PRODUCED WATER SOCIETY 2023

Produced Water Treatment and Reuse New Mexico 2023 Implementation Efforts

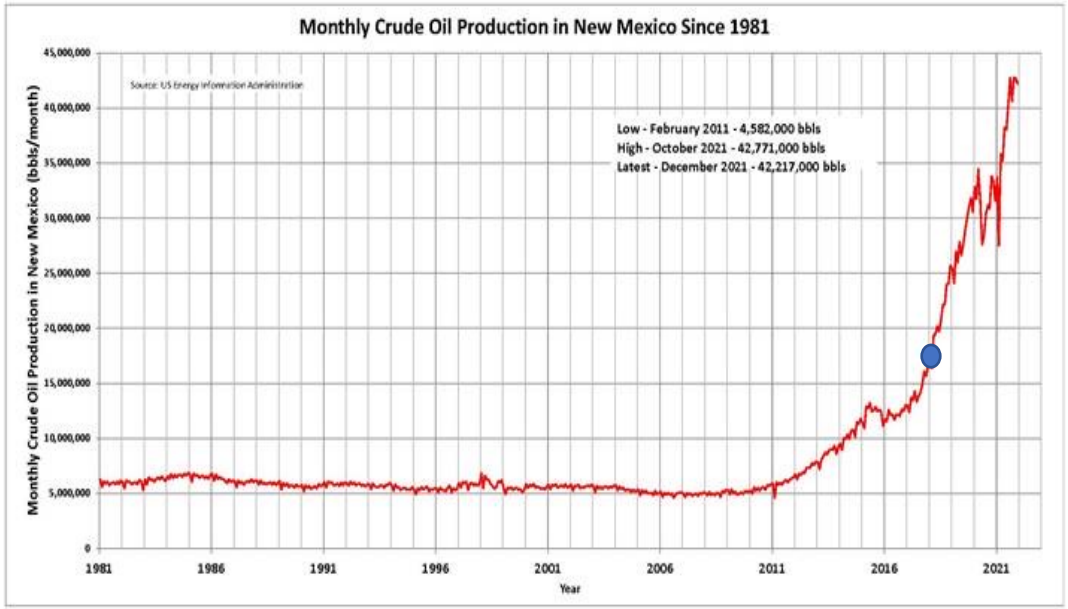
Mike Hightower, Director

New Mexico Produced Water Research Consortium

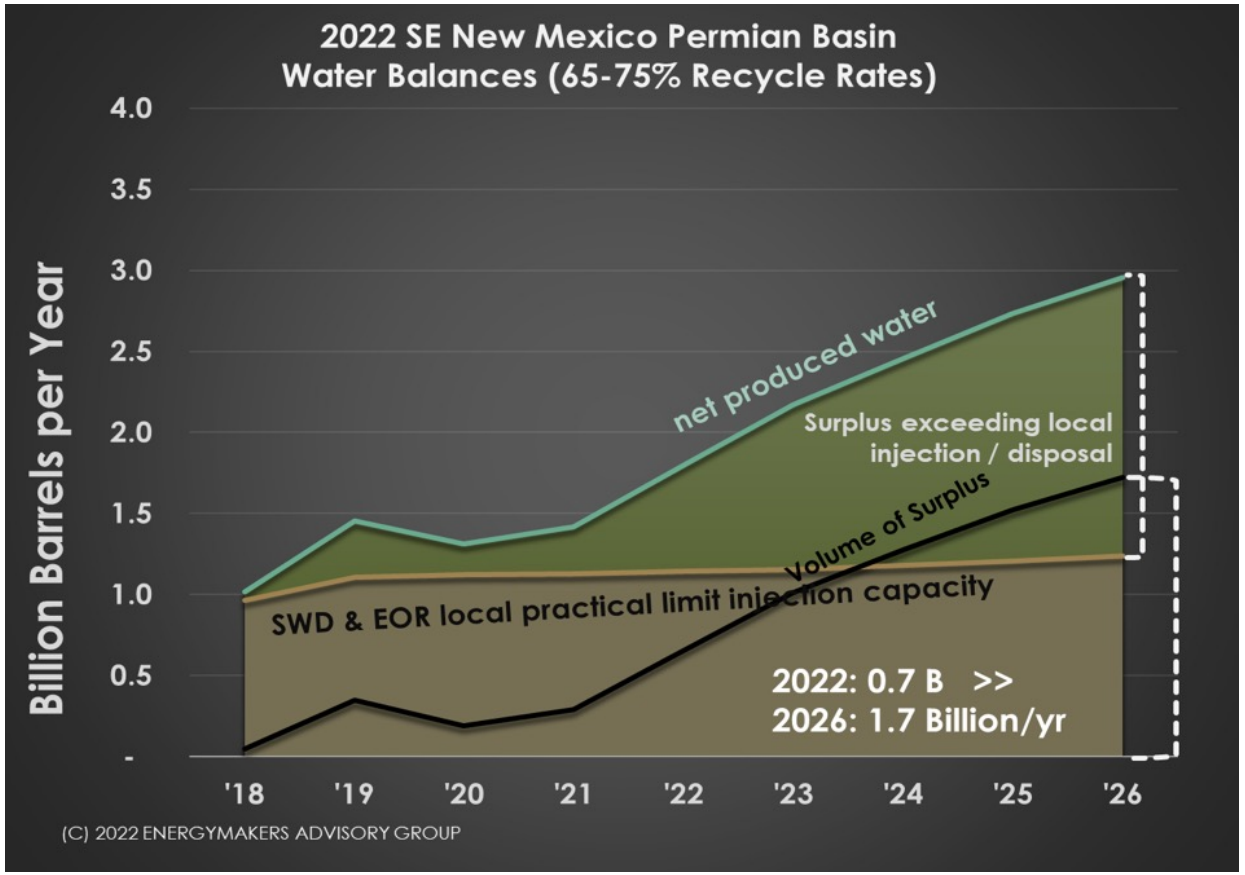
NM STATE NEW MEXICO PRODUCED WATER RESEARCH CONSORTIUM

2018 NM Produced Water Conference

- OCD estimated at 2018 volumes, New Mexico had 10 years of disposal space
- Produced water treatment is feasible if disposal is > $1.0-1.50/bbl



"Wall of Water"

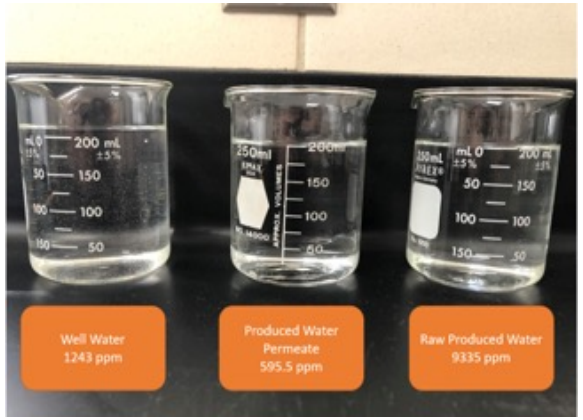


Produced Water Treatment Research

- PWS ‘Clean Brine Standard’
  - Bench and pilot-scale testing
  - No/low bulk chemical use
  - No/low voc emissions
  - Small footprint/scalable
  - <$0.20/bbl
- Treatment
  - Two successful one failed test
  - Four tests scheduled for 2023
  - Cooperative testing with TXPWC and Colorado in 2023

Permian Basin
100,000 TDS
SWD

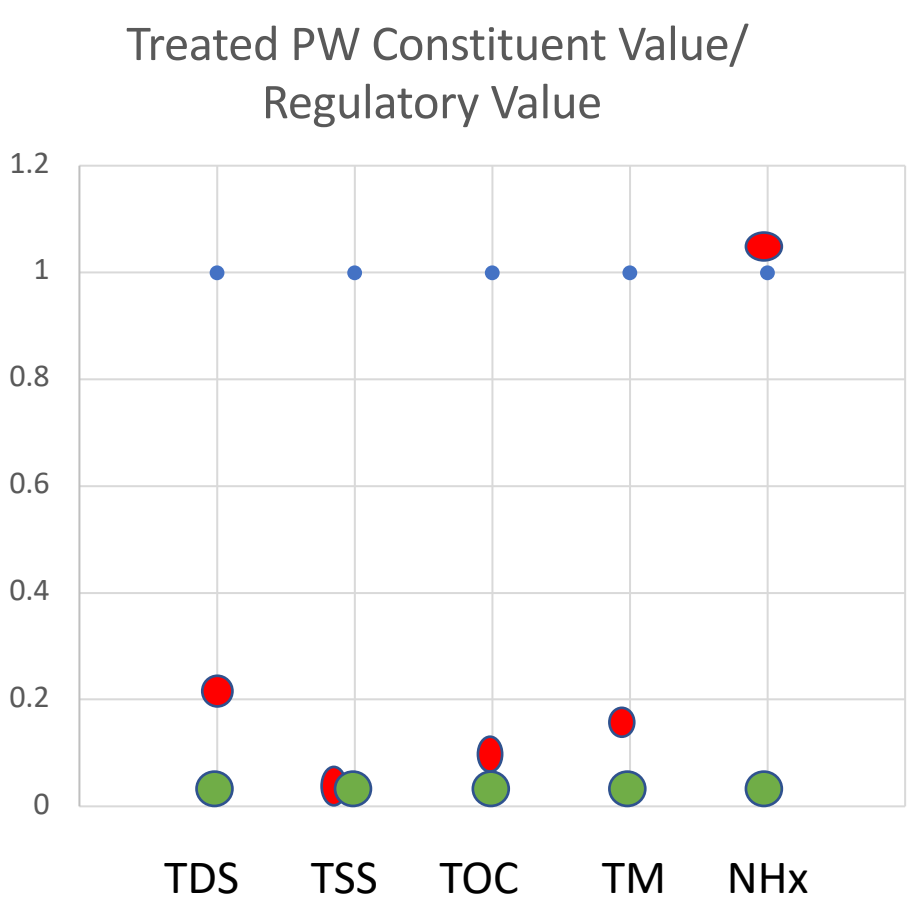
ZwitterCo Permian Basin -100,000 TDS SWD



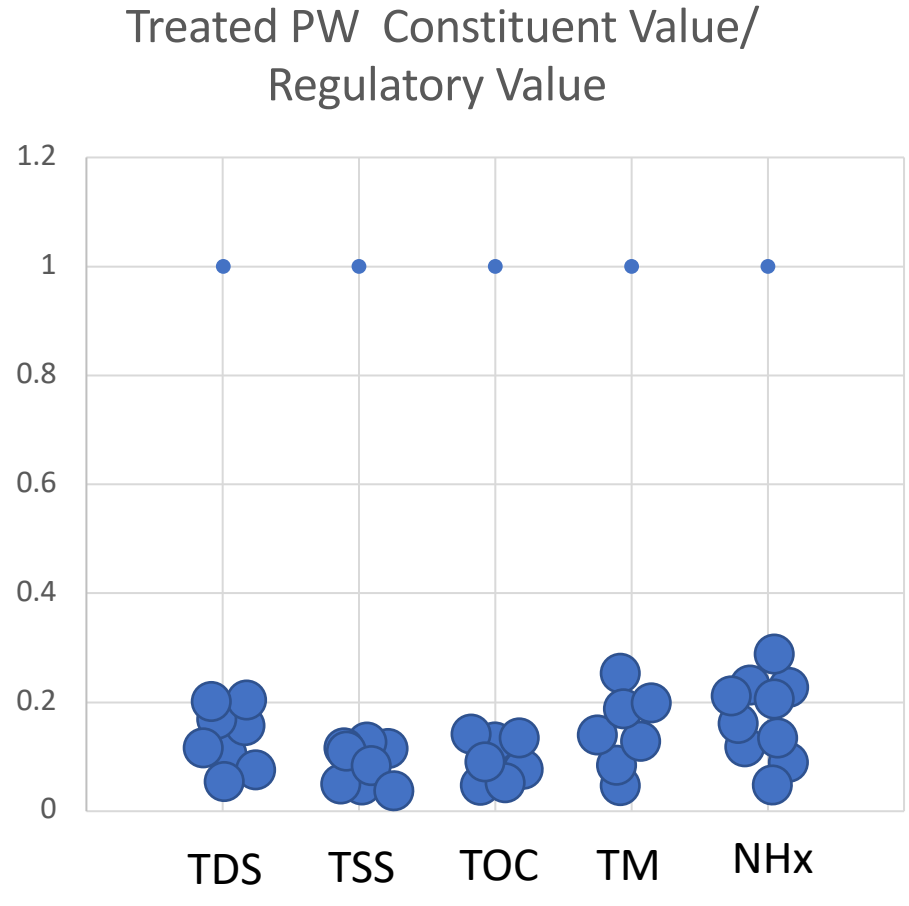
San Juan Basin
10,000 TDS
RO Treated PW

Regulatory Hurdle – Need More Treatment Data

(Need curated collaborative efforts between NM, TX, CO, OK, WY)



Current NM Curated Pilot Data



Needed NM Curated Pilot Data

10 data points ?

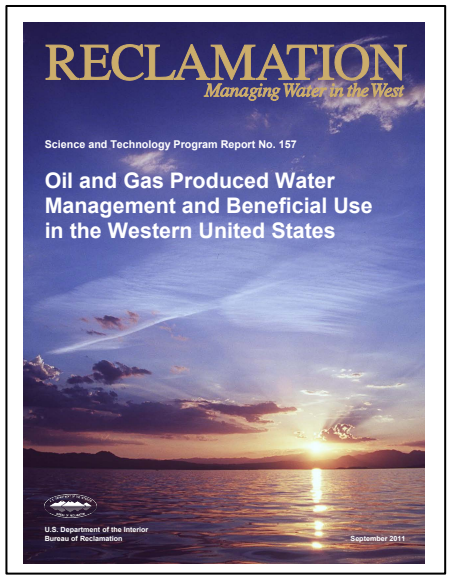
Also collecting similarly Normalized Risk and Toxicity Data

NM Treated Produced Water Reuse in 2023

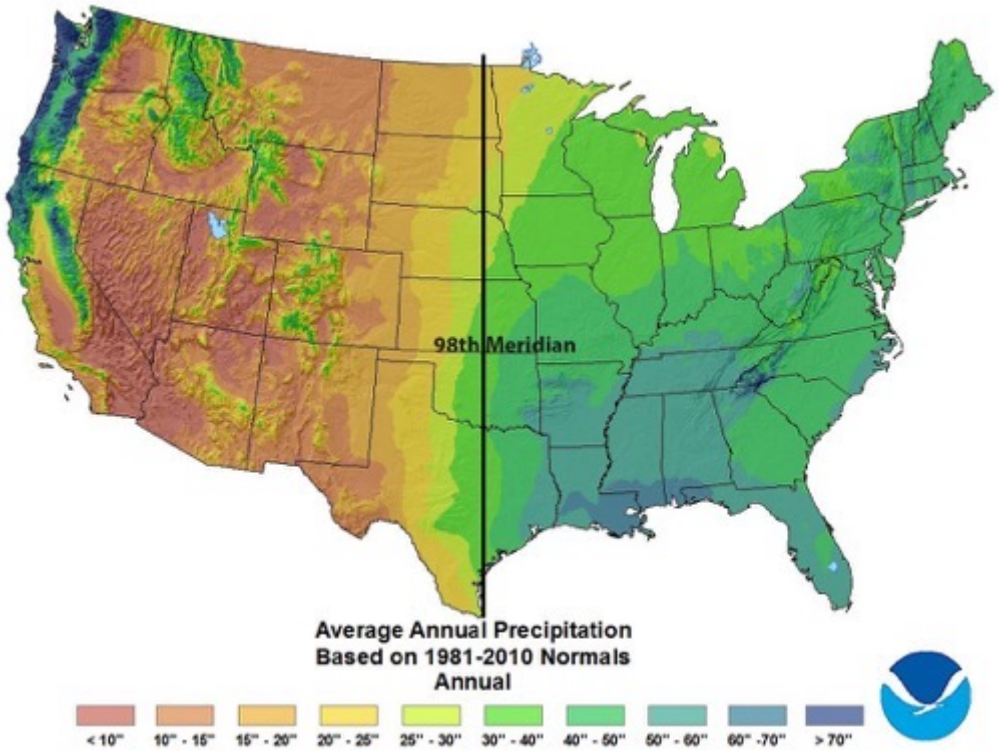
- Working with OCD on plugging hundreds of orphaned/abandoned wells (possibly up to 2,000)
- ~ $20 M of state funding, approximately 4 wells per week in 2023
- Paying $2/bbl for fresh water and $3/bbl for 10# brine,
- 3 operational areas in the Permian, 500 bbls/day – talking to technology groups
- 2 sets of water data/mo from 3 areas, for 6 months = 36 data points in 2023!

Produced Water Reuse - Ag Applications

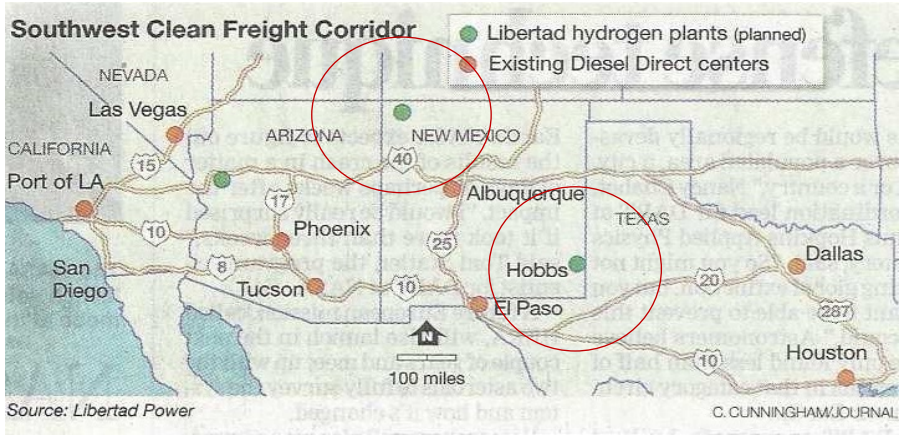
- 40 CFR 435 (Subpart E) – Produced water reuse exception west of the 98th Meridian, produced water can be discharged <u>if used for agriculture and is agricultural quality</u>



BOR Report 157, 2011

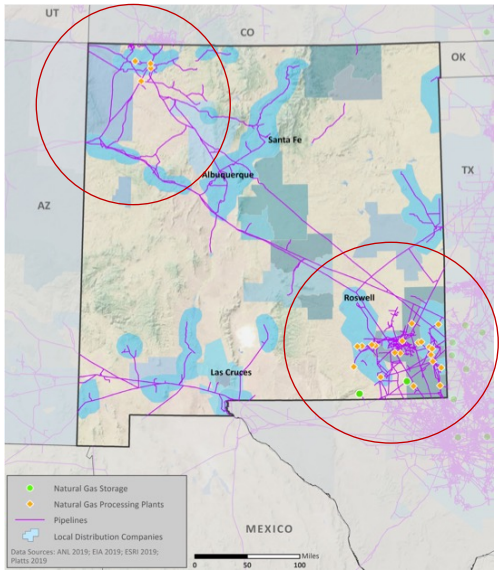


NM Produced Water Reuse Opportunities



50% of U.S. imports into LA/Long Beach

2 of 3 gas pipelines to CA



Intersection of all 3 US E- Grids

Lowest levelized cost of wind and solar

SWD, EOR, pipeline, natural gas infrastructure

NMED - Non Discharge/Closed Loop

- Greenhouses
- Data Center cooling
- Industrial

OCD – Inside oil and gas

- Blue and Green Hydrogen – transportation fuel, heating, electric grid reliability

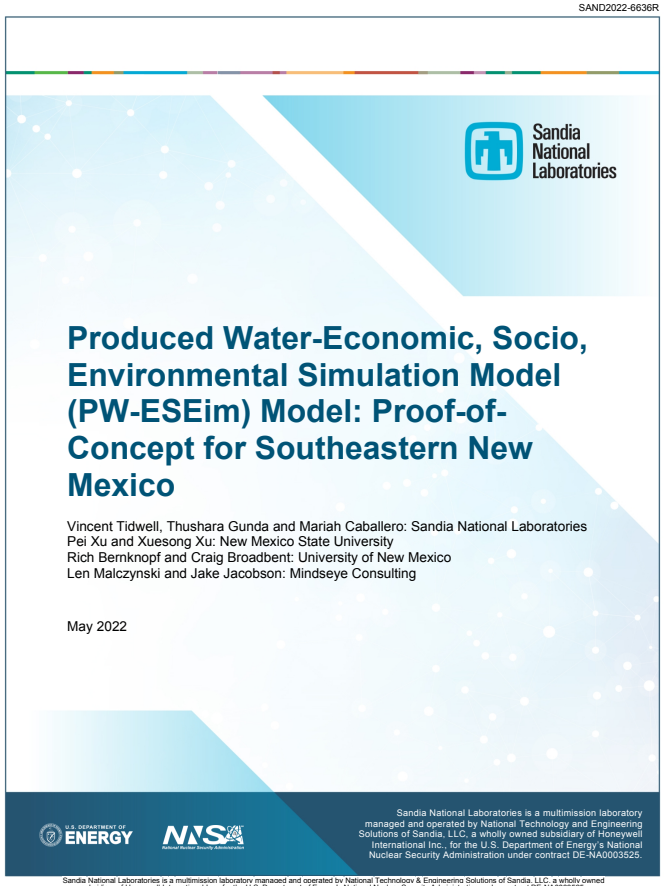
The Roosevelt Project
A New Deal for Employment, Energy and Environment

- Orphaned wells, plugging and abandonment, well pad restoration – thousands

Treated Produced Water Ownership

- In NM treated produced water water is owned by the treating company

Quantifying ESG for Produced Water Reuse



(Sandia, May 2022)

NEED

- System dynamics – based socio-economic model with Sandia, funded by DOE
- Provides quantitative ESG metrics
- Model being applied for Hydrogen Hub quantitative EEEJ requirements

CHALLENGE

- Current ESG metrics include waste reduction benefit of PW reuse, but not the economic and social benefits of PW reuse.
- Need to work with ESG rating groups

Dr. Bruce Thomson - Professor emeritus at UNM – PhD from Rice during the Pleistocene

First company to desalinate PW to drinking water quality by 3/13/26, his birthday).

Conditions:

- Q > 5 gal/min
- Permian Basin water, TDS > 100,000 mg/L
- 75% recovery
- 6 months operation
- 75% reliability (i.e. 137 d of operation)
- No cost, energy, or other criteria

Prize: Dinner for 4 (plus him) at the infamous Frontier Restaurant in Albuquerque, with Mike Hightower (NMPWRC) and Laura Capper (also Rice grad)

Thanks – Questions?

Mike Hightower, Director

NM Produced Water Research Consortium

505-859-1563, mmhightower@q.com

NM STATE NEW MEXICO PRODUCED WATER RESEARCH CONSORTIUM