

Deep Aquifers of the Four Corners Region

Four Corners Energy & Water Innovation Student Symposium

April 6, 2023

San Juan College School of Energy

Farmington, NM



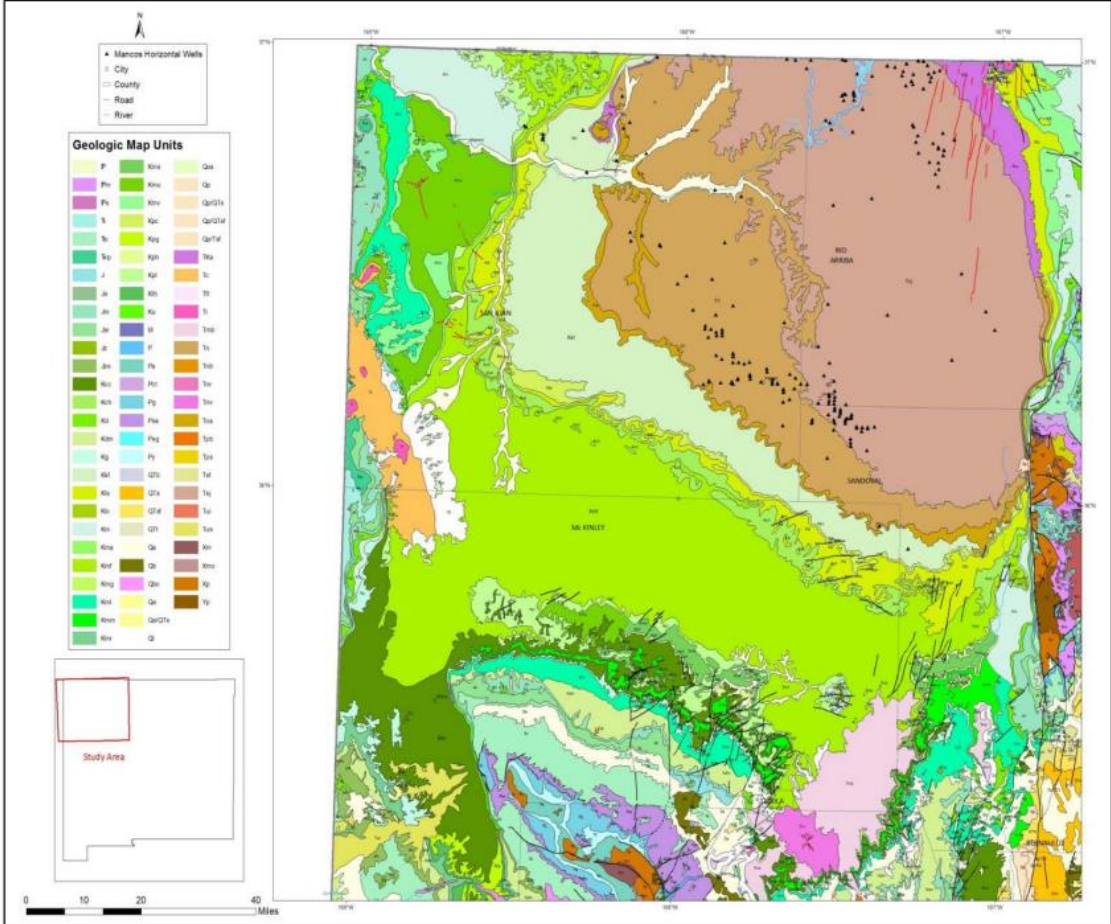
Katie Zemlick, Ph.D.

Hydrology Bureau Chief

New Mexico Office of the State Engineer

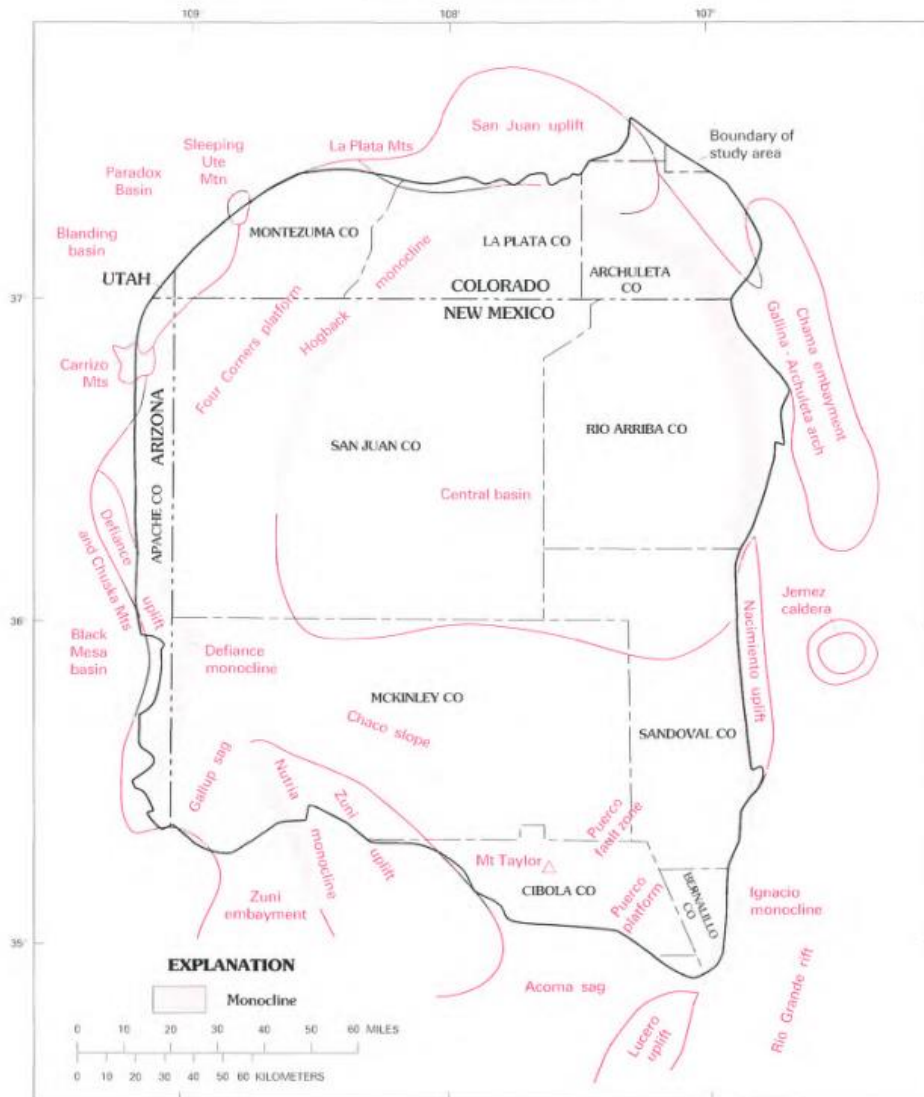
San Juan Structural Basin

Geologic Map of Northwestern New Mexico



Left: Craig, S. D., 2000, Geologic framework of the San Juan structural basin of New Mexico, Colorado, Arizona, and Utah, with emphasis on Triassic through Tertiary Rocks. U.S. Geological Survey professional paper; 1420; Right: Kelley, S., Engler, T., Cather, M., Pokorny, C., Yang, C.-H., Mamer, E., Hoffman, G., Wilch, J., Johnson, P., and Zeigler, K., 2014, Hydrologic assessment of oil and gas resource development of the Mancos Shale in the San Juan Basin, New Mexico, New Mexico Bureau of Geology and Mineral Resources OFR-566, 65 pp.

Structure



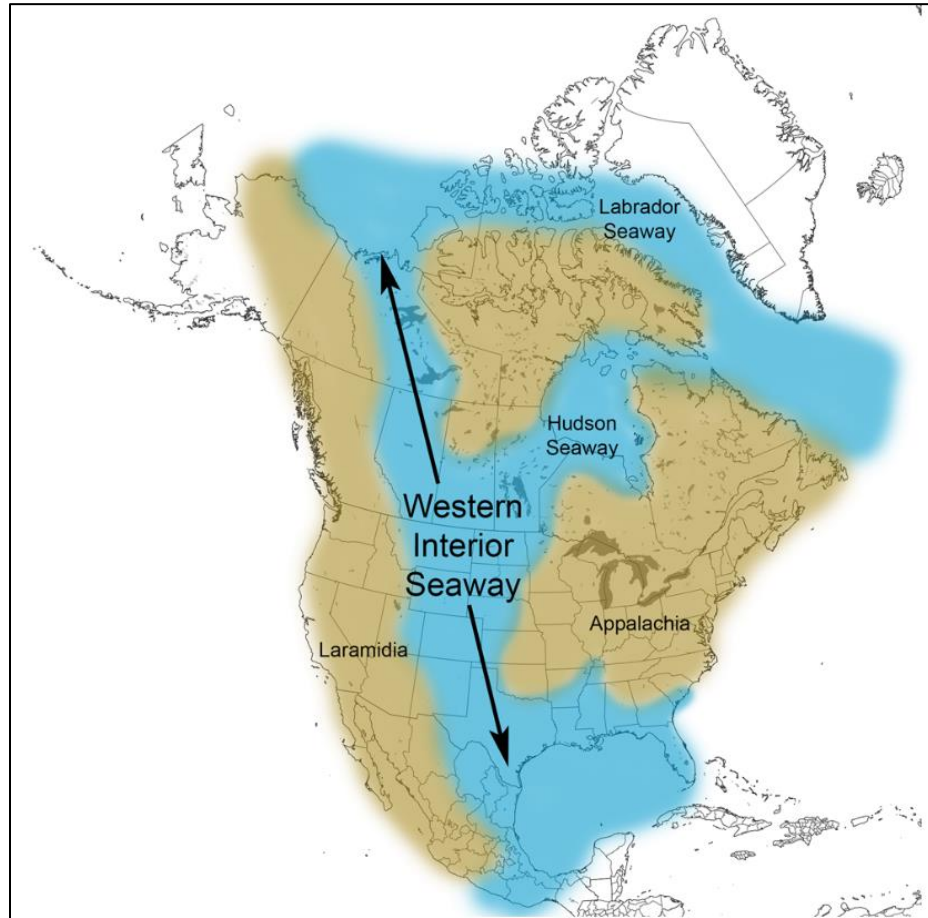
Hogback Monocline, Navajo Nation, Northern New Mexico

Left: Craig (2000)

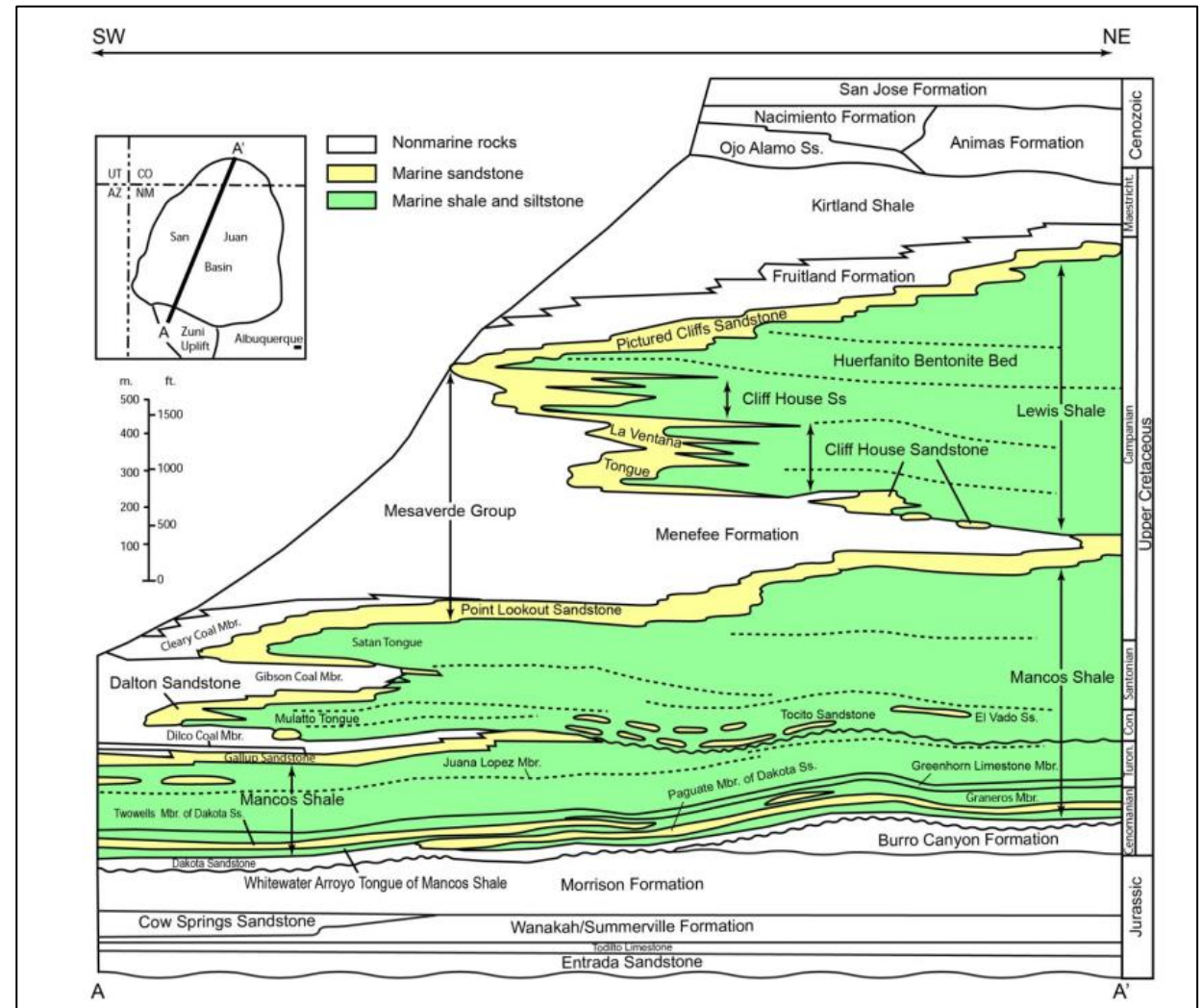
Right: https://farm4.staticflickr.com/3022/2780034363_999ae3cff1_b.jpg

Marine Deposition

Western Interior Seaway during the Cretaceous Period



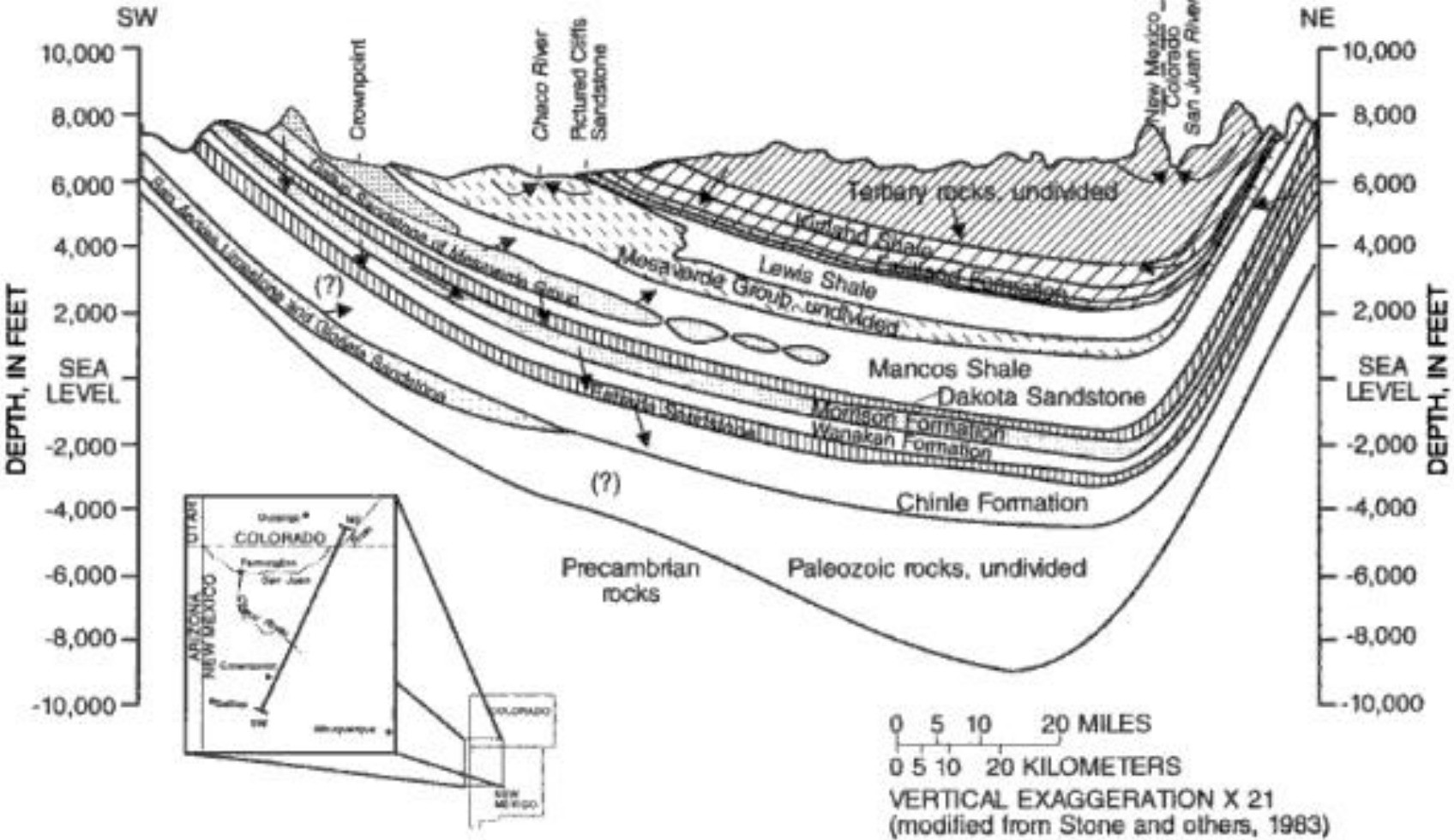
Stratigraphy of the Jurassic, Cretaceous, and Cenozoic rocks in the San Juan Basin. Modified from Molenaar (1977, 1989) and Kelley (2014)



Left: <https://osoceanfacts.files.wordpress.com/2021/04/wis.png?w=480>, Right: Kelley et al. (2014)

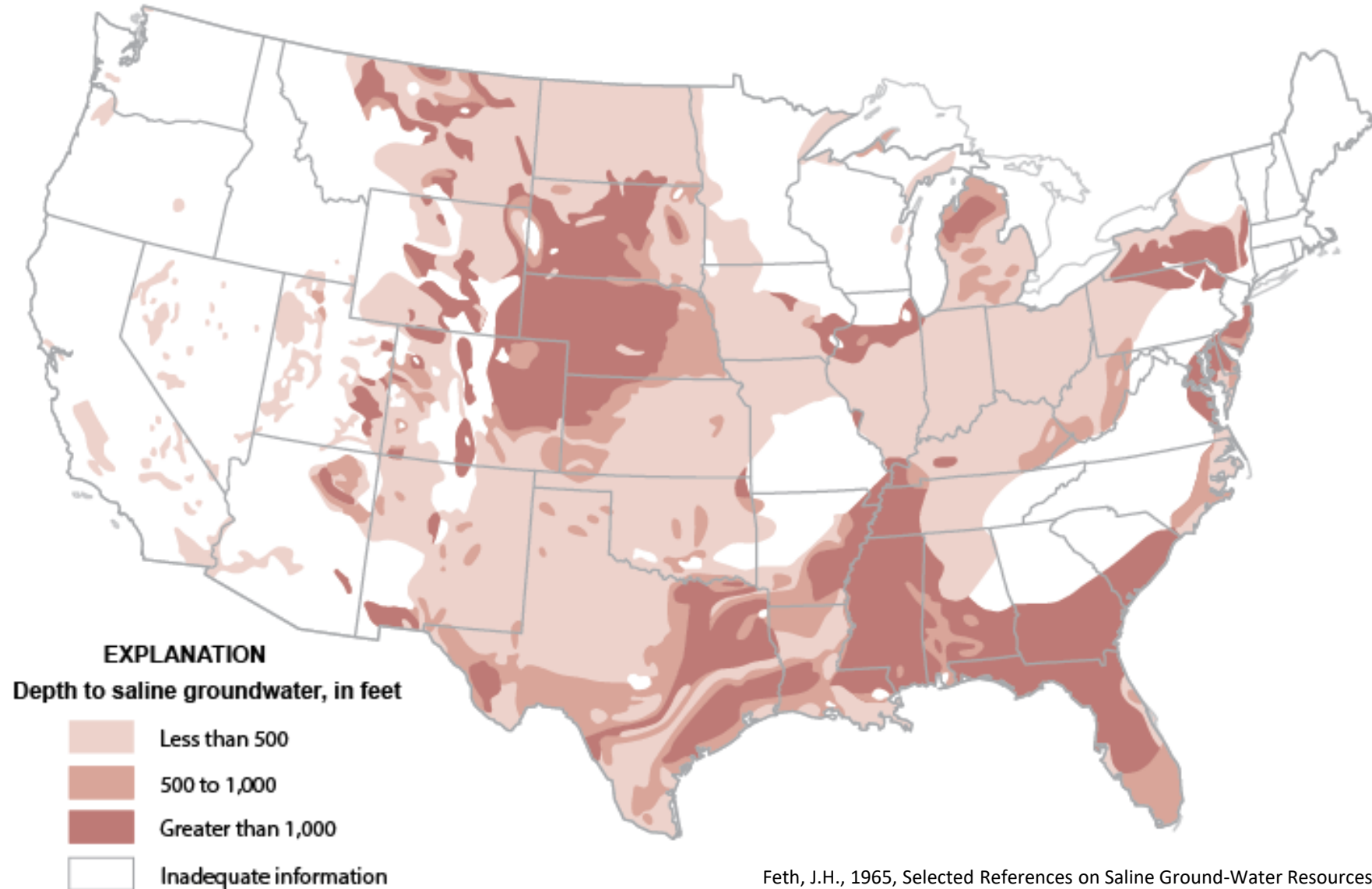
Basin Hydrogeology

“Generalized Hydrogeologic section of the San Juan Basin showing major aquifers (stippled), confining beds (blank, and direction of groundwater flow (arrows).” (Kernodle, 1996, Figure 6)



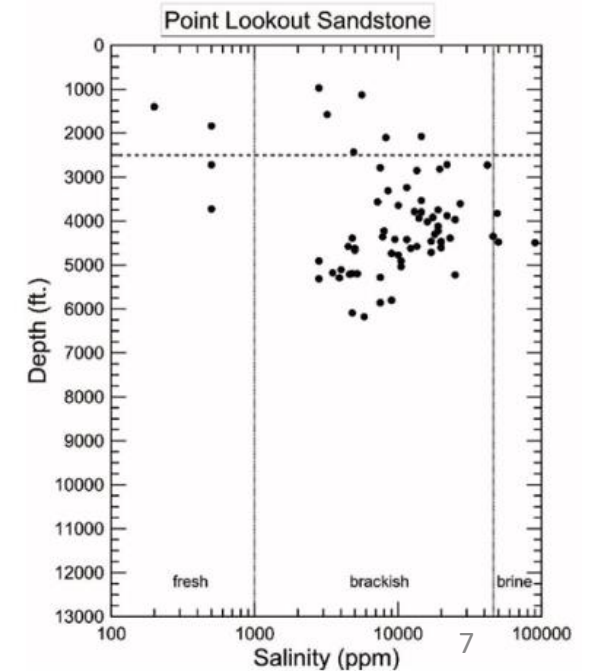
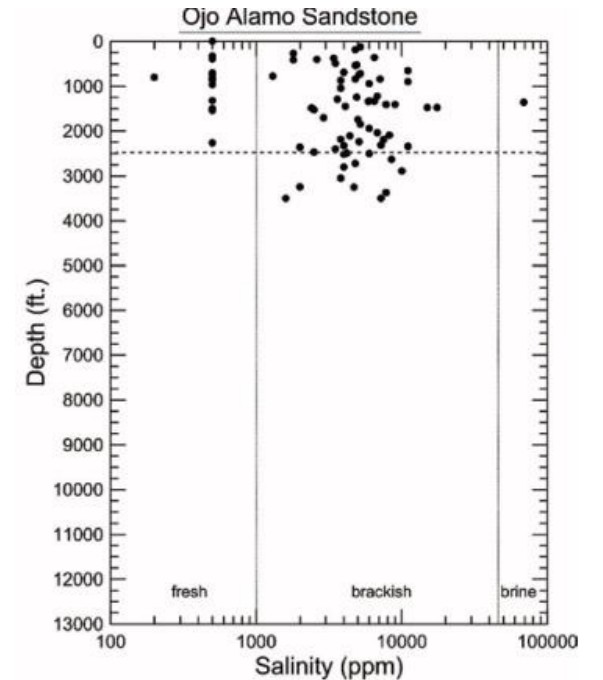
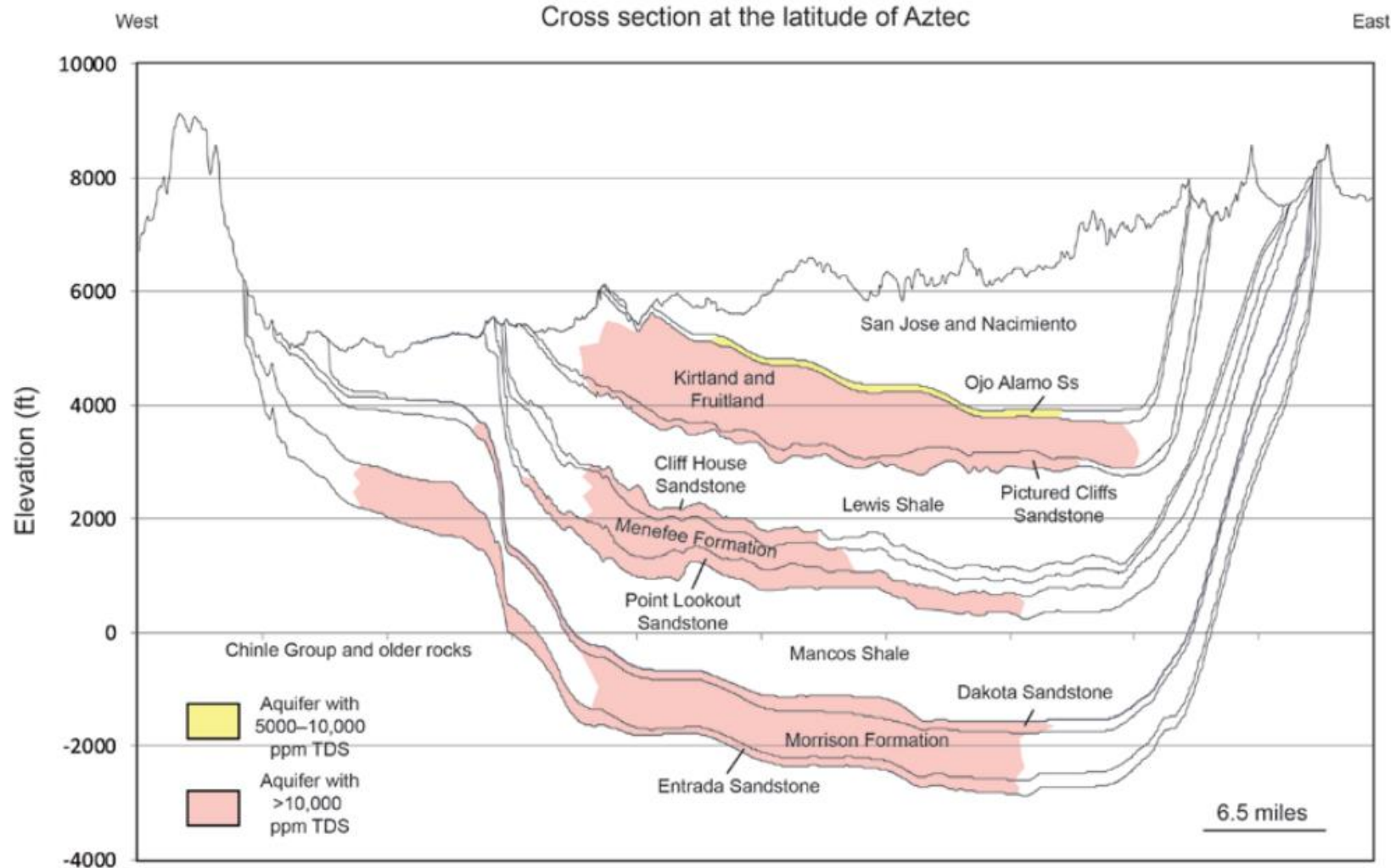
Kernodle, J. M., 1996, Hydrogeology and steady-state simulation of ground-water flow in the San Juan Basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geological Survey, Water-Resources Investigations Report 95-4187, 117 p.

Brackish Water

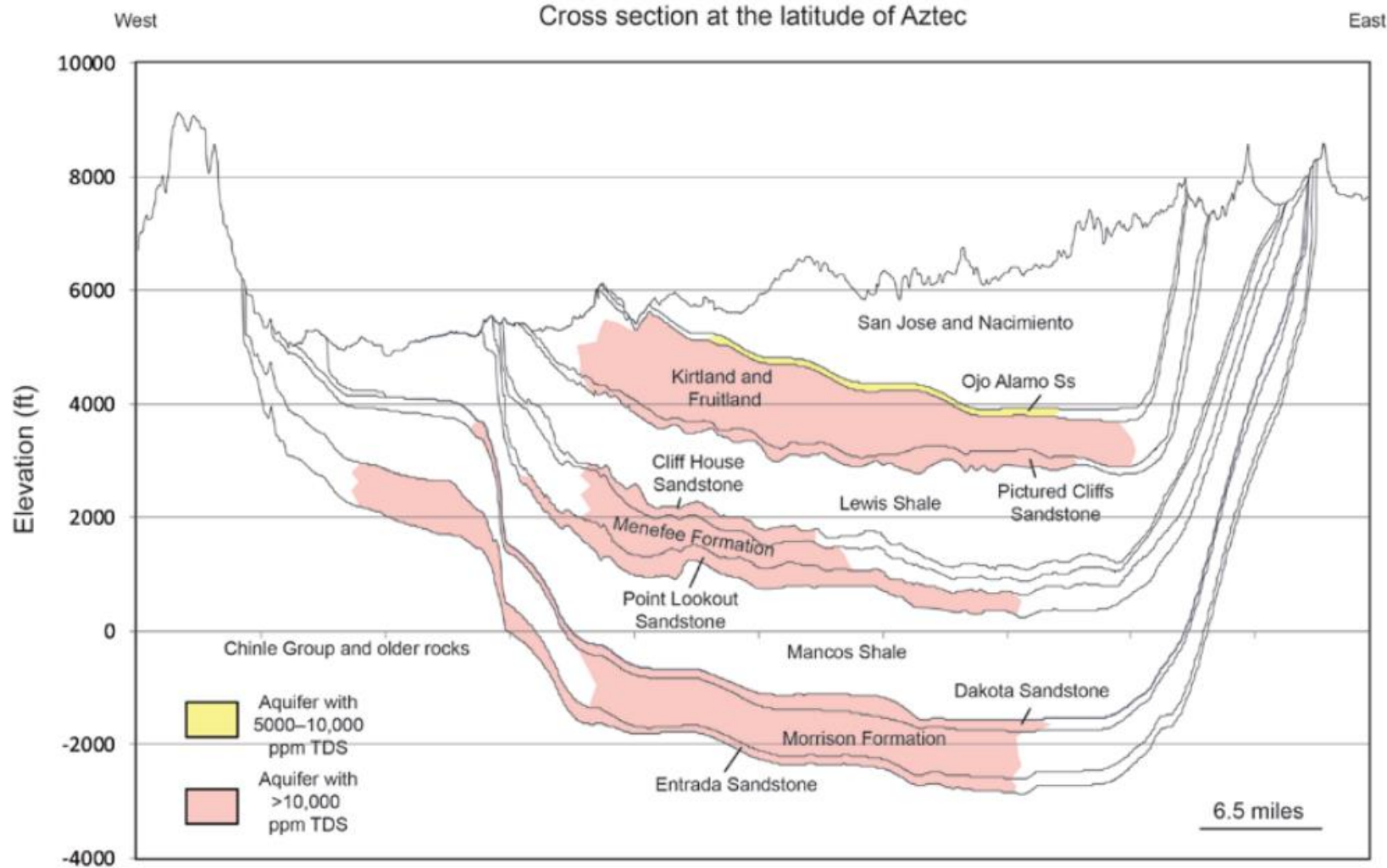


Feth, J.H., 1965, Selected References on Saline Ground-Water Resources of the United States, U.S. Geological Survey, Circular 499.

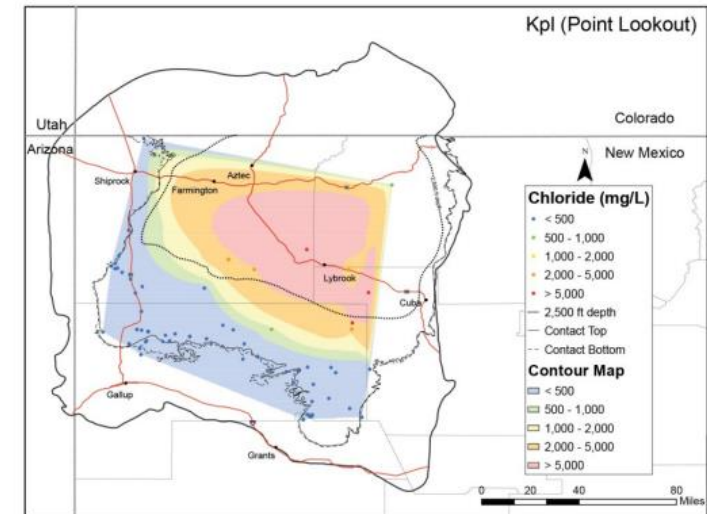
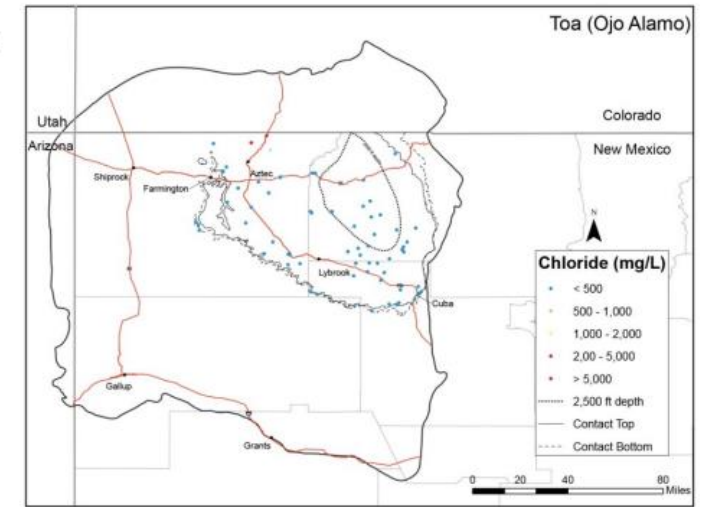
Brackish Water



Brackish Water



Chloride concentration (mg/L)



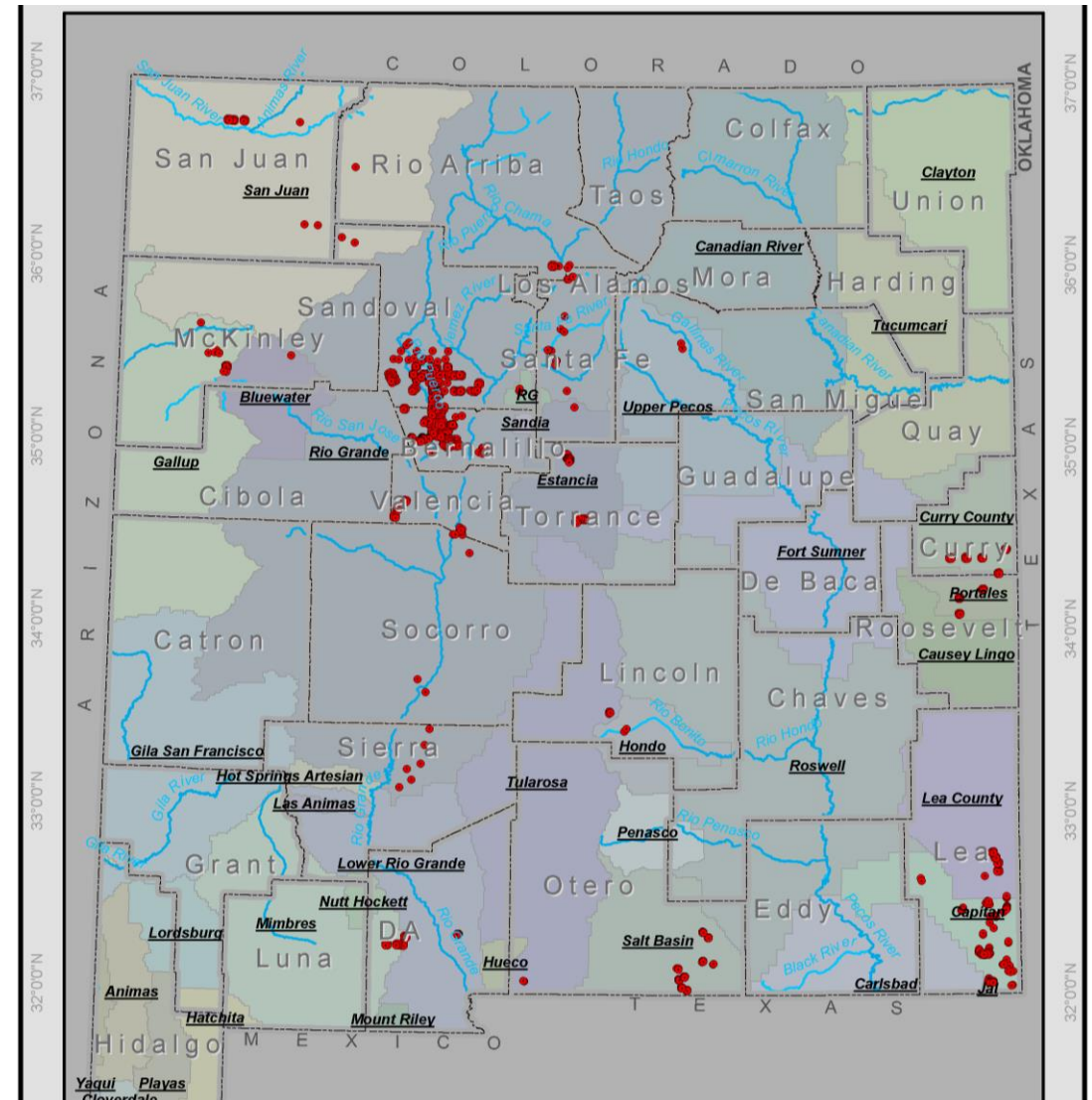
Deep Wells

72-12-25. Declaration of basin; nonpotable deep aquifers.

- A. An undeclared underground water basin having reasonably ascertainable boundaries that consists of an aquifer, **the top of which aquifer is at a depth of two thousand five hundred feet or more below the ground surface** at any location at which a well is drilled and which aquifer contains only nonpotable water, is subject to state engineer administration in accordance with Sections 72-12-25 through 72-12-28 NMSA 1978.
- B. If the state engineer declares the type of underground water basin described in Subsection A of this section, all appropriations of nonpotable water from that basin for:
 - (1) **oil and gas exploration and production, prospecting, mining, road construction, agriculture, generation of electricity, use in an industrial process or geothermal use** shall remain subject to Sections 72-12-25 through 72-12-28 NMSA 1978; and
 - (2) all other uses shall be subject to Sections 72-12-1 through 72-12-24 NMSA 1978.
- C. "Nonpotable water", for the purpose of Sections 72-12-25 through 72-12-28 NMSA 1978, **means water containing not less than one thousand parts per million of dissolved solids.**

DEEP WELL NOTICE OF INTENT (NOI)

- 763 NOIs filed through time
- Over 60 wells have been drilled or recompleted through time
- 12 applications (28 wells) in San Juan, all but one since 2018
- 34 applications (418) in the MRG
- All have been used by O&G so far
- Only a handful are pumping right now



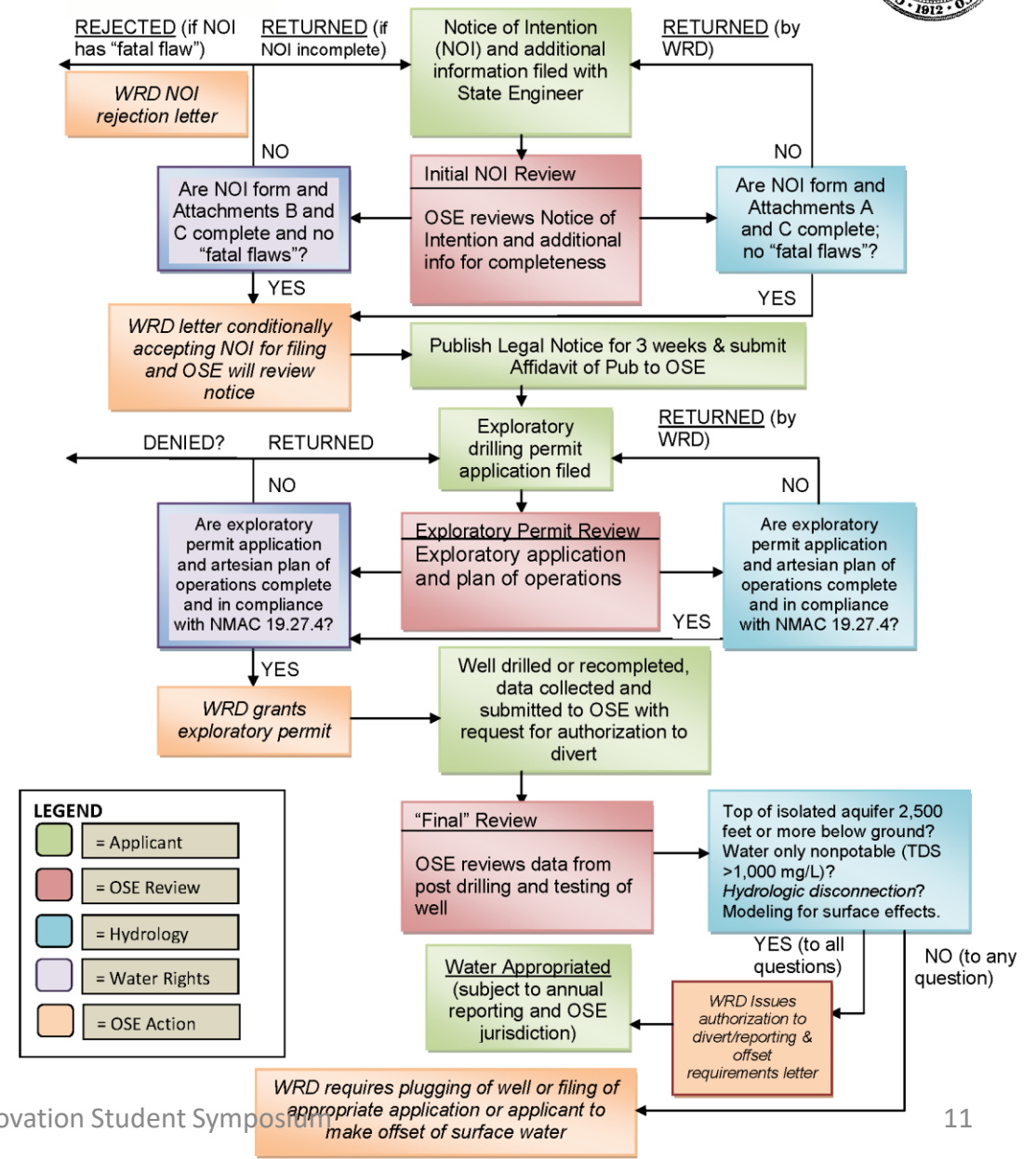


Deep Non-Potable Aquifer NOI process 03/01/2019

- Notice of Intention (NOI) and required additional information filed with State Engineer (19.27.1.72.A-E)
- Initial NOI Review - OSE reviews Notice of Intention and additional info for completeness (19.27.1.72.F)
- WRD letter conditionally accepting NOI for filing. WRD offers to review Notice of Publication.
- Applicant Publishes Legal Notice once a week for 3 weeks (19.27.1.72.G)
- Exploratory drilling permit application filed. Once 10 days past date of last publication, permit and Artesian Plan of Operations is approved.
- Exploratory Permit Review
- OSE reviews exploratory app/plan of operations (19.27.1.72.H)
- WRD grants exploratory permit
- Well drilled or recompleted, data collected and submitted to OSE
- Applicant submits a request for a "Final" Review and Letter of Authorization - OSE reviews data from drilling and water quality testing of well (19.27.1.72.L)
- **Top of isolated aquifer 2,500 feet or more below ground?**
- **Water only nonpotable (TDS >1,000 mg/L)?**
- **Hydrologic disconnection?**
- **Pumping scenarios calculated for 40 and 100 year intervals and surface effects are modeled.**
- If yes to all questions: WRD may issue authorization to divert/reporting requirements letter with offset to surface effects requirement.
- If no to any question: WRD requires plugging of well or filing of appropriate application (72-12-1 to 24) or requires applicant to purchase a surface water offset
- Letter of Authorization with offset requirements issued for Water Appropriation with reporting requirements (subject to reporting and continuing OSE jurisdiction) (19.27.1.72.M-P)



DEEP AQUIFER NOI PROCESS-Final Version 02/12/2019





YOUR WATER

WHAT WE DO

ONLINE SERVICES

INTERSTATE STREAM COMMISSION

NM WATER DATA ACT

LOCATIONS

CAREERS

OTHER APPLICATION FORMS AND FEES

Search files:

Form #	Description	Filing Fee	Open File
NOI Deep Well Flowchart	NOI Deep Well Flowchart	N/A	Open File
WR-02-ACK	Change of Ownership Acknowledgement Form (This extra acknowledgement page can be used if additional entities need to sign for either an individual or a corporation)	N/A	Open File
WR-30	Notice of Intention to Drill Wells or Recomplete Existing Wells to Appropriate Nonpotable Groundwater from an Aquifer the Top of Which is at a Depth of 2500 Feet or More Pursuant to NMSA 1978 §§ 72-12-26 and 27	\$25.00	Open File
WR-31	Application for Permit to Change the Indoor Use from a Domestic Well Point of Diversion to a Mutual Domestic Water Users Association Wells(s)	\$75.00 Per Move	Open File
WR-ERO	Notice of Intention to Construct Erosion/Flood Control Impoundment	N/A	Open File
WR-USR	APPLICATION FOR UNDERGROUND STORAGE AND RECOVERY (USR) PERMIT (NMSA 72-5A-1 through 72-5A-17 and 19.25.8 NMAC)	\$5,000.00 plus \$5.00 per acre-foot of the proposed annual storage capacity of the USR Project	Open File
lsw-03	Statement of Completion of Construction of a Livestock Water Impoundment	No Fee	Open File

All Well Construction forms must be directed to the district office that administers permits in that area.

WELL CONSTRUCTION FORMS

Search files:

[← BACK](#)

Well Construction Forms

Form #	Title	Open File
WD-08m	Multiple Monitoring Well Description	Open File
WD-08	WD-08 Well Plugging Plan of Operations	Open File
WD-09	Artesian Well Plan of Operation	Open File
WD-11	Plugging Record	
WR-20	Well Record and Log	

[GeoPro Water Well Grout Volume Calculator](#)

GUIDELINES AND HANDBOOKS

Search files:

[← BACK](#)

Guidelines and Handbooks

Title	Open File
OSE Approved Confined Casing List	Open File
OSE Sealant Table	Open File
OSE Well Plugging Handbook	Open File

Thank You

*Bisti/De-Na-Zin Wilderness
San Juan Basin, New Mexico*

Image: <https://spotlightorigin.files.wordpress.com/2021/07/bisti-de-na-zin-wilderness-landscape.jpg?w=1568>

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