerous recharge estimates that range from 6,000 to 240,000 acre-feet per year. To constrain these estimates, geochemistry analyses from sampled well waters are utilized to visualize major flow paths, chemical evolution of waters, and velocities of the groundwater in the Salt Basin. Overall basin trends are evident when the major ion concentrations from the water wells are spatially mapped onto the basin. These evolutionary trends are also visualized and categorized with Piper diagrams and a matrix of pair-wise correlation plots. The velocities of the groundwater flow paths are estimated based on the corrected radiocarbon age dates of the waters. Evolution and speed of the water can be used to determine the quantity of groundwater moving throughout the system and infiltrating into the aquifer. This recharge estimate based on chemistry can be corroborated with a soil water balance model, the Python Recharge Assessment for New Mexico Aquifers (PyRANA). The soil water balance model approximates evapotranspiration (ET) and runoff, and subtracts those from precipitation, giving a net input into the system based on local climate, ecology, and topography. A proportion of the runoff may infiltrate into the beds of the ephemeral channels of the Salt Basin and produce additional recharge. However, constraining this proportion requires additional information, such as discharge measurements. Further, the chloride mass balance method will utilize the spatial geochemistry data for chloride and bromide to produce a recharge rate and another estimate of recharge. Independent of this recharge/geochemistry subproject, a groundwater flow model is being created to produce another recharge estimate utilizing Blaney-Criddle evapotranspiration estimates for consumptive use for active agriculture in the Salt Basin. These four groundwater recharge estimates from the overall project are expected to constrain the 234,000 acre-feet range of recharge estimates from previous studies in the Salt Basin. This project is funded by the U.S. Bureau of Reclamation and is being fulfilled by collaboration between students, faculty, and staff from the Earth and Environmental Science Department and New Mexico Bureau of Geology and Mineral Resources’ Aquifer Mapping Program.

References:

https://geoinfo.nmt.edu/geoscience/research/home.cfml?id=98

Keywords:

Salt Basin, groundwater recharge estimate

pp. 17-18
2021 New Mexico Geological Society Annual Spring Meeting
April 15-16, 2021, Virtual Meeting