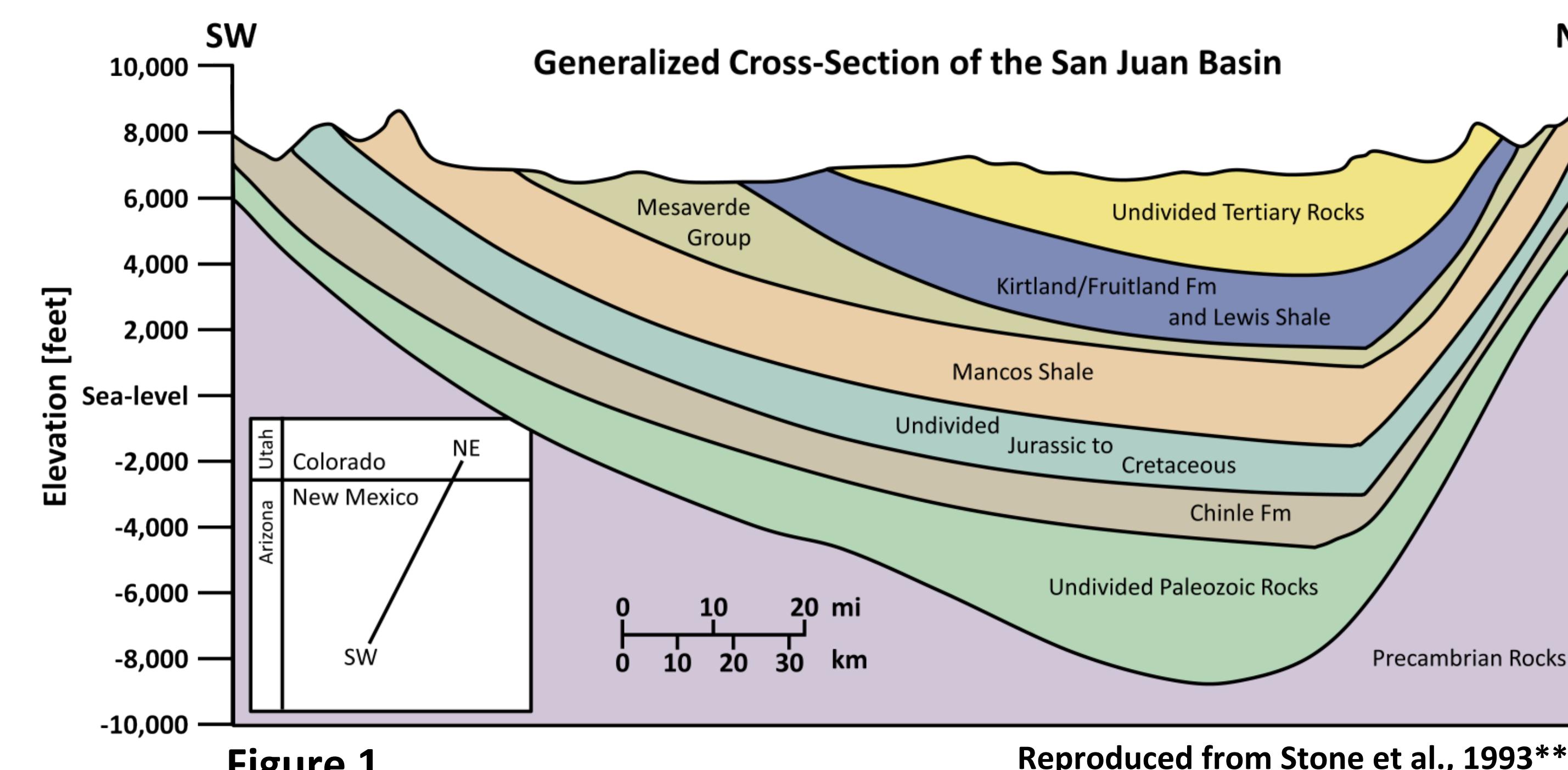


# Assessing Risk to Water Resources from Oil and Gas Activities in the San Juan Basin

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## 1. BACKGROUND

Due to increased development in the energy sector within the San Juan Basin, there is concern as to the regions ability to meet the increasing water demand in a manner that protects human health and the environment while sustainably meeting the needs of the variety of water users in the region. For oil and gas (O&G), a study of the 'Reasonable Foreseeable Development' (RFD) in Northern New Mexico\* states that between 2018 and 2037, "future activity will be primarily horizontal drilling for oil in the Mancos-Gallup play (Figure 1), with minor development targeted at natural gas production". Specifically, the study forecasts 3200 new O&G wells. Of concern is the forecasted water requirements for hydraulic fracturing, which could be up to 4.84 acre-feet (af) per well, and could average 581 af/yr through 2037.



Other potential future water demands include up to 6000 af/yr to include carbon capture and sequestration at the San Juan Generating Station, 77 af/yr for operations and maintenance of forecasted solar photovoltaic facilities, and 125 af/yr per MW equivalent of H<sub>2</sub> production from steam-methane reforming.

Taken together, the stress on the regions water supply is rapidly increasing and its implication is unknown. Of particular concern is the long-term cumulative effects of groundwater use and determining where and when potential shortages and/or conflicts could occur.

## 2. OBJECTIVE

This work uses a multi-disciplinary approach to identify, assess, and evaluate the impacts of future development to groundwater resources in the BLM Farmington District region. Of key importance is identifying the risk to water quantity and quality and establishing a baseline to better detect changing water conditions over time.

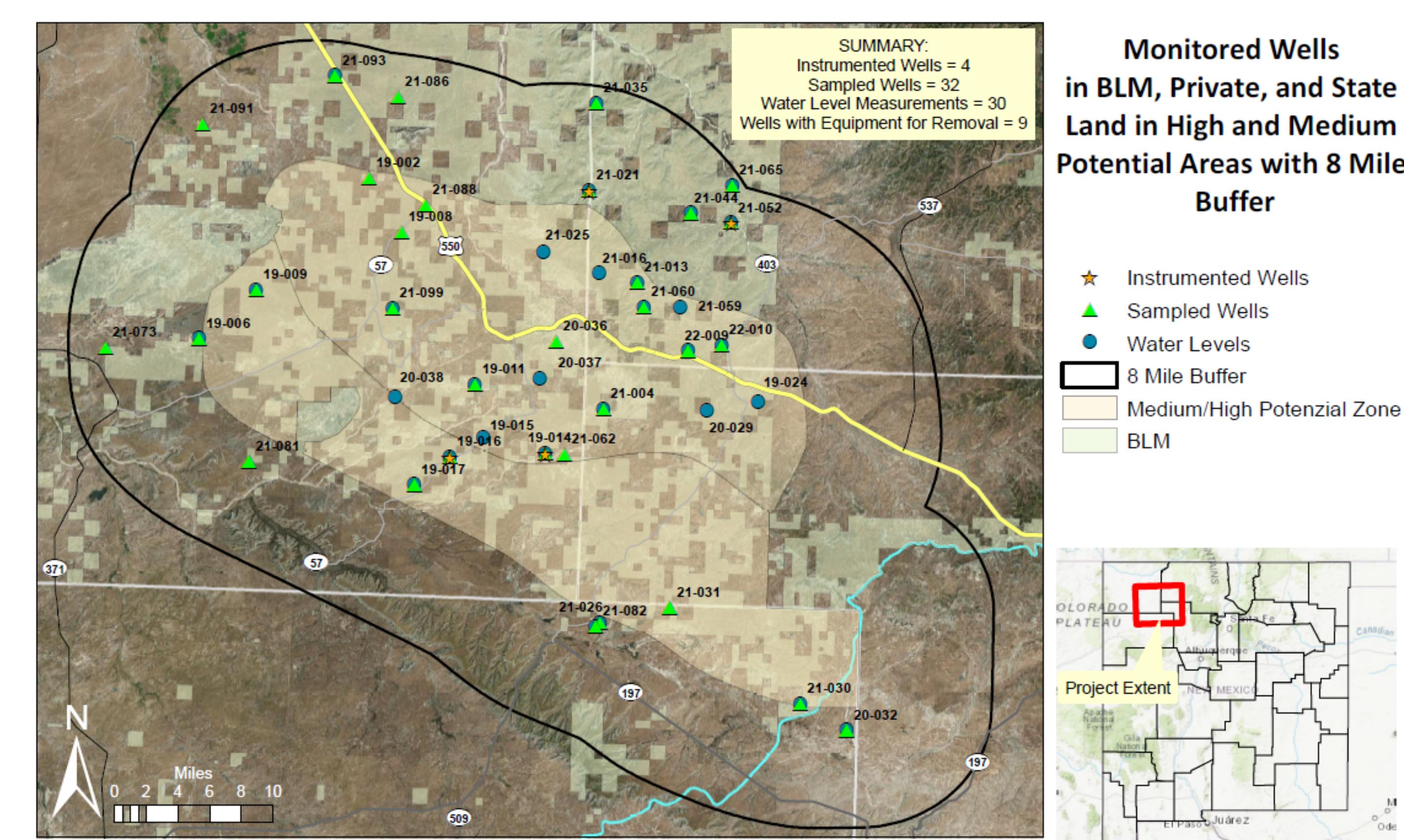


Figure 2

The project is focused on an area within an 8-mile boundary surrounding the "high" and "medium" O&G development potential areas as per the 2018 RFD and has performed reconnaissance on 143 wells, 40 of which were sampled for water quality indicators, 30 which were measured for depth to water, and 4 which have been instrumented for long-term monitoring (Figure 2).

## 3. PRELIMINARY RESULTS

Preliminary results of the water sampling indicate most of the waters are either sodium chloride (22 samples) or sodium bicarbonate (18 samples), which may indicate older waters (Figure 3).

TDS values range from non-detect (<1 mg/L) to 6800 mg/L, with a median of 1695 mg/L (Figure 4).

Conductivity values range from 130  $\mu\text{mhos}/\text{cm}$  to 14,000  $\mu\text{mhos}/\text{cm}$ , with a median of 2750  $\mu\text{mhos}/\text{cm}$  (Figure 4).

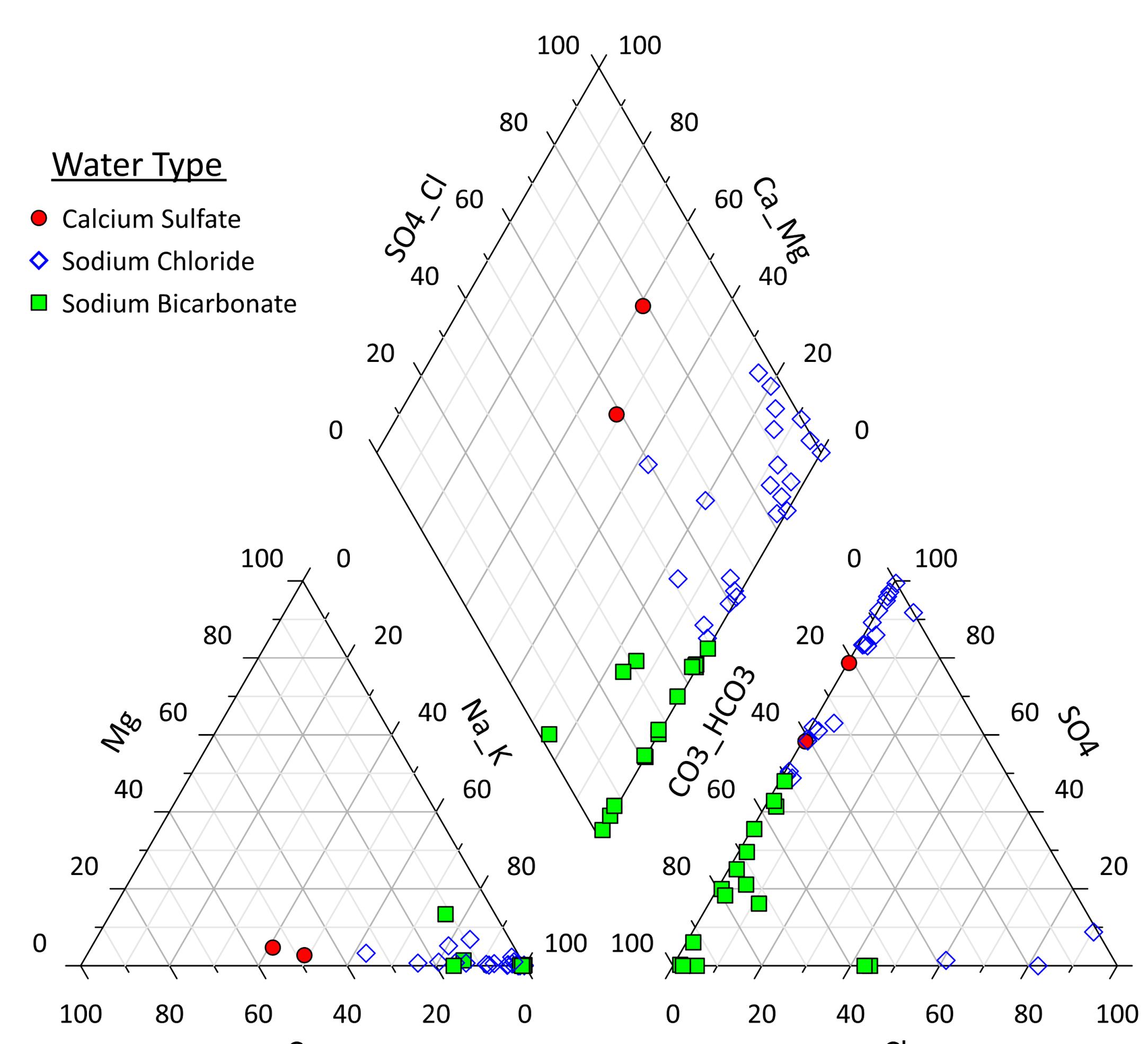


Figure 3

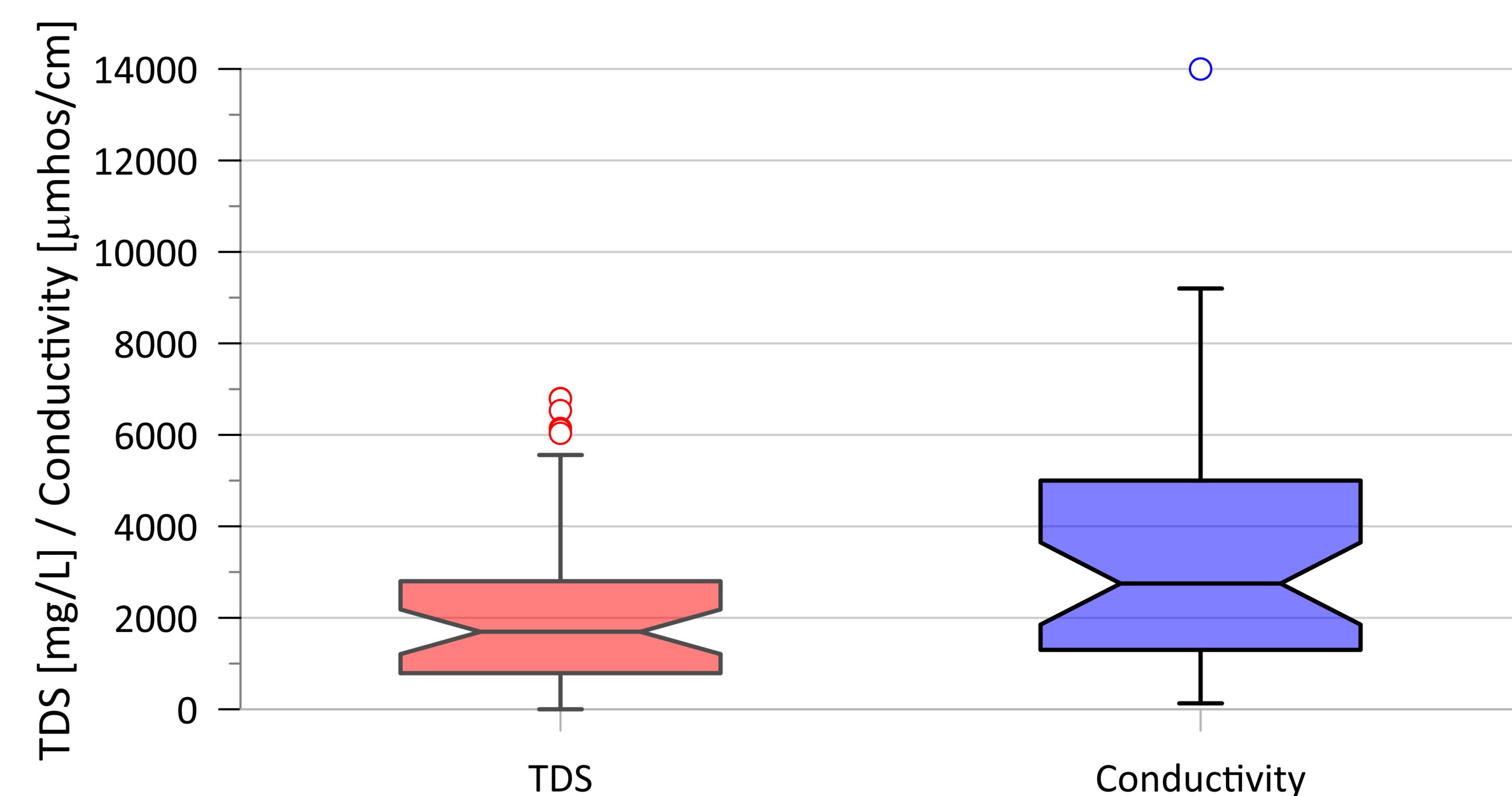


Figure 4

## 4. NEXT STEPS

Over the next 2 years, the project aims to instrument 6-8 additional wells with continuous level monitoring equipment. Further analyses will examine the spatial variation of the water quality and water productivity including variations by depth and by formation. Additional observational wells may be drilled in areas that are critical to our understanding and that lack available data.

### References

- \* Crocker, K., and Glover, J.F., 2018, Reasonable Foreseeable Development Scenario for Oil and Gas Activities, Mancos-Gallup RMPA Planning Area, Farmington Field Office, Northwestern New Mexico, Final Report, US Bureau of Land Management, 29 pp.
- \*\* Stone, W.J., Lyford, F.P., Frenzel, P.R., Mizell, N.H., and Padgett, E.T., 1983, Hydrogeology and water resources of San Juan Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Hydrologic report 6, 70 p.