Assessment of Safe Aquifer Yields within the Salt Basin in NM and TX: Approach and Model Update

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Overview

- Hydrologically closed basin with large salt flats in low elevations of TX

Goals:

- Assess the water resources in the Salt Basin region
- Refine hydrologic water budget of the Salt Basin, especially recharge
- Effects of increased pumping in NM
Overview

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Safe Aquifer Yields

- **Safe Yield** is the maximum pumping rate for which the consequences are considered acceptable.  
  (Alley, 1999 USGS)

- **Sustainability**: A decision-making concept describing development that meets the needs of the present without compromising the ability of future generations to meet their own needs.  
  (NMOSE Glossary of Water Terms)

  ![Diagram of Aquifer Yield](image)

  (Mark Person, 2021)

  ![Diagram of Aquifer Yield](image)

  (Sophocleous, 2000)
Dell City, TX Water Levels

Dell City, TX Hydrograph

Legend
- Select Dell City, TX Wells
- State Boundaries
Five Past Models

- Hutchison (2008)
- Ritchie (2011)
Past Model Parameter Summary

- hydraulic conductivities (feet/day)
- recharge and discharge (acre-feet/year)

Sources:
- Hutchison (2008)
- Ritchie (2011)
Current Model

• Updated the Geology
• Updated the Model Boundary
• Dynamic ET, water table depth dependent
• Stream Flow Routing (SFRs), focused recharge
• PyRANA based recharge
• Parameter ESTimation (PEST)
Recharge Evaluation

~40,000 acre-feet/year of recharge
Root Mean Squared Error = 0.023

~60,000 acre-feet/year of recharge
Root Mean Squared Error = 0.021

~80,000 acre-feet/year of recharge
Root Mean Squared Error = 0.015
$^{14}$C Groundwater Ages

(Ritchie (2011) and Sigstedt (2010))

(this study)
Recharge Evaluation

• Hutchison (2008)’s steady state models used 63,000 acre-feet/year
• DBS&A (2010) found that minimum evapotranspiration from the playas is 28,300 acre-feet/year
• DBS&A (2010) modeled recharge as 63,000 acre-feet/year with a range of (37,000 to 82,000 acre-feet/year)
• Shomaker (2010) calibrated model to 62,000 acre-feet/year
• Water level and age data does not contradict 60,000 acre-feet/year recharge model
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• 60,000 acre-feet/year of recharge selected
• Additional age data, as well as transient calibration, may guide adjustment
Future Model Plans

• Move to transient model
• Test hypothetical well fields in NM
Acknowledgments/References


- NMOSE Glossary of Water Terms


- Sigstedt, S. C., 2010, Environmental tracers in groundwater of the Salt Basin, New Mexico, and implications for water resources [Master’s Thesis]: Socorro, New Mexico, New Mexico Institute of Mining and Technology.


Thank you