RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

# Refining Interpretation Techniques for Determining Brackish Aquifer Water Quality

A review of current geophysical log analysis practices and challenges: Identifying future research needs and opportunities

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This literature and technology review helps to define current challenges and needs for specific future research efforts, and provides several recommended future research directions for brackish groundwater characterization using geophysical well logs.

### Mission Issue

If pursued, the various recommended future research and development efforts will help provide a means to more fully quantify the Nation's groundwater resources. This will help management of this valuable limited natural resource, and mitigate the need for more costly options for producing potable water in the future.


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## Problem

In recent decades, it has become increasingly apparent that one of the most important and limited natural resources in the United States is potable groundwater. Demand for fresh water has steadily increased over time, mainly due to sustained or increasing general population usage, commercial and industrial developments requiring large amounts of fresh water, and a lack of adequate recharge rates. Because of the demands placed on fresh groundwater supplies, there is a growing national interest and need to characterize and quantify brackish groundwater aquifer resources throughout the United States. Geophysical well log analysis offers great opportunities for addressing these needs, but comes with a set of its own unique technical challenges.

## Solution

This project included a literature and technology review of standards of practice to characterize aquifer water quality using bore geophysical logging. The final report summarizes parameters and approaches to assess existing log data, identifies common data gaps, discusses challenges related to analysis of log data, and makes recommendations for future research and development efforts.

Here, spatial sparsity of required log data is the most prominent challenge to comprehensive nation-wide groundwater characterization efforts, and so the identification of various research opportunities for addressing these and other technical data gaps is a key result of this review. These include identifying the added value in integration of additional data-types, such as airborne geophysical surveys, and the use of more advanced computational analysis techniques, including machine learning and advanced geospatial interpolations, for the sake of supplementing missing data and augmenting data analysis workflows.

***"This research effort has helped to develop a future roadmap for needed well log analysis R&D efforts, in order to improve our understanding of national brackish groundwater resources."***

Justin Rittgers
Geophysicist
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### Collaborators

Great Plains Region Oklahoma-Texas Area Office

Texas Water Development Board

### More Information

https://www.usbr.gov/research/projects/detail.cfm?id=7106

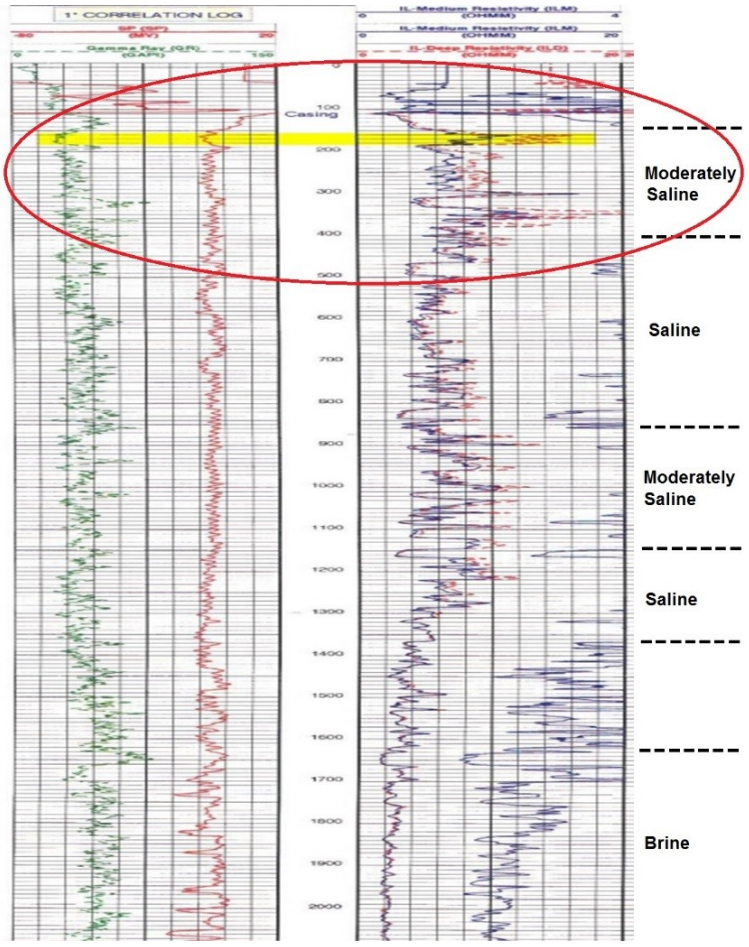
https://www.usbr.gov/research/projects/researcher.cfm?id=2810

## Application and Results

This report focuses on the general challenges, and it also presents various technology and research opportunities to help address these various interpretation challenges. This literature and technology review has led to the general conclusion that the most promising approaches to addressing the various challenges faced by well log analysts and stakeholders are invariably going to be hybrid techniques that use a variety of different, yet complementary, technologies to assess and characterize brackish groundwater resources.

## Future Plans

Future partnerships and collaborations between municipal, state and federal level stakeholders will enable a more robust and unified approach to addressing future water needs. This will involve the gathering and digitization of thousands of existing logs as well as to acquire and integrate additional data types and analysis techniques that can help make the best use of existing logs and bridge any data gaps. Research should enhance current geophysical techniques while also looking to other fields for insights into data processing and analytics techniques capable of improving the value of existing sparse well log data.




*Example of geophysical logs with relatively shallow groundwater exhibiting a desirable moderate salinity.*