PRODUCED WATER SOCIETY SEMINAR 2022

US EPA National Water Reuse Action Plan and State Collaboration on Produced Water Treatment and Reuse

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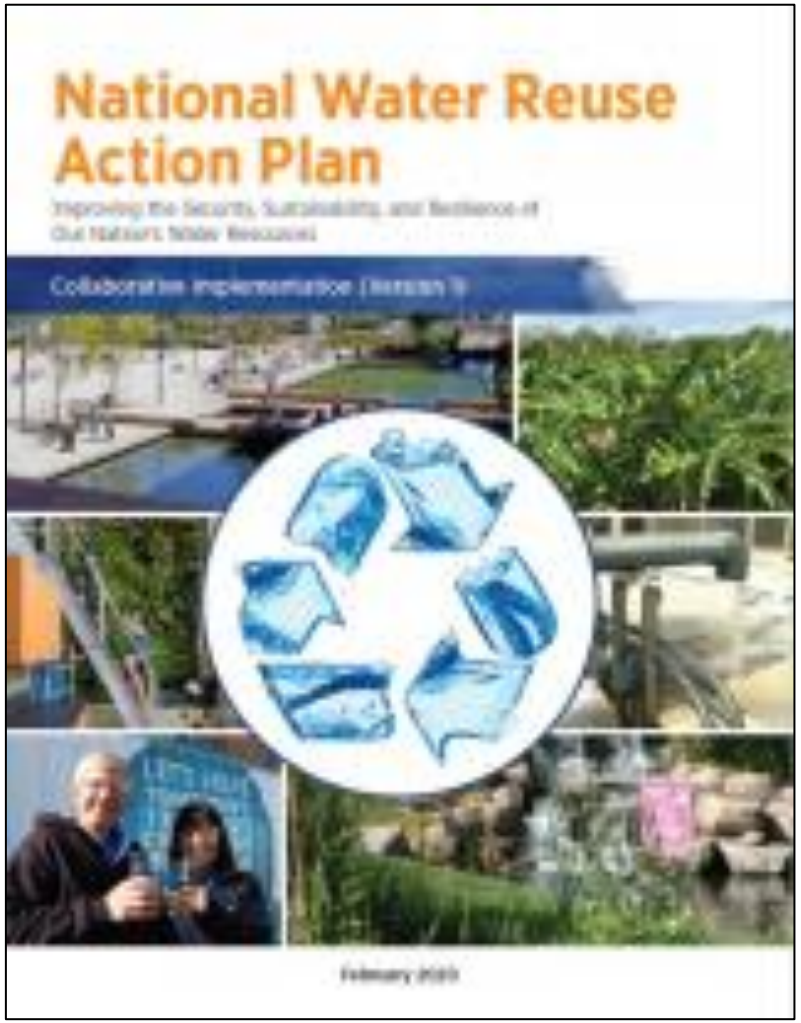
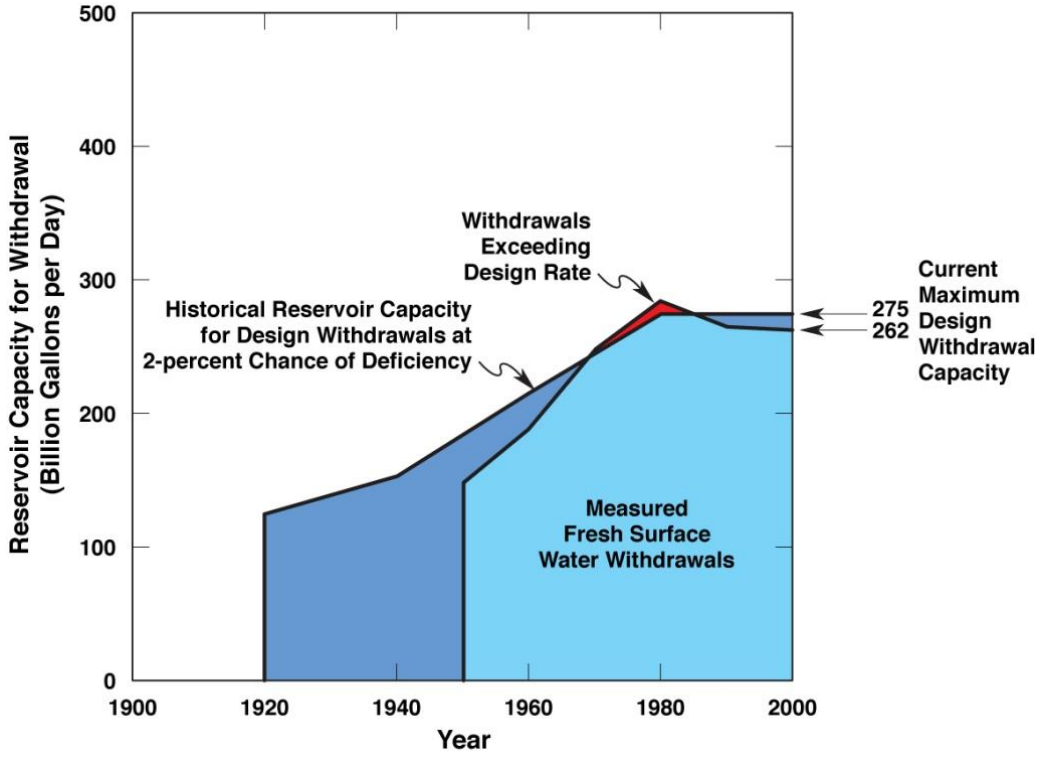
NM STATE NEW MEXICO PRODUCED WATER RESEARCH CONSORTIUM

EPA National Water Reuse Action Plan - Feb 2020



- Focus on fit-for-purpose treatment and reuse of waste water
- In five major areas:
  - Thermo-electric cooling water
  - Agricultural waste water
  - Municipal waste water
  - Produced water
  - Storm water
- EPA asked the NMPWRC to lead research efforts for the treatment and reuse of produced water
- NMPWRC has established a state coordinating council to improve collaboration and funding opportunities (NM, AZ, TX, WY, OK, CO, PA)

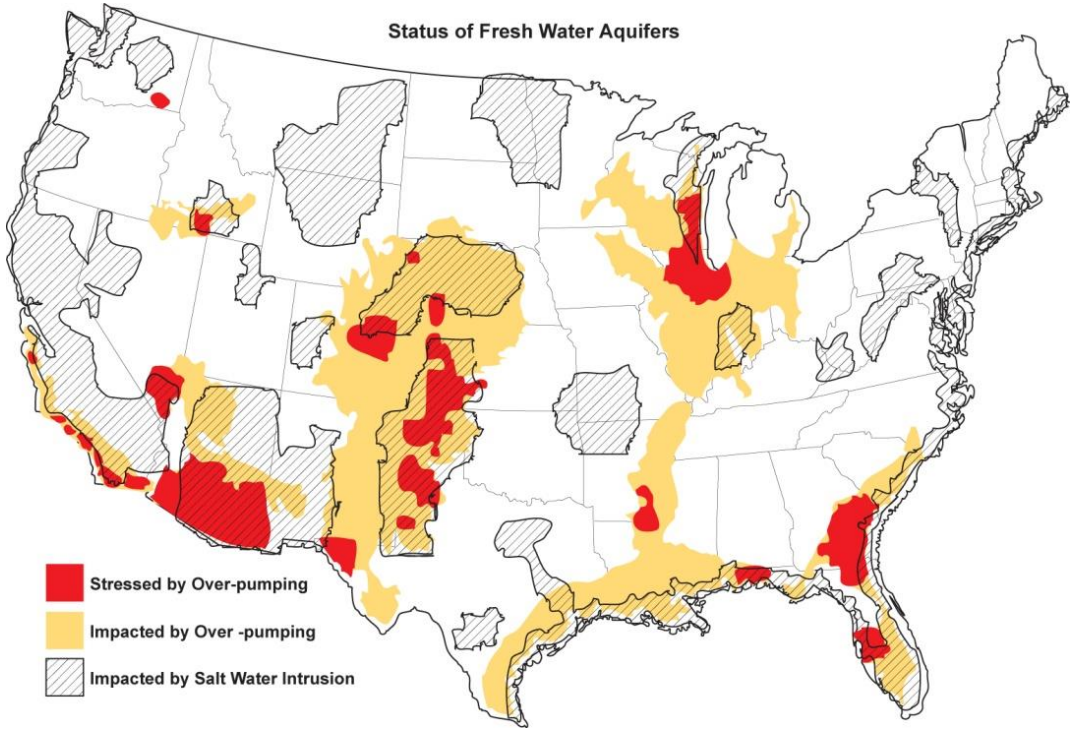
Fresh Water Issues Driving Waste Water Reuse



(Based on USGS WSP-2250 1984 and Alley 2007)

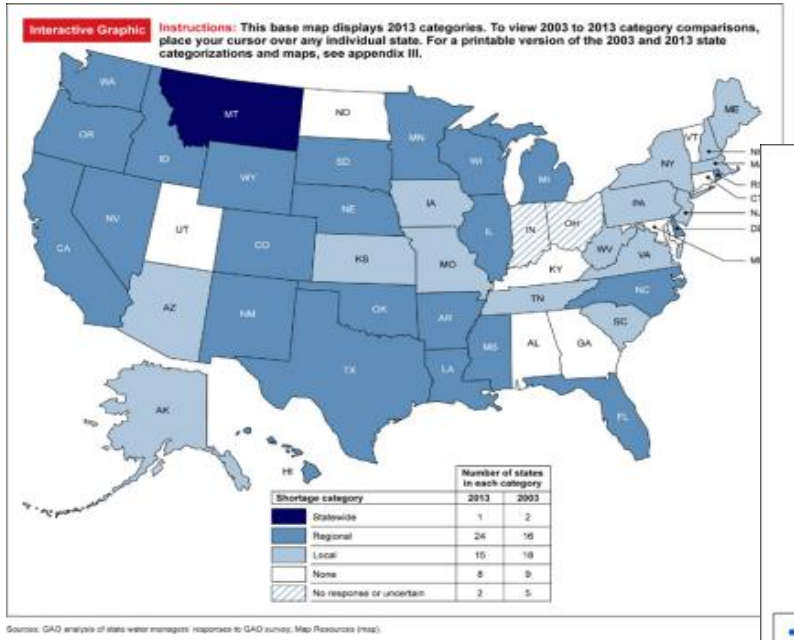
- No new surface water storage capacity since 1980

- All major groundwater aquifers overstressed

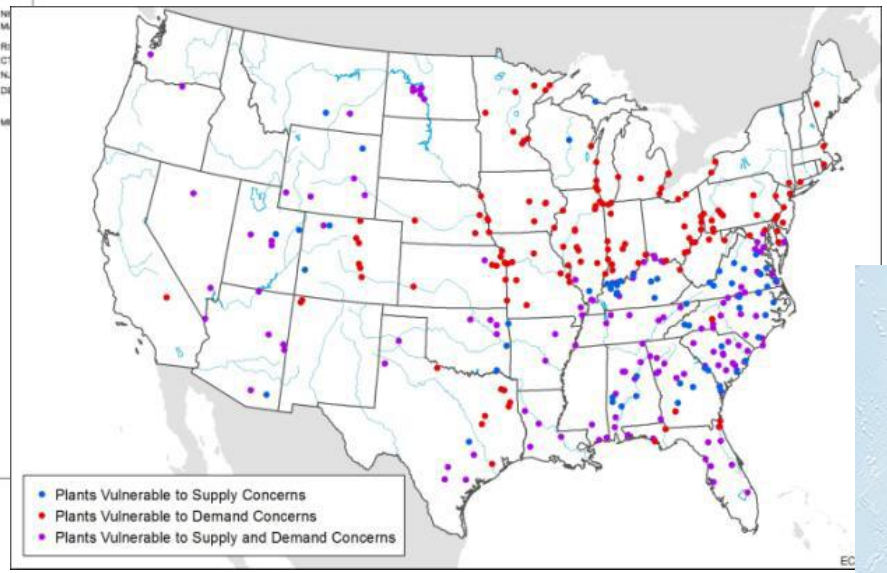


(Shannon 2007)

Why is Produced Water Even Being Considered as a New Water Alternative?

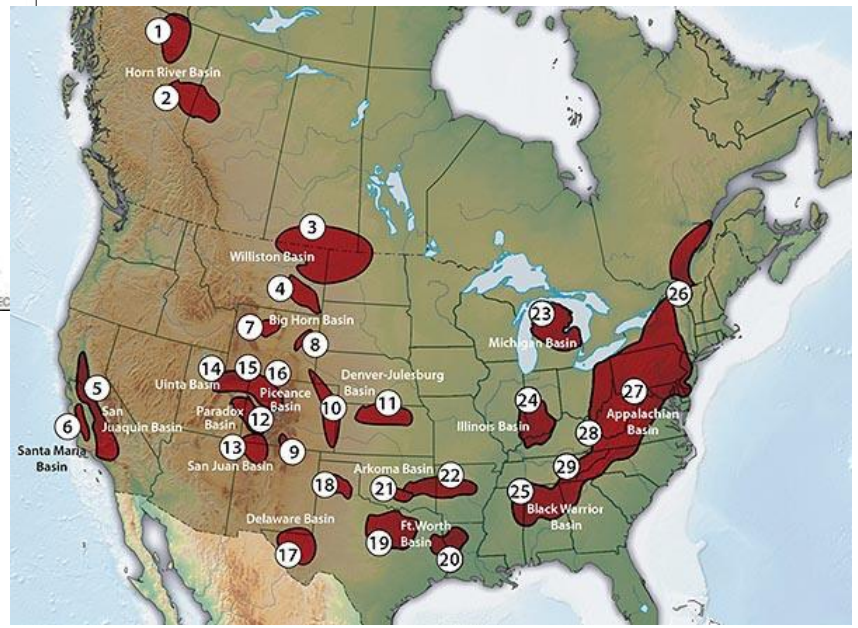


State Water Manager Identified Water Shortages by 2020



Thermoelectric Power Plants with Water Supply or Demand Concerns

Shale/Produced Water Basins



Waste Water Treatment and Reuse is Challenging

Raw Municipal Waste Water

~60 major constituents

Raw Pecos River Water

~70 major constituents

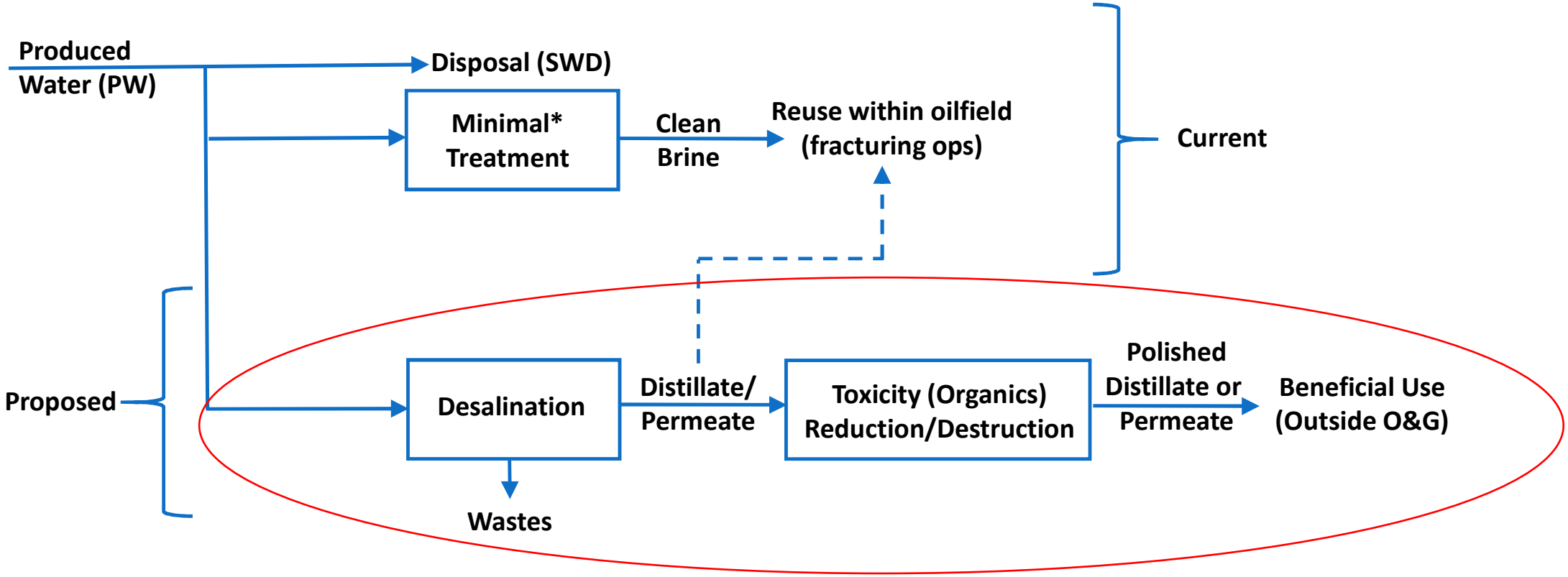
Raw Produced Water

~90 major constituents

Produced water in most basins has ~100 +/- 20 constituents
NMSU found similar trend in Permian based on water collected in 2020/2021

NMSU has an analytical method to identify over
400,000 constituents in treated waste water

EPA WRAP Produced Water Focus is on Treatment to Support Fit-for-Purpose Reuse



Based on Ganesh Ghyre - ExxonMobil

"Overcoming fear requires making the unknown known"

"we oppose even entertaining the idea of using this on crops." "Because it's chemically altered, we believe it can never be returned to the evolutionary process as water."
NM 2018 Produced Water Forum, Protestor Wash Post Dec 8, 2018

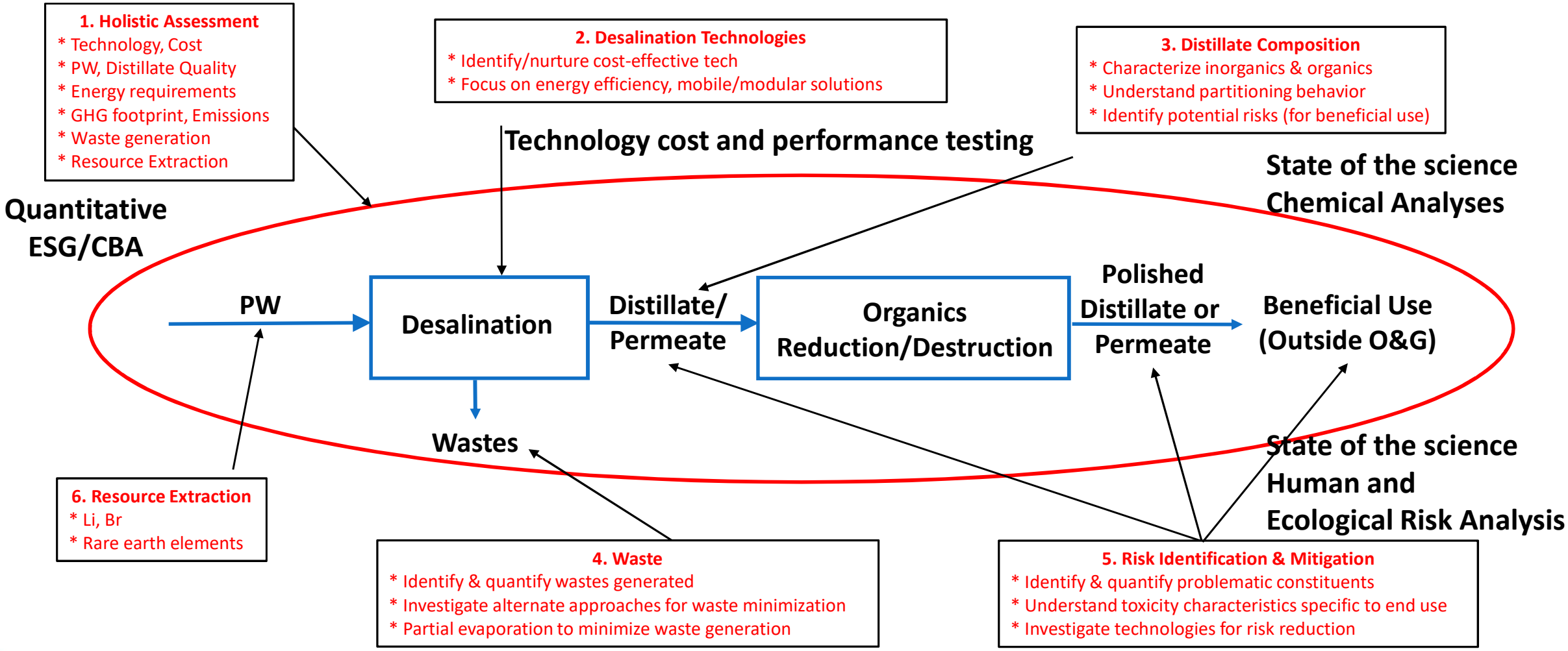
"..produced water has unknown poisonous and hazardous proprietary chemicals.."
NM 2019 Public Meeting, Participant

Georgia O'Keeffe

"… we have been using treated waste water for 40 years, we are not afraid of it, what we want to do is protect our fresh water resources…"

SE NM Elected Officials Meeting, July 2021

Information Needs for Science-based Regulations and Policies on Produced Water Fit-for-Purpose Reuse



From Ganesh Ghyre - ExxonMobil

EPA Goal – Establish a Consistent Approach for Fit-for-Purpose Reuse

- **Collaborative discussions** – inclusive of multi-state health and resource agencies
- **Common data collection and data portal framework** – consistent sampling and public access to important data
- **Standardized technology testing and evaluation -** consistent assessment criteria that address health, safety, and cost
- **Standardized risk and toxicology testing and analysis** – support consistent science-based public and environmental health and safety regulations
- **Standardized quantitative socio-economic Cost/Benefit Analysis** - reduce risks and liabilities of reuse and facilitate local economic development

Benefits Everyone - Public, Regulators, Industry, Technology Vendors

2050 Electric Grid Reliability and Sustainability

- "Collectively, EEI's member companies are on a path to reduce their carbon emissions at least 80% by 2050, compared with 2005 levels.
  - The switch from coal to natural gas and renewable energy has been the single most effective tool over the past decade for reducing carbon emissions while keeping rates steady and while ensuring that electricity remains affordable and reliable.
- It is important that we lead on clean energy in a way that we are still able to use natural gas….
- To eliminate the last 10% to 20% of emissions. …. we need advanced renewables, long-duration energy storage, demand efficiency, advanced nuclear, hydrogen, carbon capture … and getting critical transmission and energy grid infrastructure built more quickly."

Tom Kuhn, president of the Edison Electric Institute, association of U.S. investor-owned electric companies. Jan. 26, 2021

Example - Oil and Gas Operation Impacts on Public and Environmental Health and Safety

< 0.25 miles from oil and gas operations

- Highest level of acute public health impacts
- Highest occurrence of environmental impacts - noise, air, land. and water pollution and contamination

0.25 - 0.50 miles from oil and gas operations

- Significantly reduced public health impacts
- Significantly reduced environmental impacts or damage from operations or accidents

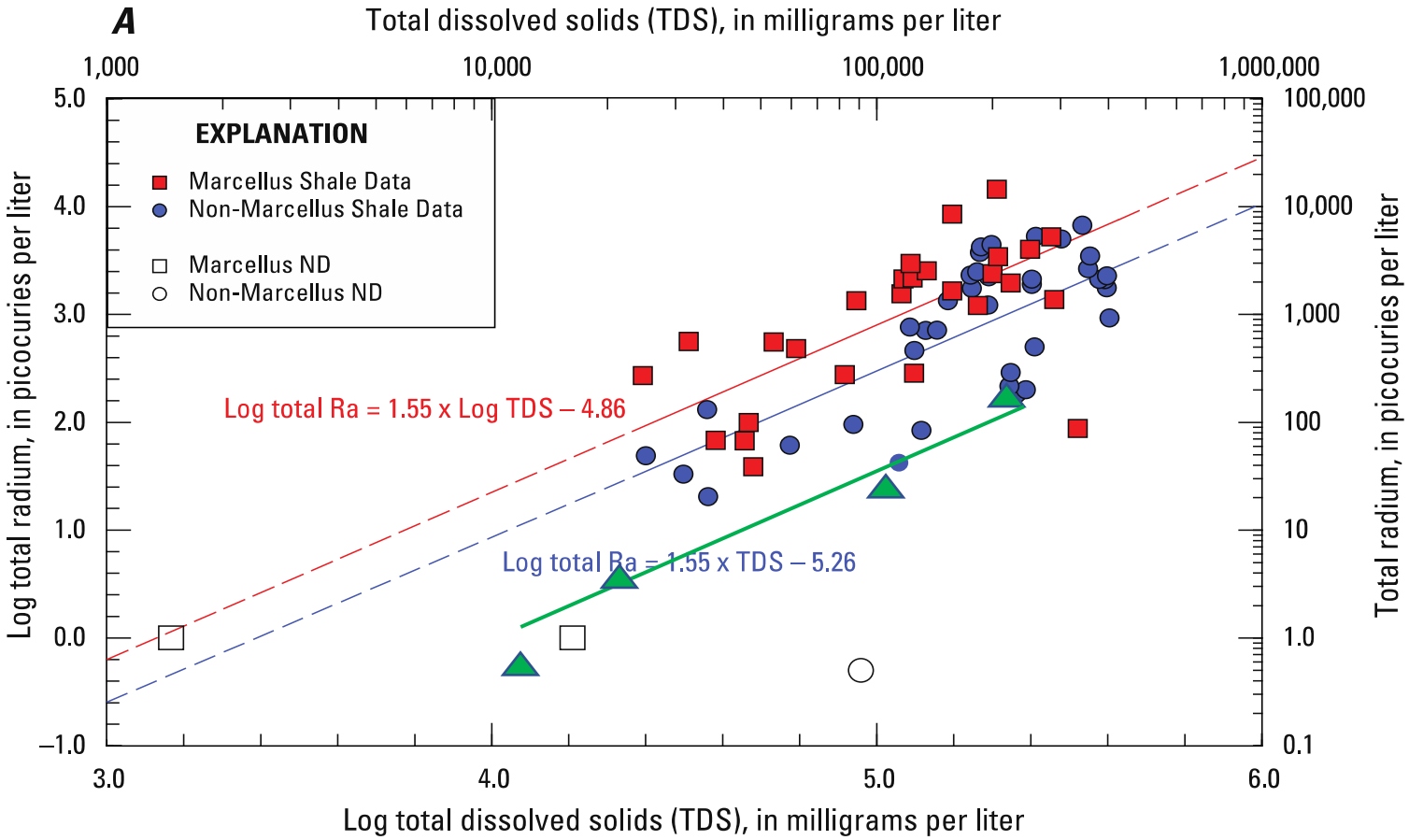
> 0.50 miles from oil and gas operations

- Little observed acute or chronic public health and safety or environmental impacts
- Especially in open, flat, and non-wooded operational areas

- Highest impacts in populated areas, especially in wooded, rolling terrain
- Highest impacts to permanent residents on small private land parcels in closely aggregated operations
- NM DOH has no record of fracking damaging a personal water supply

Physicians for Social Responsibility-Colorado Symposium - Health Effects of Oil and Gas Development, December 4, 2020.

Produced Water Relative Radiological Issues

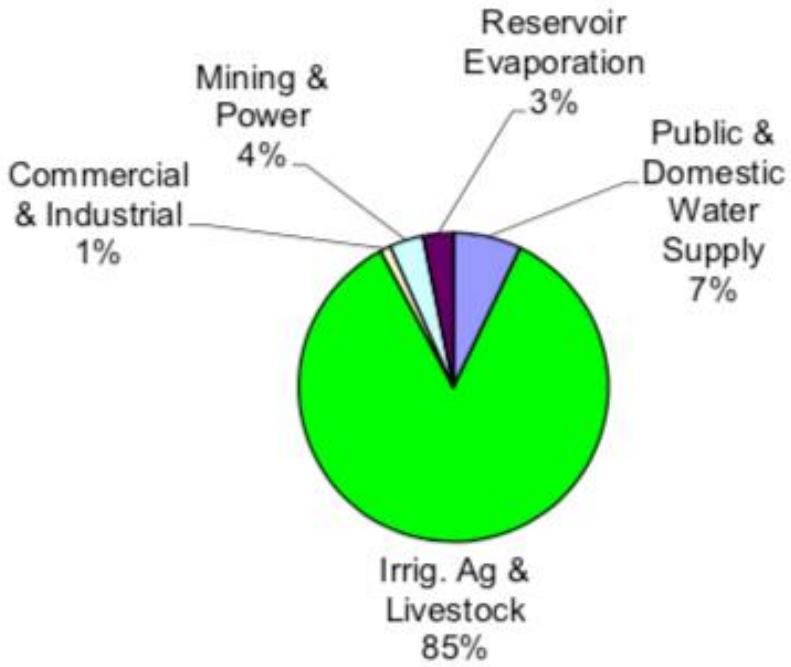


[USGS 2020]

NM PW Data

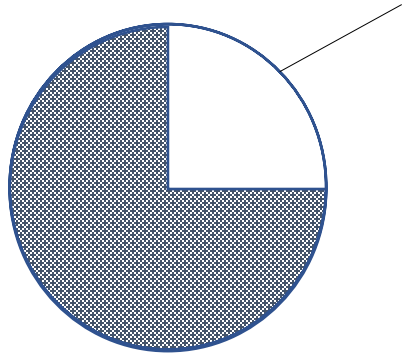
NORM easily removed by both thermal and membrane desalination technologies, risk issue is generally managing concentrated NORM from treatment processes

Economic Impact Of Produced Water Reuse



Eddy & Lea Counties
Total withdrawals = 427,800 AF/yr (3.3 B bbls/yr)

Annual Fresh Water Withdrawal
[Thompson 2020]



Expected Surplus Produced Water Volumes (~25% of Fresh Water Withdrawals)

Surplus expected to be ~1 B bbls/yr (2-3 M bbls/day)

Projected Produced Water Surplus

Why Support Produced Water Fit-for-Purpose Treatment and Reuse?

- Provides improved natural resource sustainability
- Supports local community economic development
- Supports national energy security, reliability, and sustainability
  - Supports continued use of economical energy storage
  - Provides missing infrastructure to support clean energy transitions without using fresh water
  - Supports an equitable cost structure for consumers
- Provides improved producer and midstream ESG

Thanks – Questions?

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