

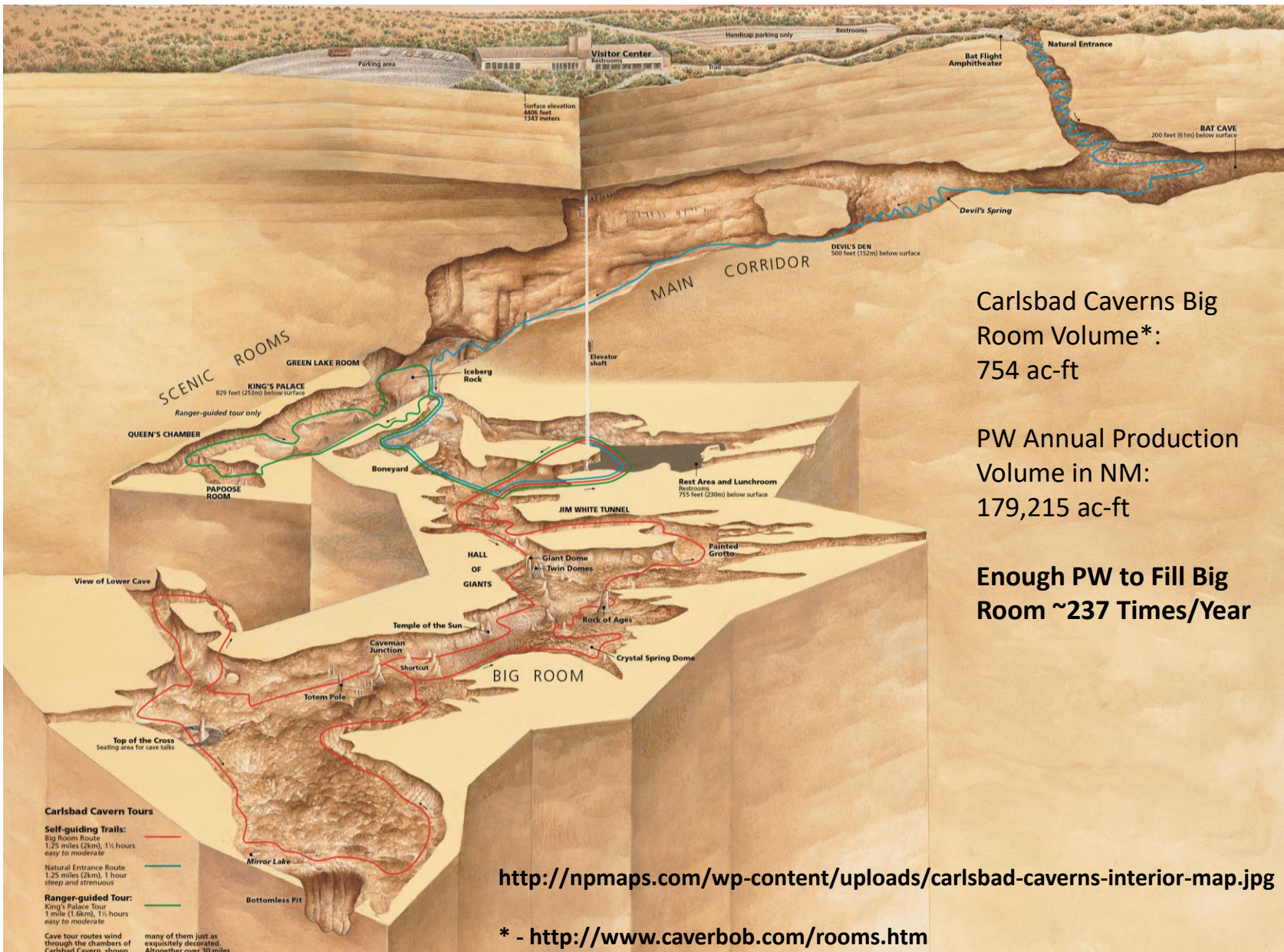


Produced Water Fit-for Purpose Reuse Research Treatment Technology Research Approaches

NMSU Carlsbad
November 9, 2021



BE BOLD. Shape the Future.



Carlsbad Caverns Big Room Volume*:
754 ac-ft

PW Annual Production Volume in NM:
179,215 ac-ft

Enough PW to Fill Big Room ~237 Times/Year

<http://nmpmaps.com/wp-content/uploads/carlsbad-caverns-interior-map.jpg>

* - <http://www.caverbob.com/rooms.htm>



BE BOLD. Shape the Future.

Treatment Technology Selection Drivers

- For safe fit-for-purpose reuse of produced water, we need to remove the constituents of concern to the appropriate level for each specific application, including:
 - Suspended solids, oils, and grease
 - Salts (referred to as dissolved solids)
 - Dissolved organics (e.g., petroleum hydrocarbons, volatile and semi-volatile compounds)
 - Metals
 - Dissolved gases (e.g., H₂S, NH₃)
 - Naturally occurring radioactive material (NORM)
 - Bacteria
- This will often require integration of multiple technologies.
- An integrated treatment system must also be cost-effective.

A produced water treatment system will often require a combination of pre-treatment, desalination, and post treatment technologies.

Pretreatment Technologies

Basic Separation

- Settling
- Coagulation
- Hydrocyclone
- DAF



Adsorption

- Activated carbon
- Zeolite
- Ion exchange



Advanced

- Chemical oxidation
- Microfiltration
- Ultrafiltration



Biological

- Activated sludge
- MBR
- BAF
- SBR-MBR



Common Desalination and Post-treatment Technologies

Membrane Separation Technologies

High Pressure Membrane

- Reverse Osmosis
- Nanofiltration

Electrically Driven Processes

- Electrodialysis
- Electrodeionization

Novel Membrane Processes

- Membrane Distillation
- Forward Osmosis

Thermal Technologies

- Thermal Distillation
- Dewvaporation
- Multi-Effect Distillation
- Mechanical Vapor Compression
- Thermal Vapor Compression
- Multi-Stage Flash



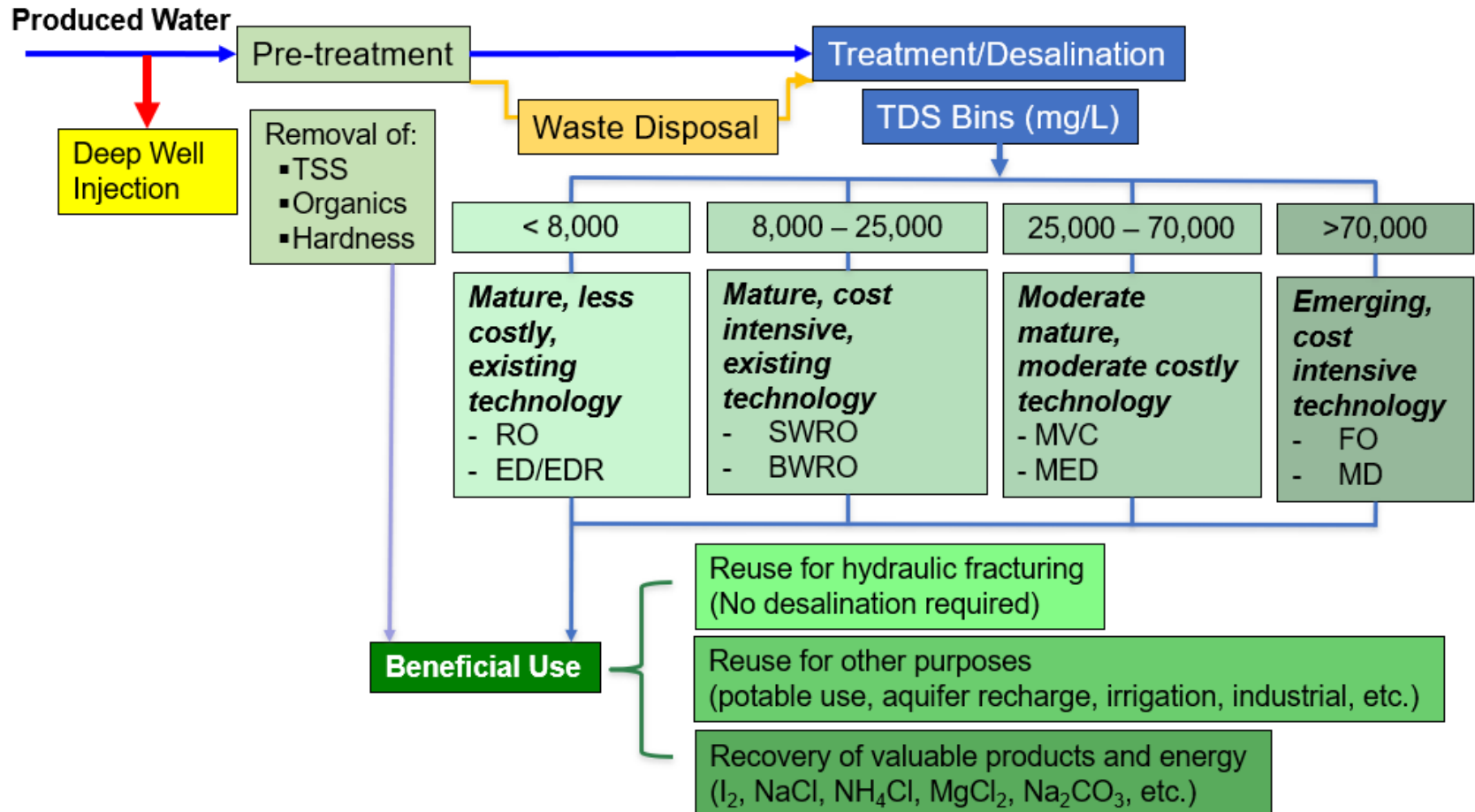
Post Treatment

- pH Adjustment
- SAR Adjustment

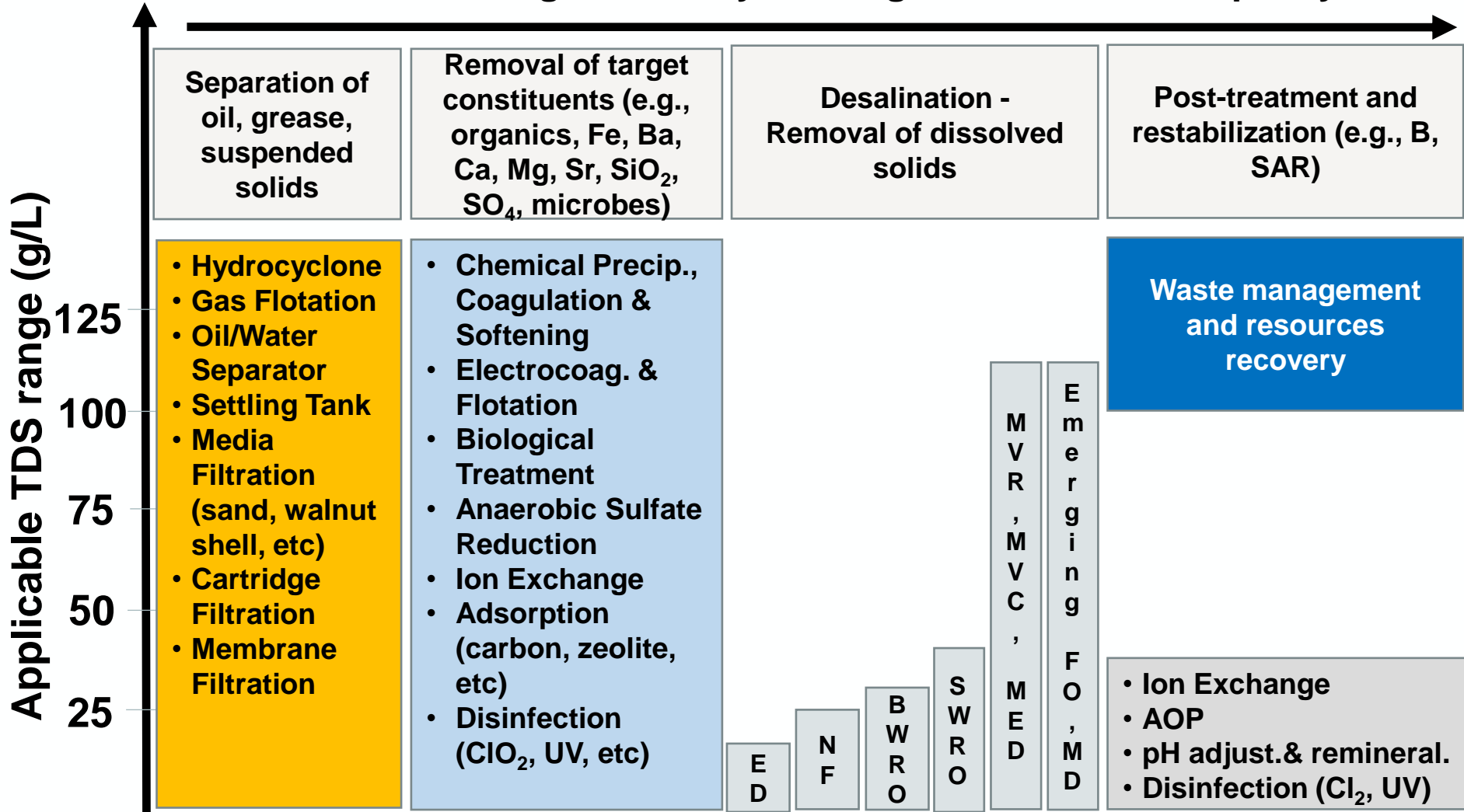
Brine Management

- Evaporation Basins
- Injection Wells
- Crystallizer

Treatment technology selection depends on PW salinity, composition, and final reuse.



Costs increase with higher salinity, and higher treated water quality

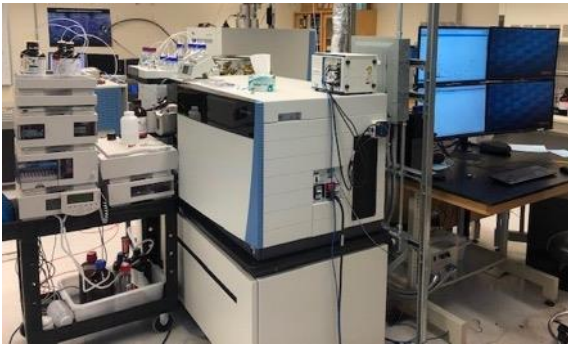


Levels of treatment increase with higher treated water quality criteria

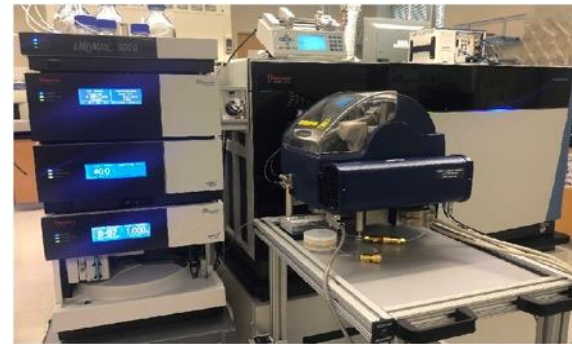
3 Consortium Research Goals for Reuse

1. Improve the characterization of produced water – quantity, quality, and location.

Orbitrap Fusion Mass Spectrometer



Nano-Flow Liquid Chromatography



Gas Chromatography / Mass Spectrometry

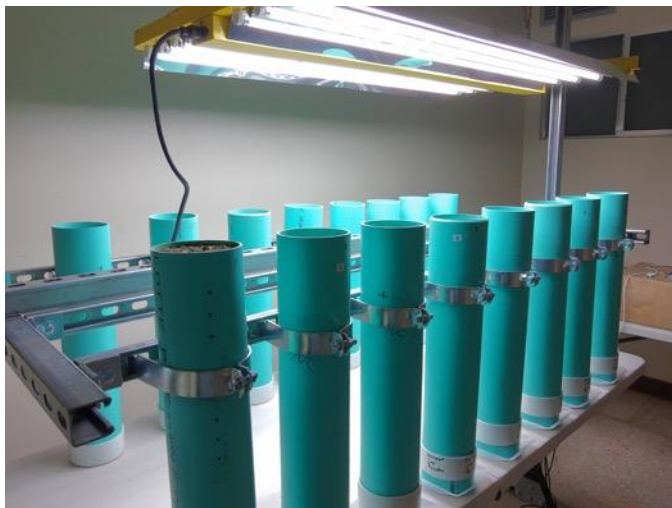


Inductively Coupled Plasma Mass Spectrometer



3 Consortium Research Goals for Reuse

- 2. Identify the human and ecological health and safety requirements for the safe, fit-for-purpose, reuse of treated produced water for various applications – construction, ag and rangeland, industrial, and water supply augmentation.



3 Consortium Research Goals for Reuse

- 3. Evaluate the cost and performance of various treatment technologies that can provide a safe and efficient way to meet fit-for-purpose treatment and reuse requirements.





Questions? Where to get more info

Access our resources and learn more at:

<https://nmpwrc.nmsu.edu/> (or search NMPWRC)

Email: NMPWRC@nmsu.edu

Want more info about produced water topics? Search – EPA WRAP, or GWPC

We want your feedback!

Please complete and return the session questionnaire.