New Mexico Desalination Association

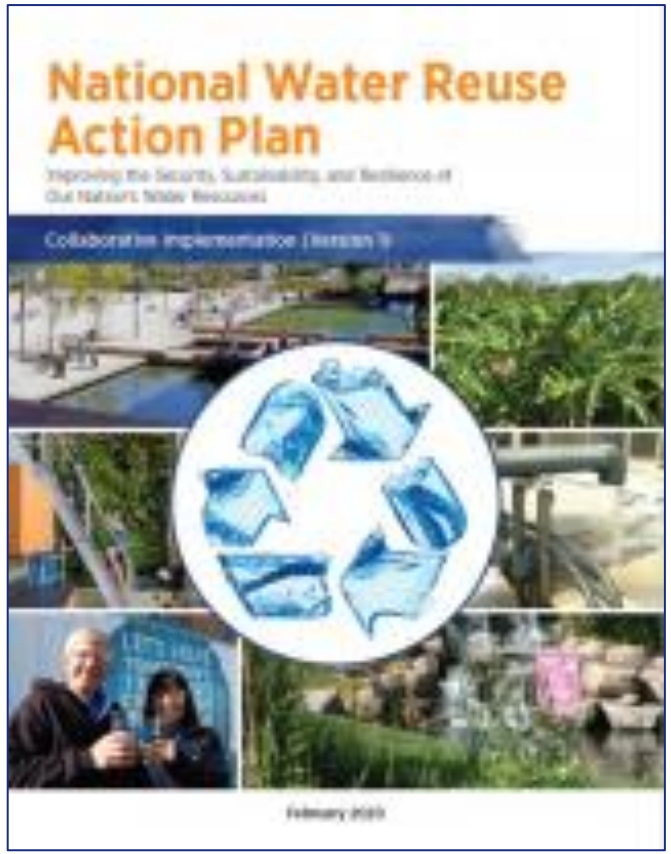
Economics of Unconventional Water

Deborah Dixon, P.E. and Mike Hightower, P.E.

New Water for New Mexico Conference

October 20, 2022

EPA National Water Reuse Action Plan



- 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

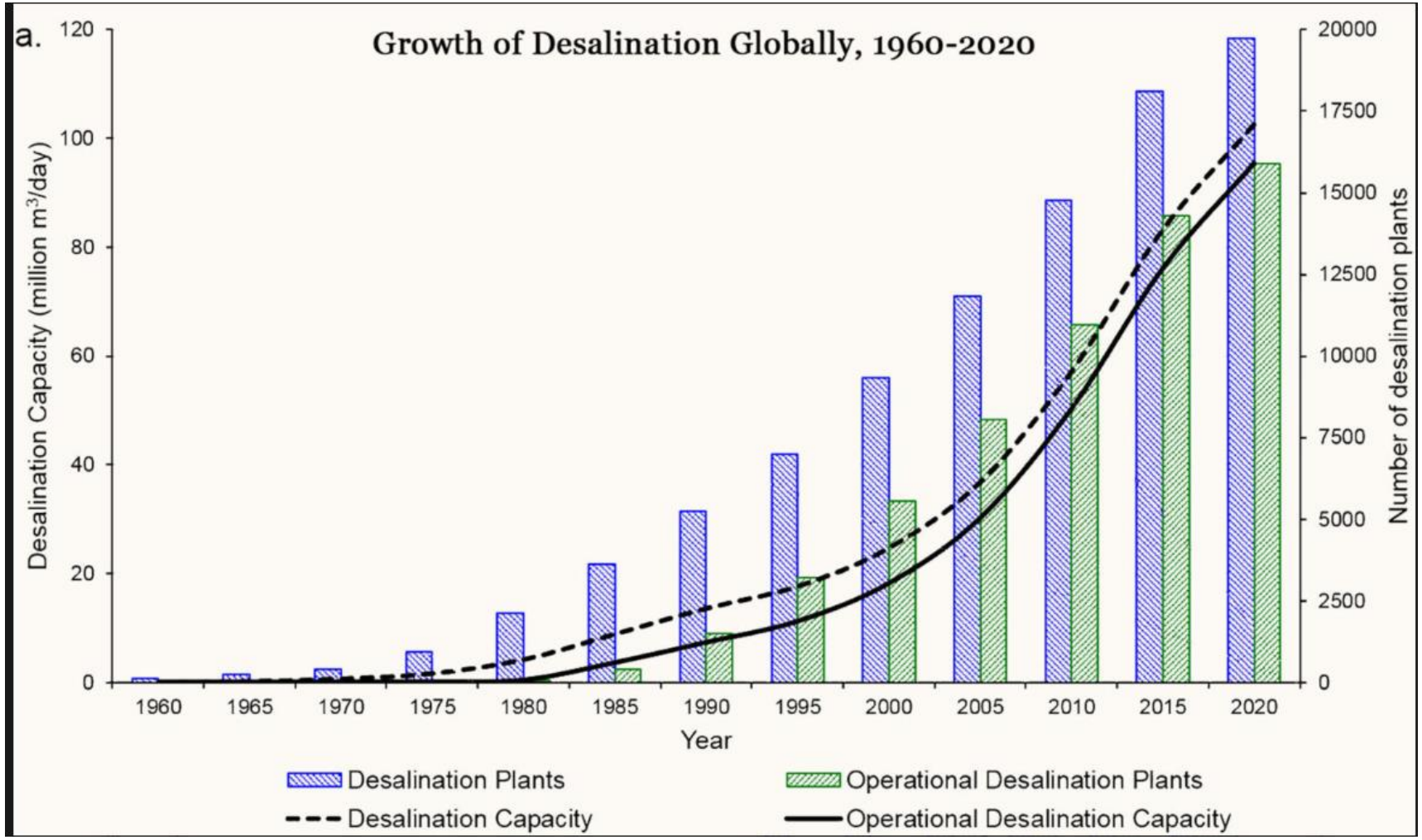
Requires some level of desalination for reuse

- NM leading collaboration (NM, AZ, TX, WY, OK, CO, PA, KS) on <u>produced water</u> treatment research and implementation

Answers to These Questions:

- Is there adequate supply of brackish water to make it sustainable?
- Is desalination too expensive?
- Are systems mobile and flexible enough to meet municipal, industrial, commercial, and agricultural needs?
- What about the concentrate?
- Is funding available?
- Is desalination economically feasible?

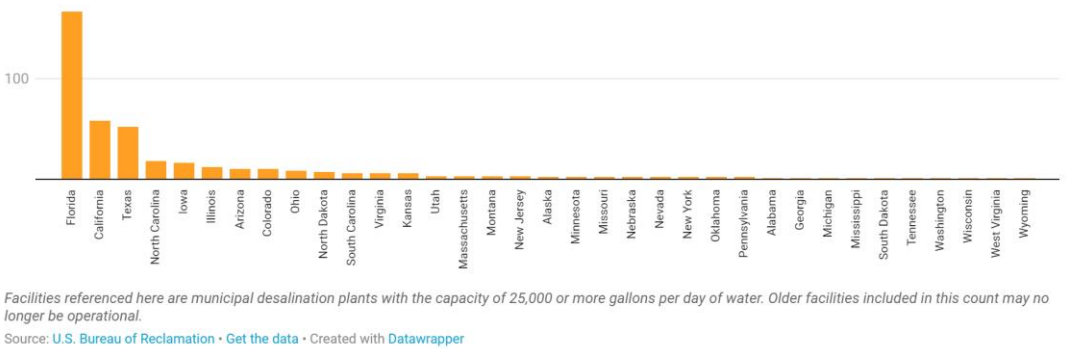
Desalination Is Growing



(JONES ET AL, SCIENCE OF THE TOTAL ENVIRONMENT, 2019)

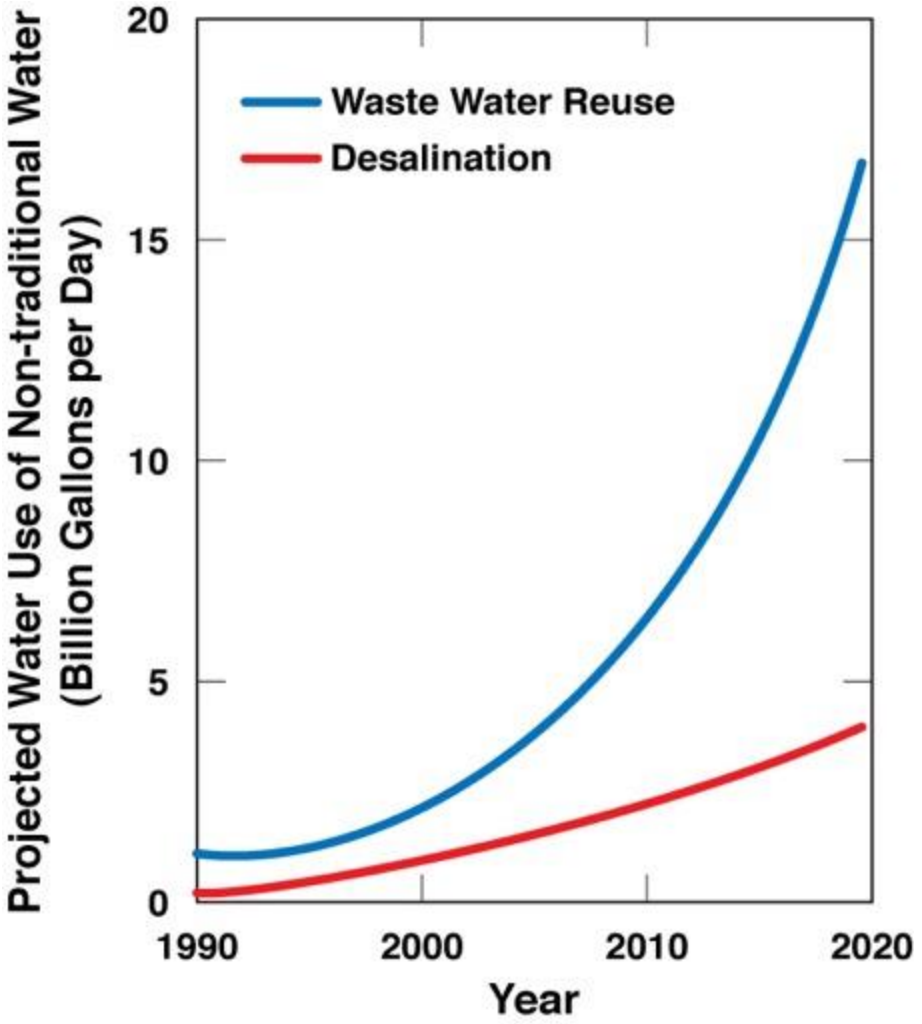
Desalination in U.S.

- Wastewater reuse 15% per year
- Desalination ~ 10% annual growth rate
- Desalination plants in the US (2017)
  - FL – 167
  - CA - 58
  - TX - 53
  - AZ – 10
  - CO 10



Facilities referenced here are municipal desalination plants with the capacity of 25,000 or more gallons per day of water. Older facilities included in this count may no longer be operational.

Source: U.S. Bureau of Reclamation • Get the data • Created with Datawrapper

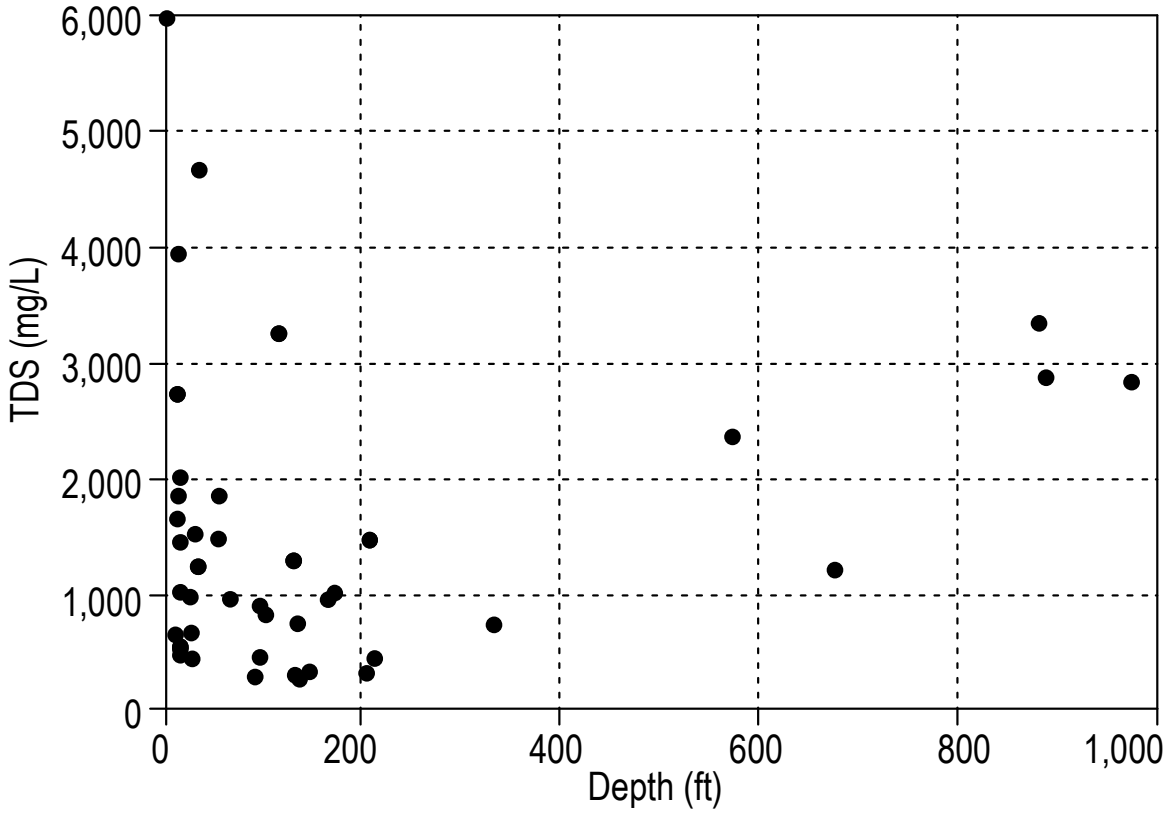


(Based on Water Reuse 2007, Mickley 2003)

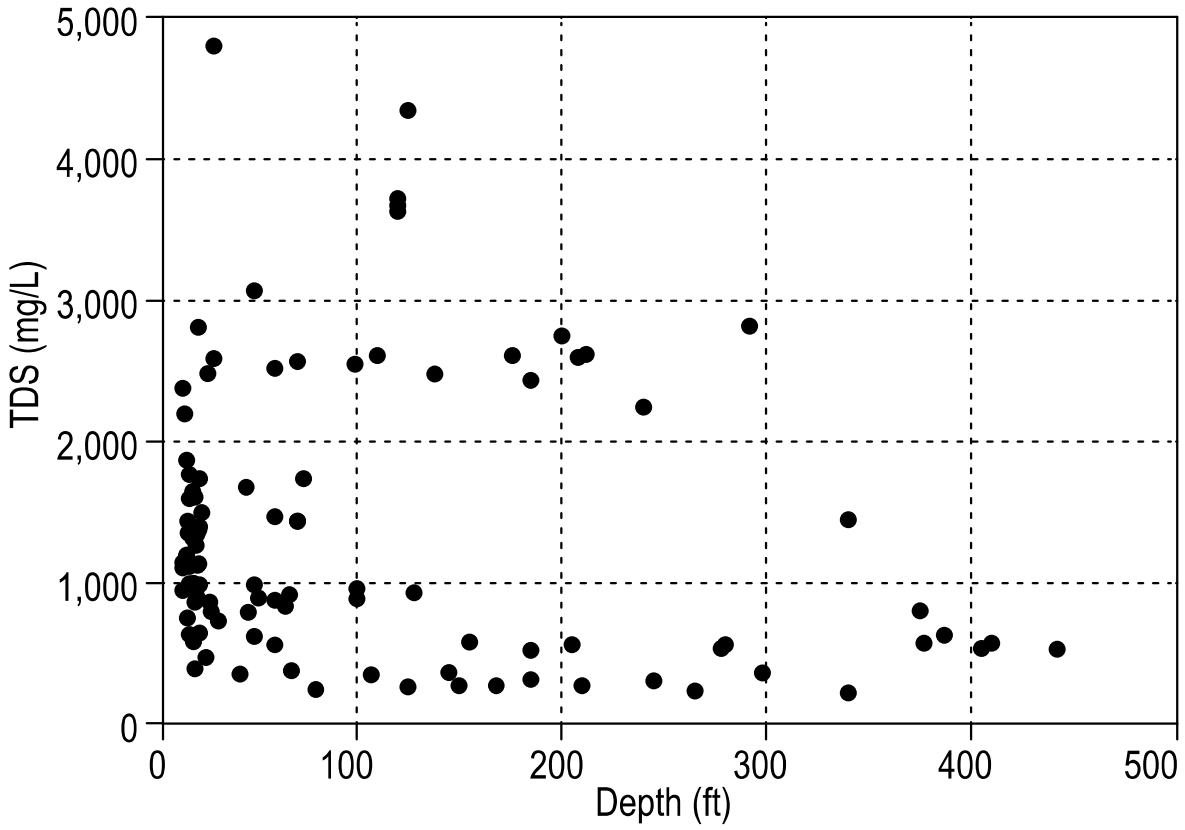
Desalination in New Mexico

- 5 in NM are using desalination (municipal and power generation applications)
- Most rural supplies in NM are individual wells
- NM is behind other states
- Most major freshwater groundwater aquifers in NM are over-stressed
- Many brackish aquifers with 300 yr supply
- Future economic growth will require desal

Many NM Ground Water Basins Contain Zones of Brackish Water that are Easily Recoverable

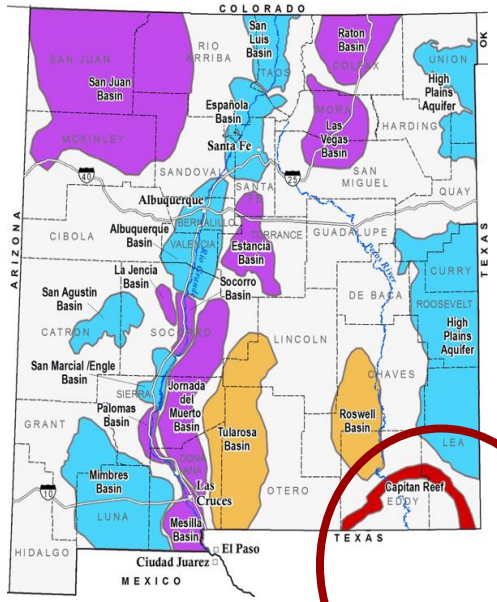


Raton and Las Vegas Basins

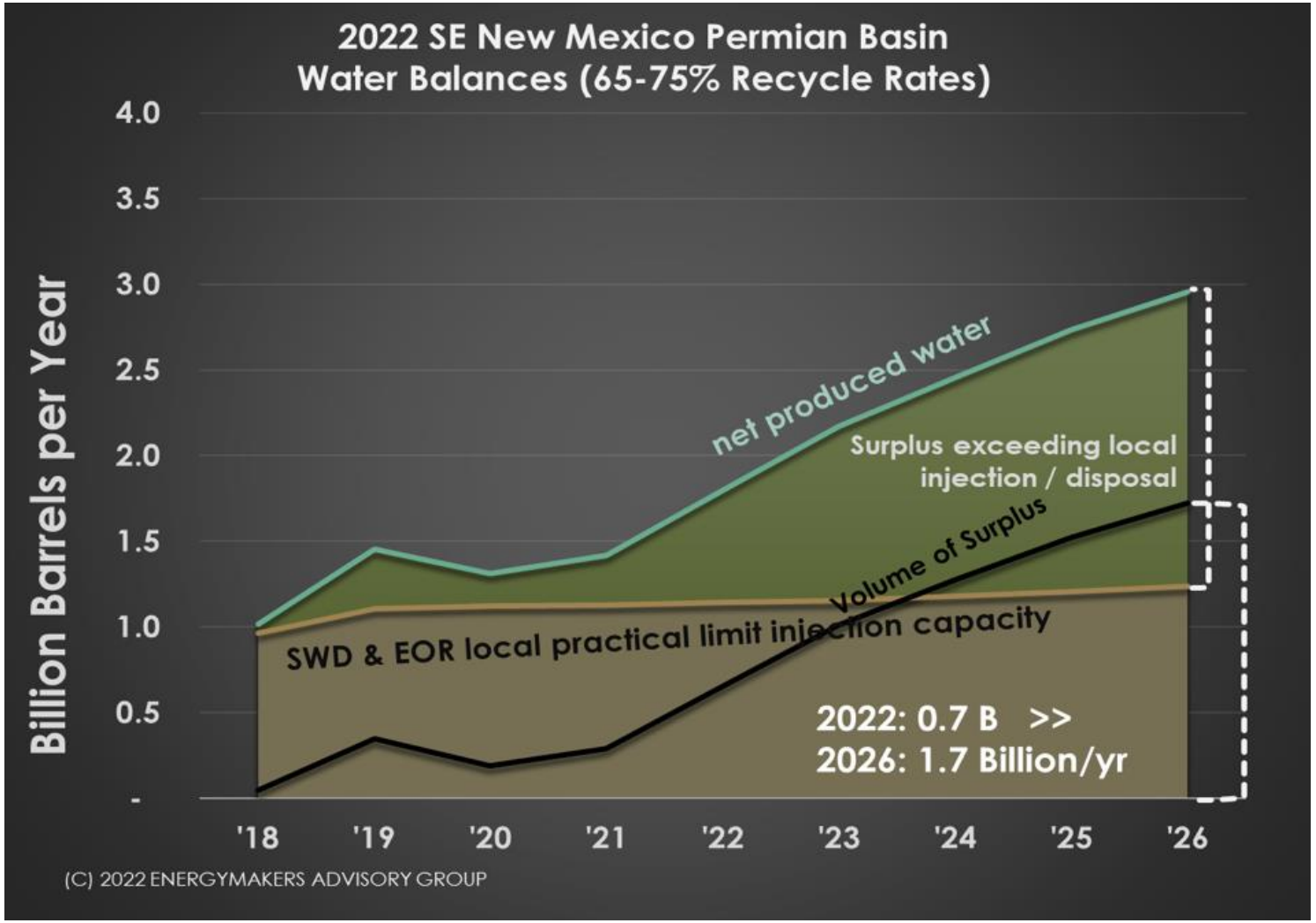


Palomas (T or C) Basin

NM Brackish and Saline Waters – Significant Resources



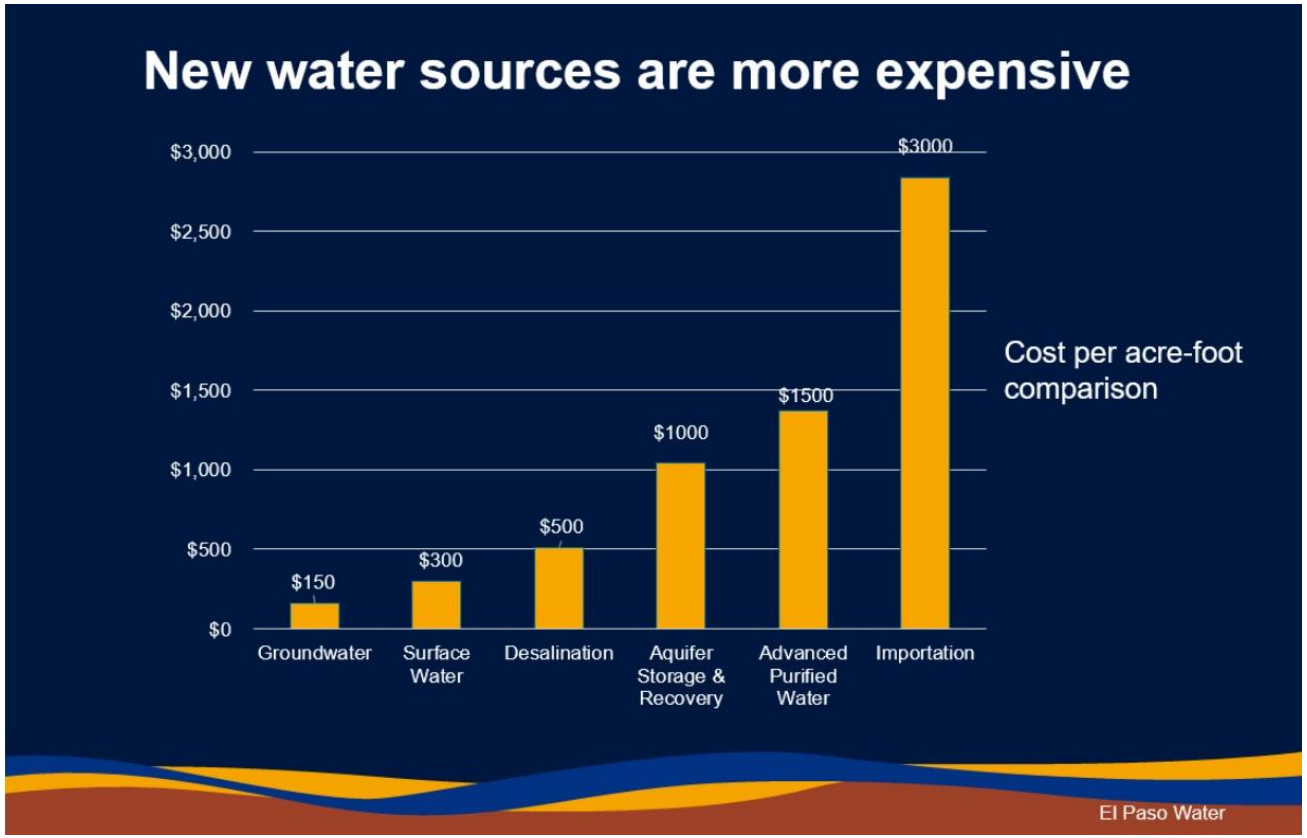
Permian Basin



Desal vs. Fresh Water Importation – El Paso Example

El Paso Water is setting its sights about 80 miles east to Dell City.

The Bone Spring-Victorio Peak aquifer underneath New Mexico is one of the few West Texas aquifers that's consistently replenished by rainfall.



"NEW WATER *FOR* NEW MEXICO"

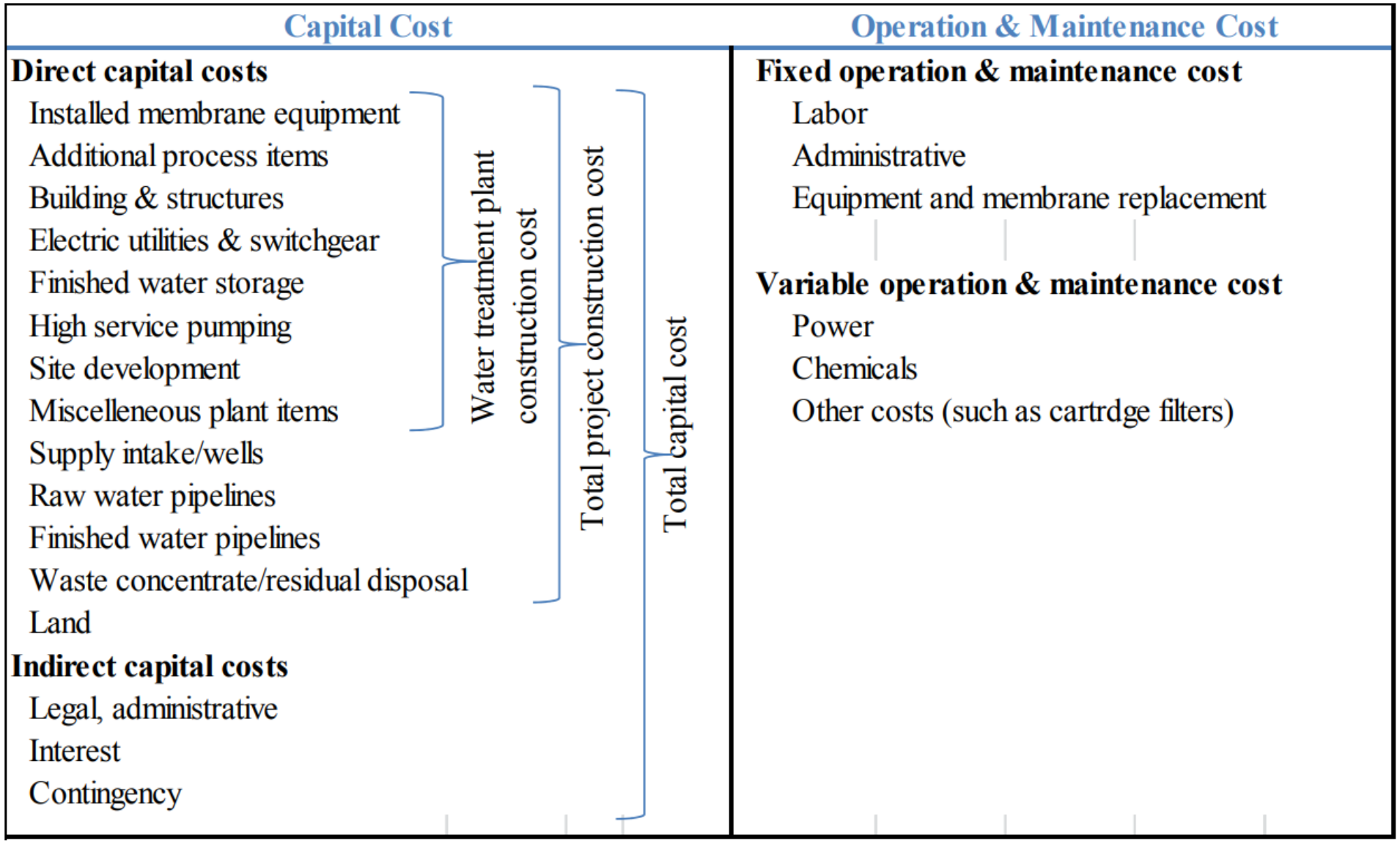
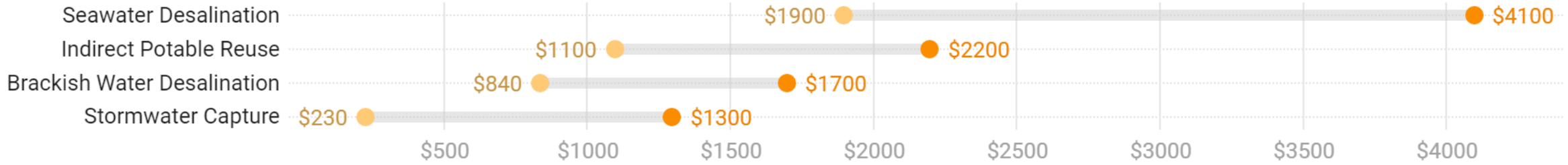


Figure 1 - Key factors for capital and operation and maintenance costs of a desalination facility (Bergman, 2012).

Cost Differences Between Varying Types of Water Supply

Approximate Cost of Water in California, 2015

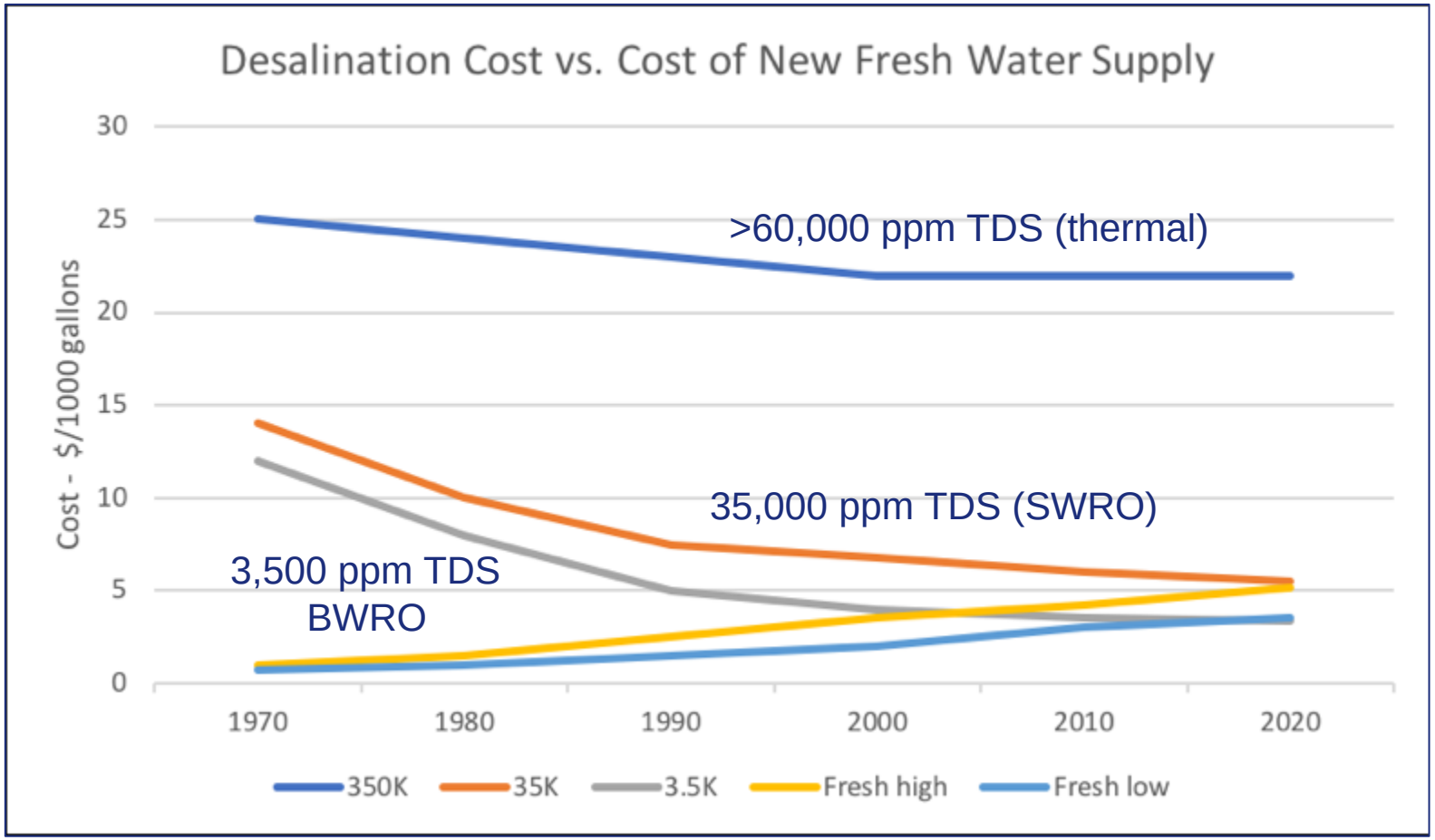
The approximate cost to operate alternative water source facilities per acre foot of water.



All values are rounded to two significant figures. Costs reflect 2015 dollars. Low and high costs represent the 25th and 75th percentile of the estimated cost range. Values represent both large and small facility types. An acre-foot is the amount of water required to cover an acre one foot deep.

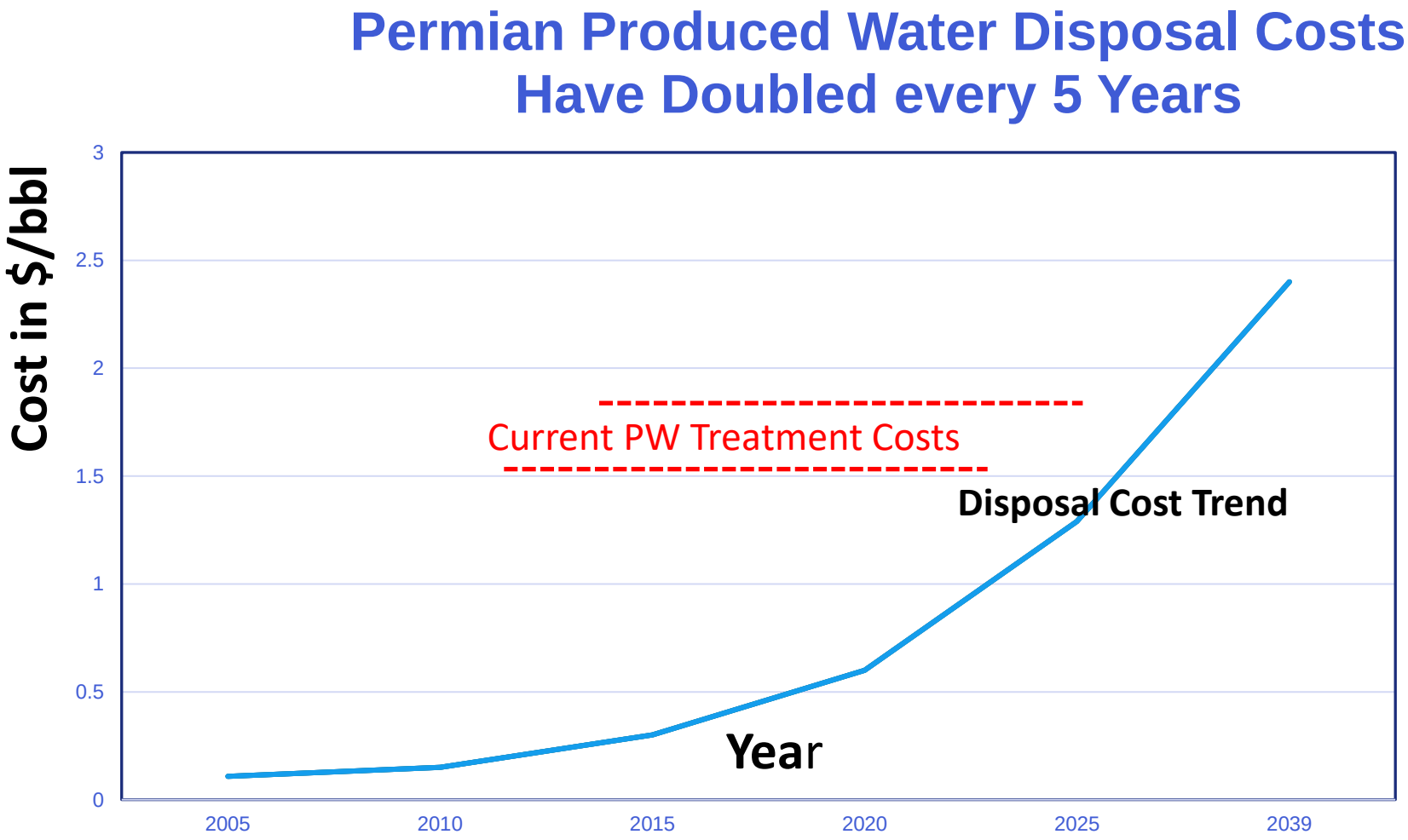
Source: APM Research Lab analysis of Pacific Institute data • Get the data • Created with Datawrapper

Cost Differences Between Desal and Fresh Water



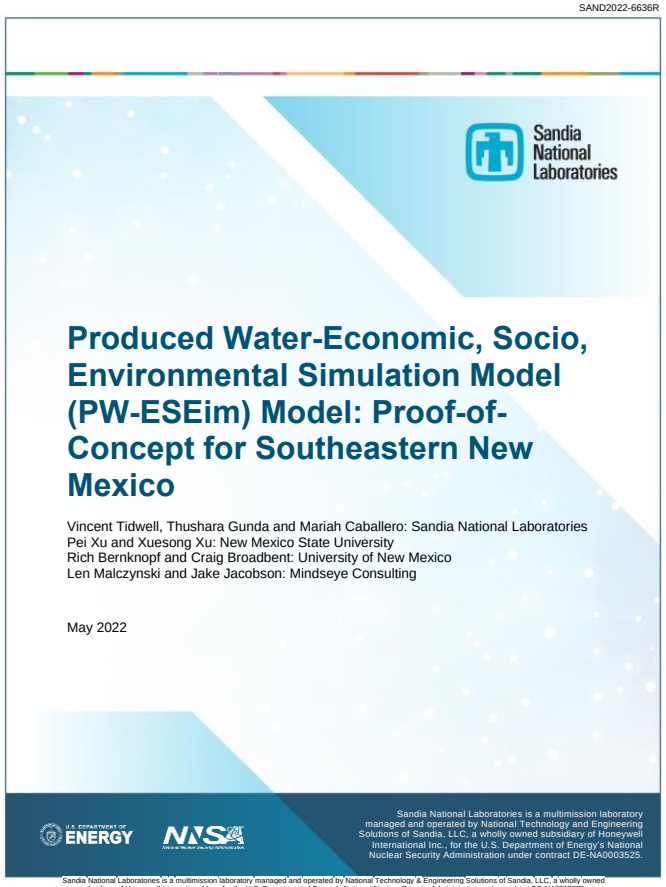
(EWRI Hightower 2018)

Trends in Permian Basin PW Disposal and Treatment Costs



$35 to $45 per 1,000 gal

Produced Water Value – Quantified ESG Benefits with Reuse


SAND2022-6636R

Sandia National Laboratories

Produced Water-Economic, Socio, Environmental Simulation Model (PW-ESEim) Model: Proof-of-Concept for Southeastern New Mexico

Vincent Tidwell, Thushara Gunda and Mariah Caballero: Sandia National Laboratories
Pei Xu and Xuesong Xu: New Mexico State University
Rich Bernknopf and Craig Broadbent: University of New Mexico
Len Malczynski and Jake Jacobson: Mindseye Consulting

May 2022

U.S. DEPARTMENT OF ENERGY | NNSA

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

(Sandia, 2022)

- Developed a socio-economic-ecologic impact model with Sandia funded by DOE
- Quantitative ESG metrics using
  - Produced water data portal data
  - Treatment cost/performance model
  - Health and safety risk model
  - Provides, economic, social, environmental impacts/benefits for selected application and location
- Need to expand to the San Juan Basin

Cost/Benefit	Range of Values
Price of Oil (WTI)	$55.00
Price of Recycled Water per barrel	$0.50 - $7.00
Marginal Cost of Production & Taxes	$20 - $25
Marginal Cost of Water Disposal per barrel	$0.50 - $2.25
Marginal Cost of Transportation	$0.00 - $9.00
Marginal Cost of Recycling	$1.00 - $16.00
Marginal Private Value of Recycled Water	$0.25 - $1.75
Marginal Social Value of Recycled Water	$0.48 - $51.24

(Chermak & Patrick, 2018)

Analyses suggest economic benefits of
$500 M to $1 B per county using treated produced water

Desalination Scalable – Single Well to Community Scale

500 gpd
desal syster

250,000 gpd
desal container

20,000 gpd
desal system

100,000 gpd
Portable Veolia
desal system

Alamogordo
1 MGD
desal system

BGNDRF
15,000 gpd
desal system

Blending is often used to double capacity

Concentrate disposal options

Alamogordo
1-MGD evaporation pond

Concentrate is commonly disposed of through one of five practices:

1. Discharge to waste water treatment plant or waste water lagoons (dilution)
2. Surface water discharge (dilution)
3. Irrigation (if low concentration)
4. Deep well injection
5. Evaporation ponds and/or enhanced evaporation (solids)

w w w . a m t a o r g . c o m

(FS-4) Feb. 2018

Deep well injection

Selective irrigation

Constructed salt marsh wetlands

Funding of Unconventional Water

- EPA Bipartisan Infrastructure Law
  - $26 million to NMED &NMFA

NM Infrastructure Fund/Drinking Water State Revolving Fund capitalization grant = $17,992,00

Economics of Unconventional Water

- Questions?