Success Implementation of

Direct Potable Reuse

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Andy Salveson

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Thanks to Jeff Mosher, Eva Steinle –Darling, George Tchobanoglous, and Shana Epstein, among many others

Engineers...Working Wonders With Water®

California Potable Water Reuse Projects

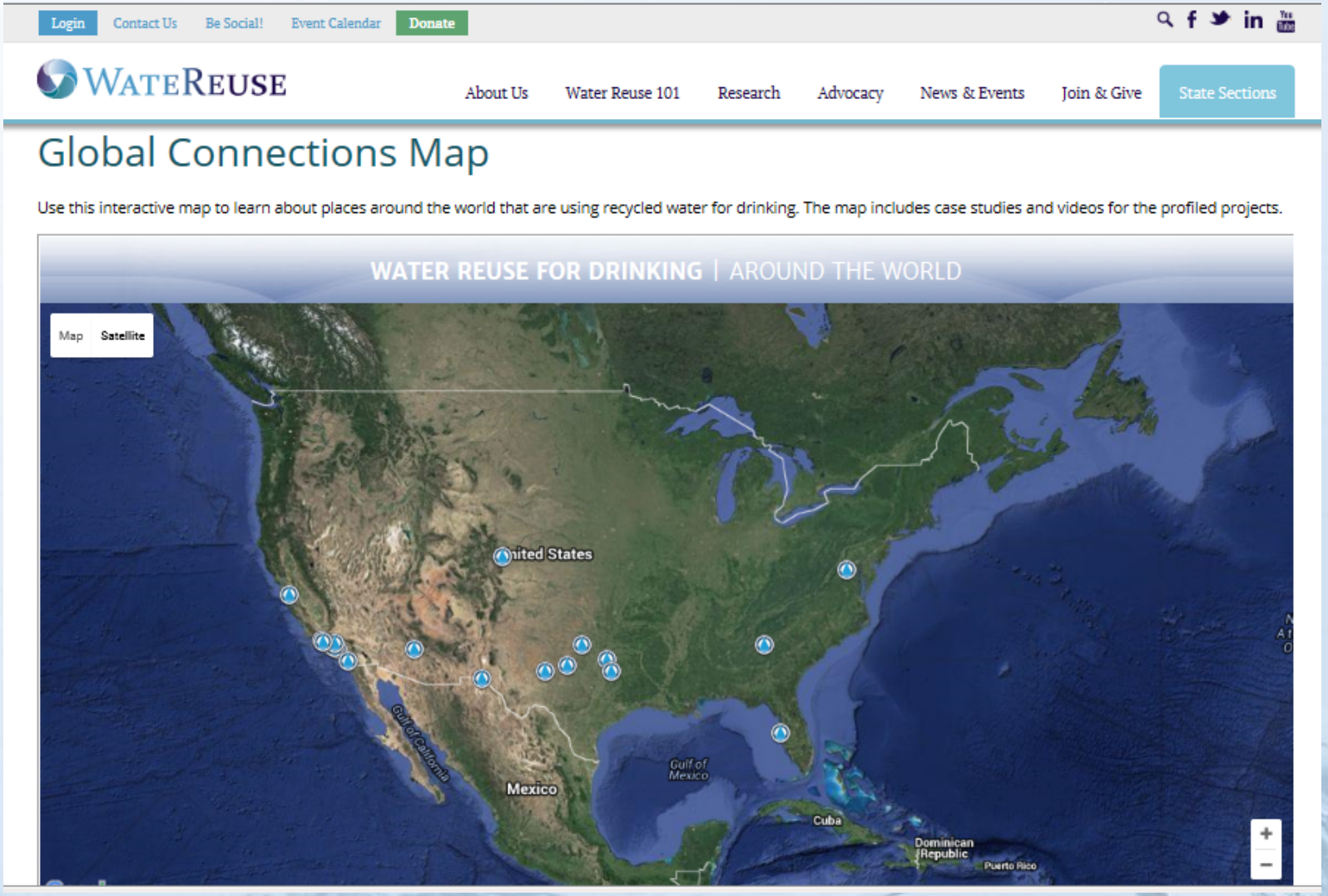
- **Current**
  - Groundwater Replenishment System
  - Montebello Forebay (Los Angeles)
  - West Basin MWD (Los Angeles)
  - Water Replenishment District
  - Inland Empire Utilities Agency
  - Cambria
- **Near Term (2016-2020)**
  - Santa Clara Valley Water District
  - Oxnard
  - City of Los Angeles (expansion)
  - Metropolitan Water District
  - Padre Dam
  - San Diego

Why Potable Reuse?

- **Limitations with nonpotable water reuse**
  - Cost, storage, dual system
- **(Large) increases in water supply**
  - Uses existing infrastructure
- **Improves “reliability”**
  - Drought proof and locally controlled
- **Sustainable supply**
  - Diversified water portfolio
  - Optimizes a water supply
  - Less energy than alternatives
  - Local resource
  - Not as susceptible to climate

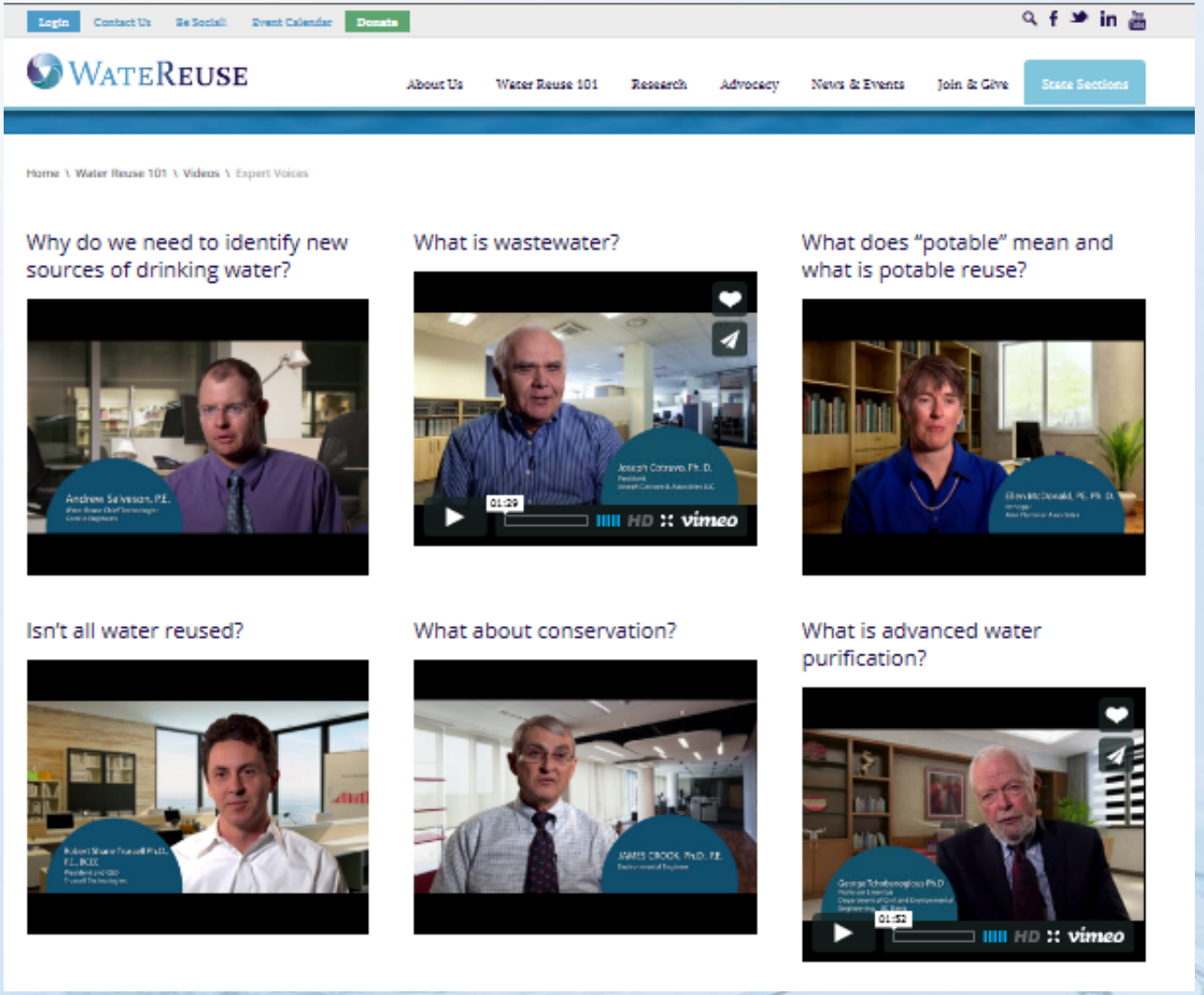
Outreach and Education

Extensive Resource Materials Available From WateReuse



https://www.watereuse.org/water-reuse-101/global-connections/

Extensive Resource Materials Available From WateReuse



https://www.watereuse.org/water-reuse-101/videos/expert-voices/

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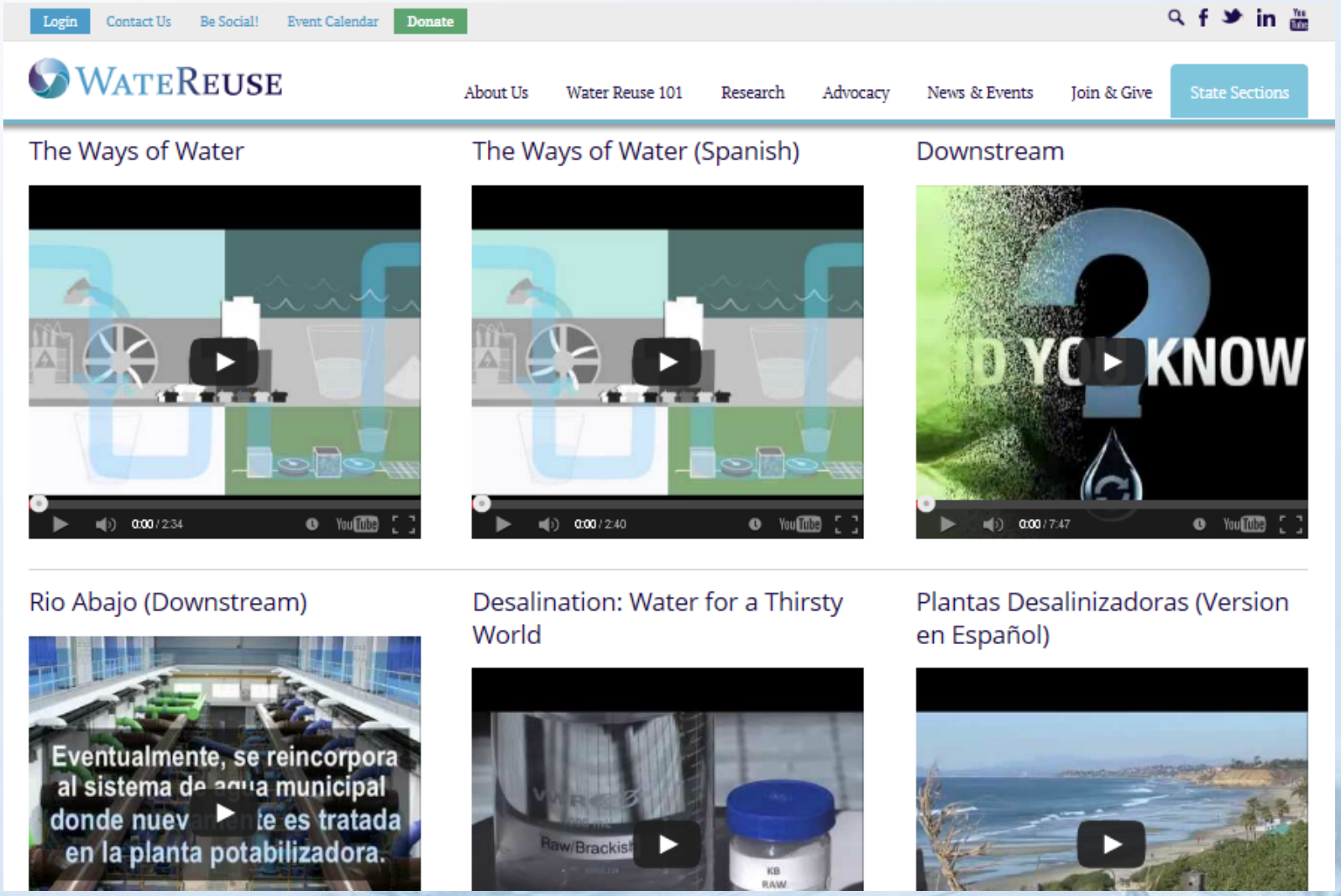
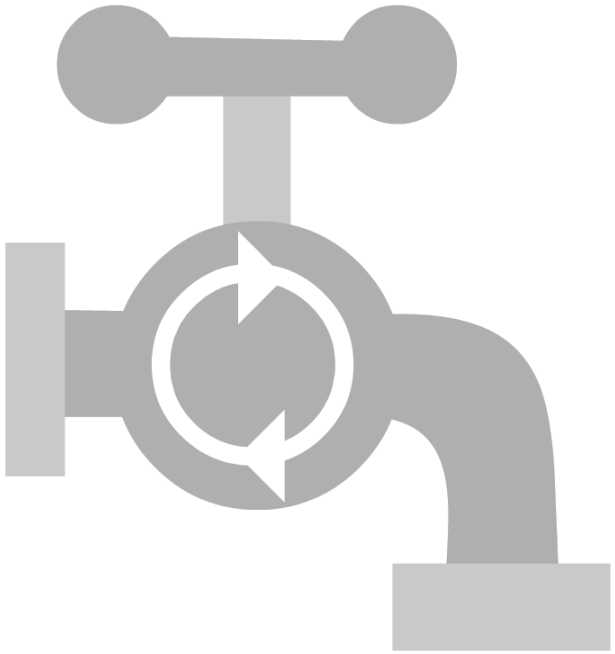


https://www.watereuse.org/water-reuse-101/watereuse-videos/

The Survey Research

- West Basin Municipal Water District in El Segundo provided the email addresses and sent the notification of the survey research and a reminder.

TAKE SURVEY



Support for
Direct Potable Reuse*

73% supportive/very supportive

15% moderately supportive

12% slight supportive/not supportive

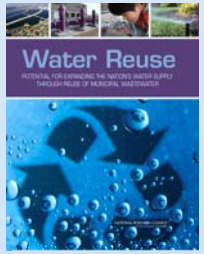
*Q12: How supportive are you of highly purified used water being delivered directly to your tap from an engineered treatment and storage system before consumption

Public Health & Potable Reuse

Properly Engineered Potable Water Reuse is Supported by National Health Experts

Organization	Confidence in the Safety of Potable Water Reuse?
State of California Division of Drinking Water (formerly CDPH)	Yes, formal regulations finalized in 2014
National Research Council	Yes, 2012 report documents safety of potable water reuse and demonstrates comparative safety of potable reuse to conventional water supplies
California Medical Association	Yes, CMA demonstrates support for potable reuse in 2012
Texas Commission on Environmental Quality	Yes, multiple approved projects based upon a case by case analysis
Arizona, Virginia, Colorado, New Mexico, etc.	Yes, many states have potable reuse projects safely producing water based upon different regulatory approaches

CALIFORNIA Water Boards



TCEQ

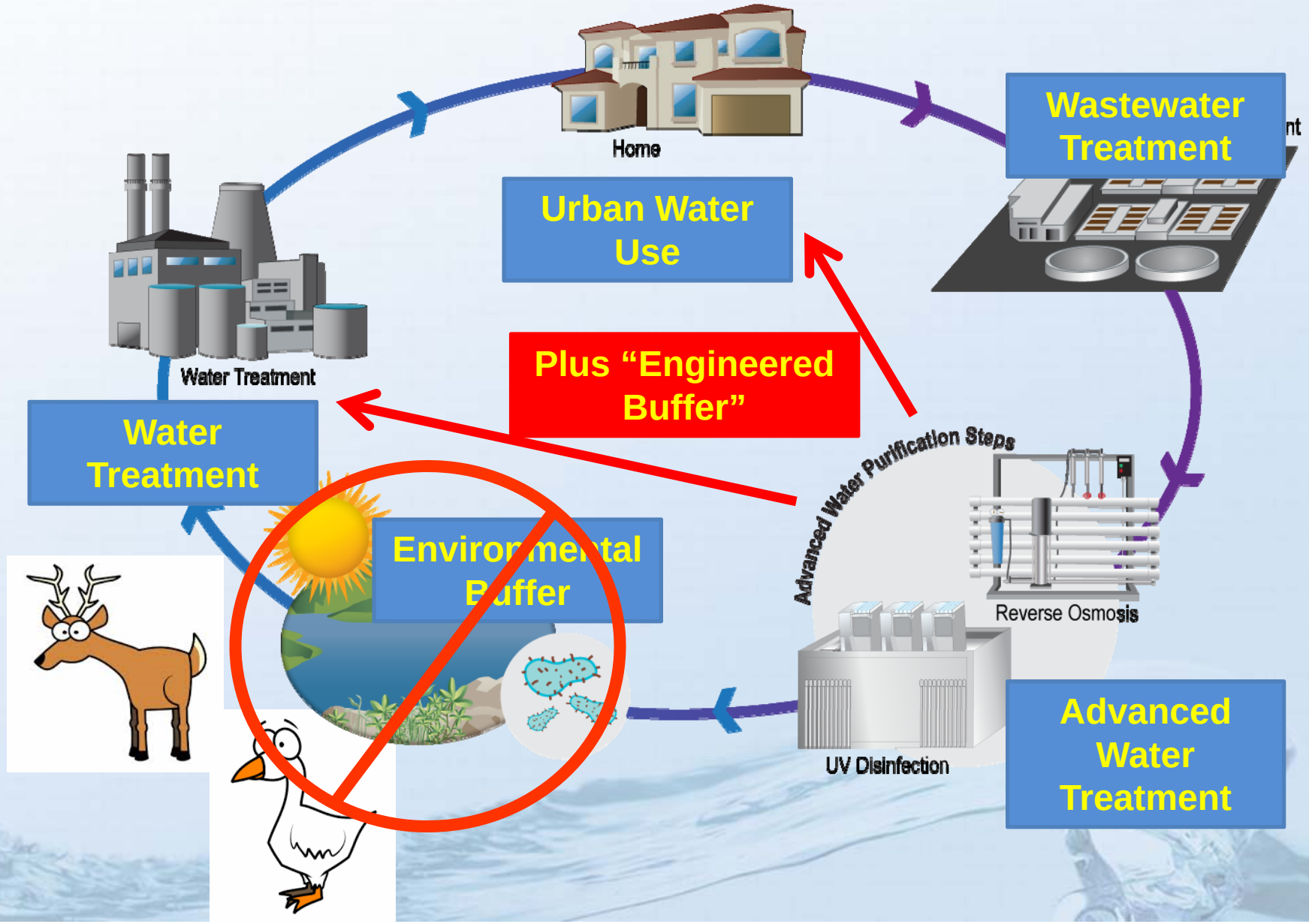
National Research Council (2012) Documents Margins of Safety for CECs

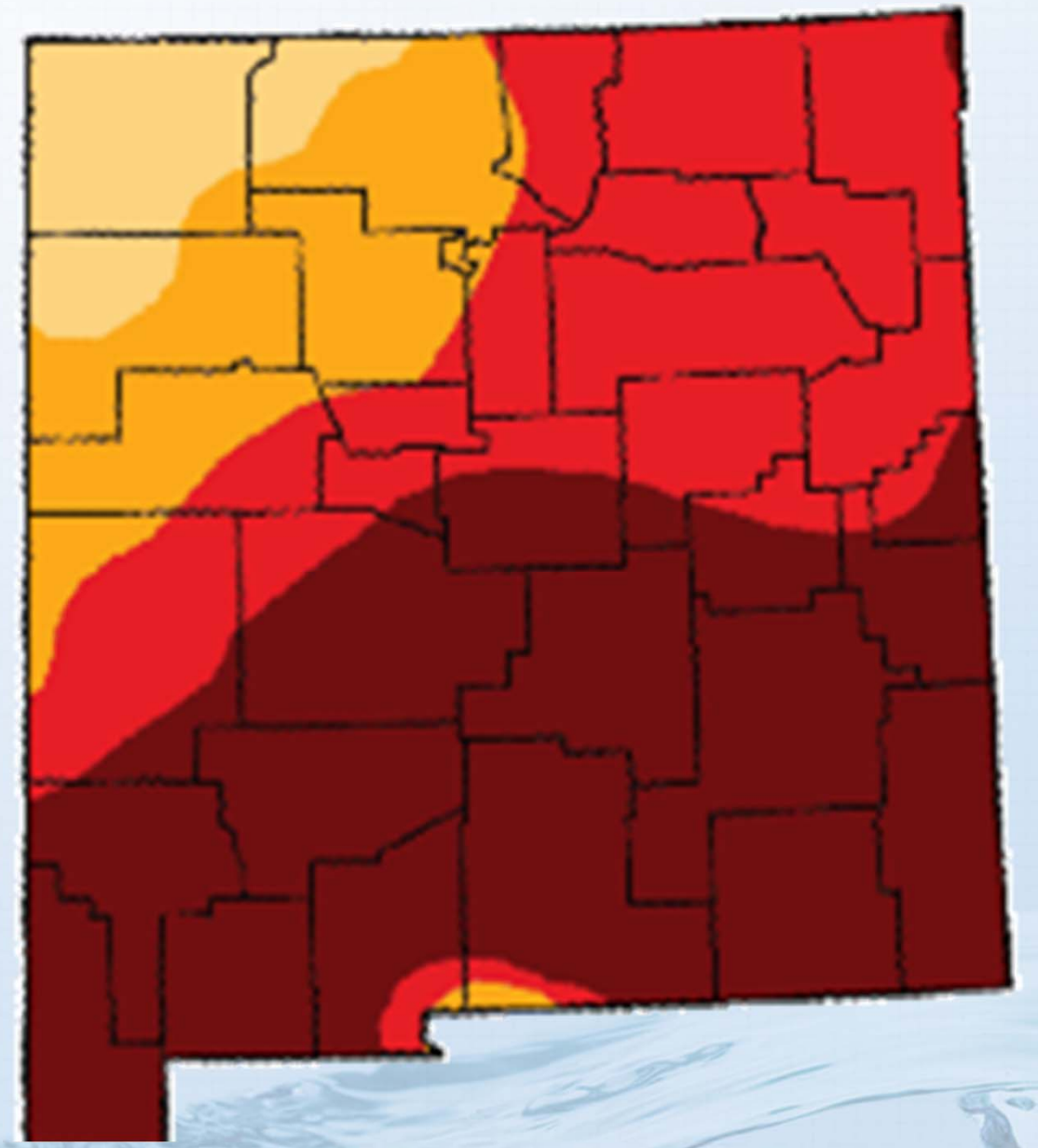
Table 1 **Margin of Safety Estimates for Constituents Treated with MF/RO/UV AOP[1] Groundwater Replenishment Feasibility Study Soquel Creek Water District**

Constituent	Risk-Based Action Level	Margin of Safety (MOS[2]) MF/RO/UV AOP Train
Ibuprofen	120,000 µg/L	>280,000,000
Carbamazepine	186,900 µg/L	>190,000,000
Gemfibrozil	140,000 µg/L	>140,000,000
Sulfamethoxazole	160,000 µg/L	>160,000,000
Meprobamate	280,000 µg/L	>930,000,000
Primidone	58,100 µg/L	>58,000,000
Caffeine	70,000 µg/L	>23,000,000
17-β Estradiol	3,500 µg/L	>35,000,000
Triclosan	2,100 µg/L	>2,100,000
TCEP	2,100 µg/L	>210,000
PFOS	200 ng/L	>200
PFOA	400 ng/L	>80

Direct Potable Reuse

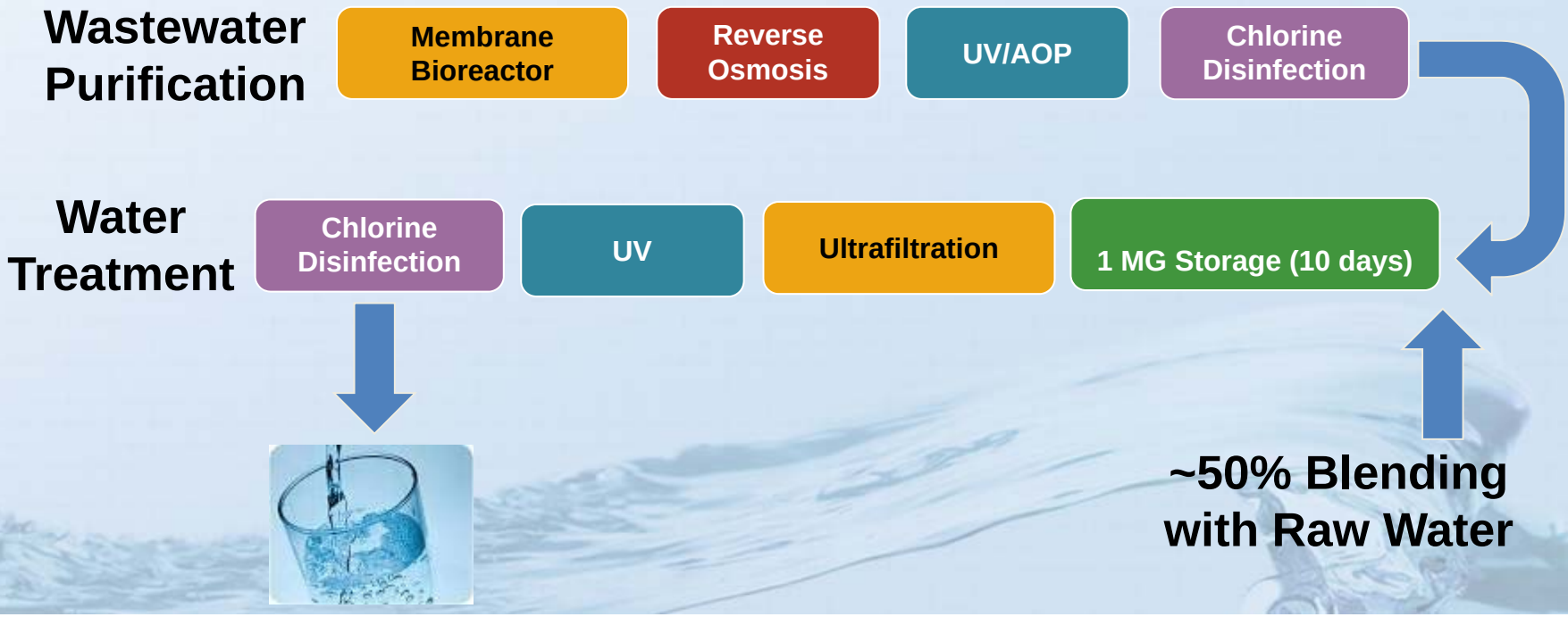
Direct Potable Reuse





Proposed DPR System for Cloudcroft

- System is not yet operational.
  - 80%+ constructed.
  - Goes online 2016.
- Highly advanced and redundant processes.



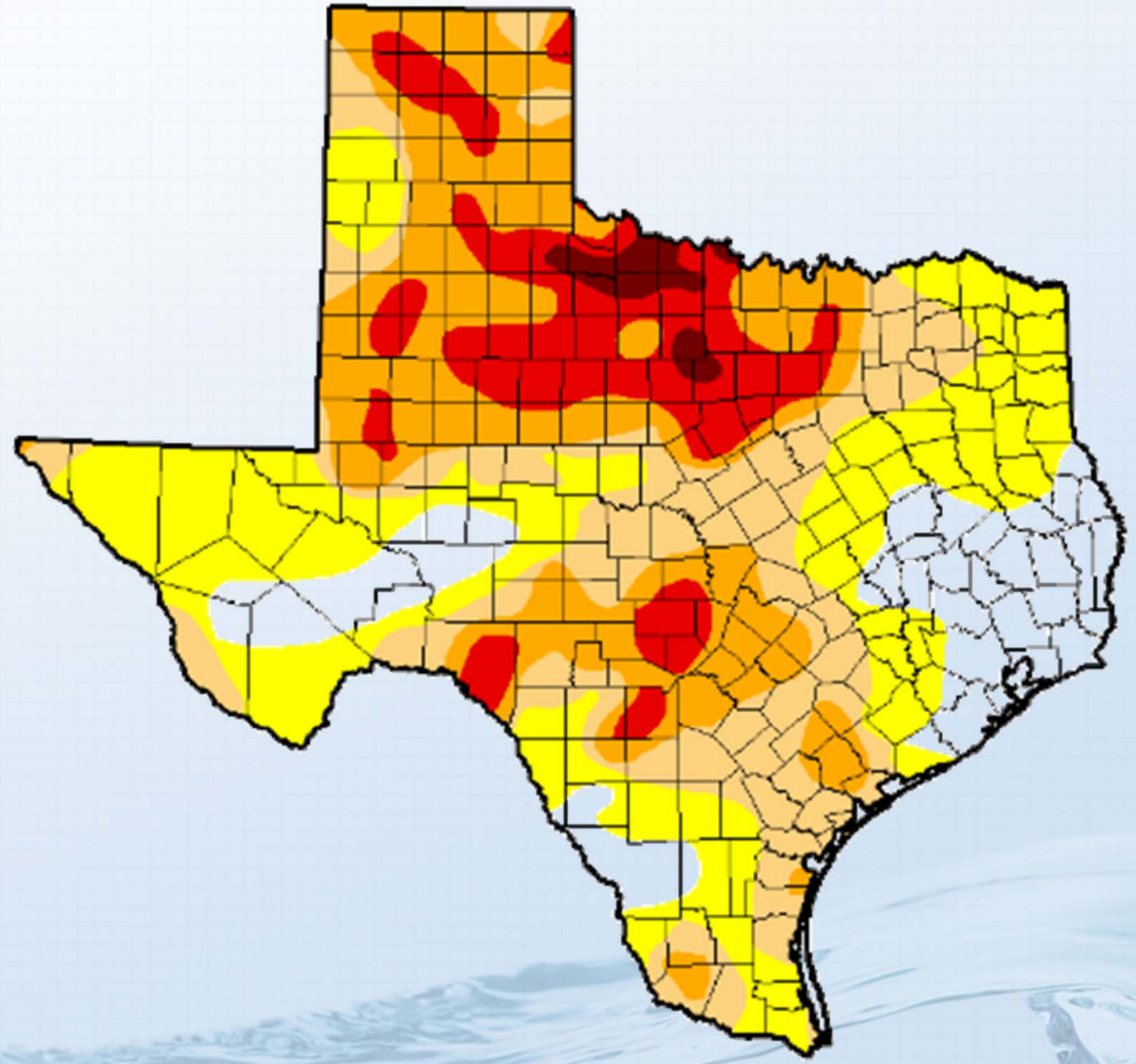
Critical Issues to Address in Cloudcroft

- **New Mexico Environment Department needs answers.**
  - What level of treatment meets public health standards?
  - Is the existing treatment scheme sufficient? What about process monitoring?
  - How will a small community properly operate an advanced facility?
  - What type of statewide guidance is needed for big and small DPR projects?

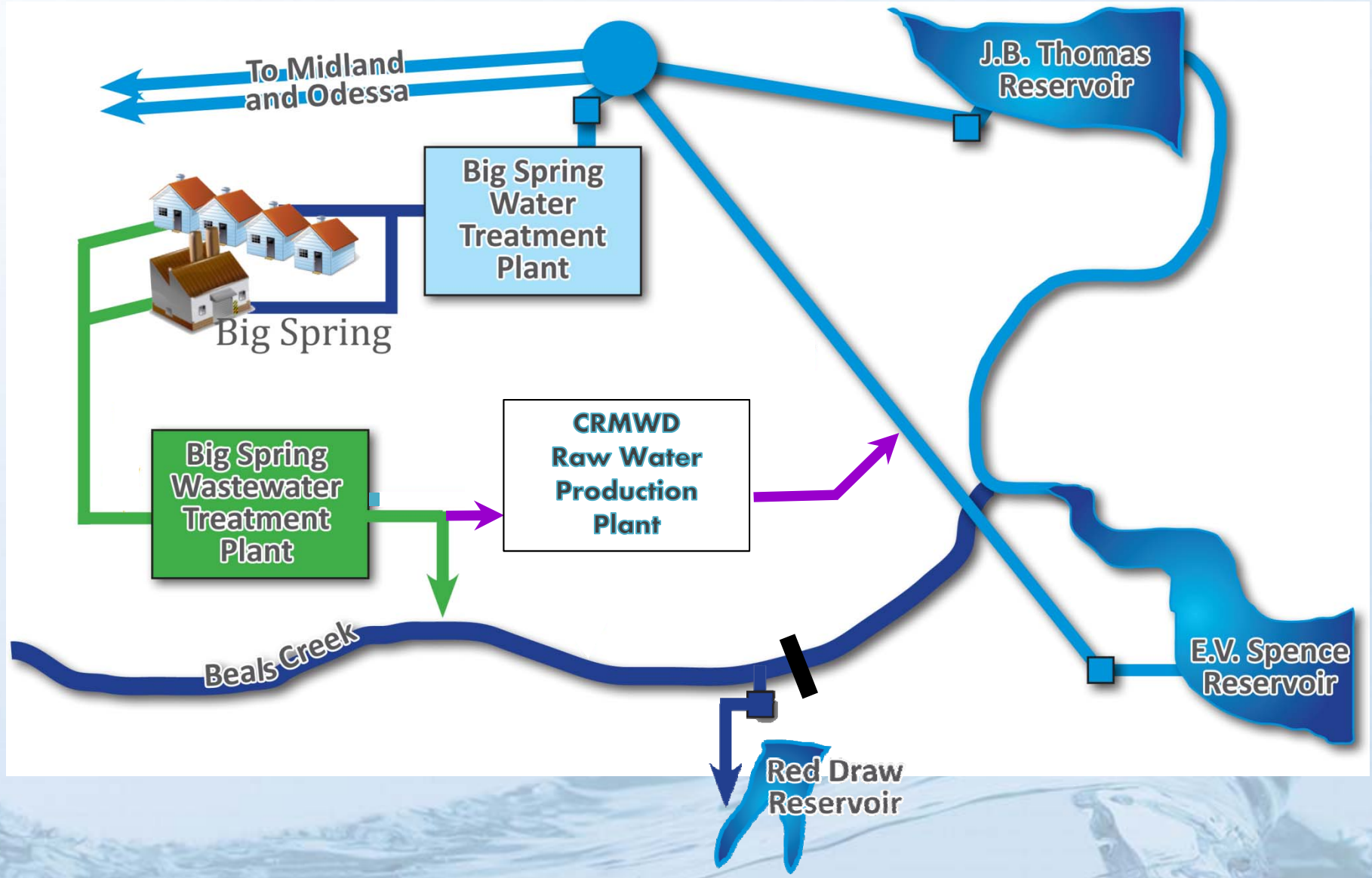
- Expert Panel (IAP)
  - Jeff Mosher, NWRI
  - Jim Crook, Chair
  - Joe Cotruvo
  - Andrew Salveson, Panelist
  - Bruce Thompson, UNM
  - John Stomp, Albuquerque

NWRI Panel Key Issues

- Operation and maintenance (O&M) issues are key!
  - Training
  - Retraining
  - Staff redundancy (small community!)
  - Budgeting - this will be a large increase in O&M costs.
- Outreach & Education ASAP

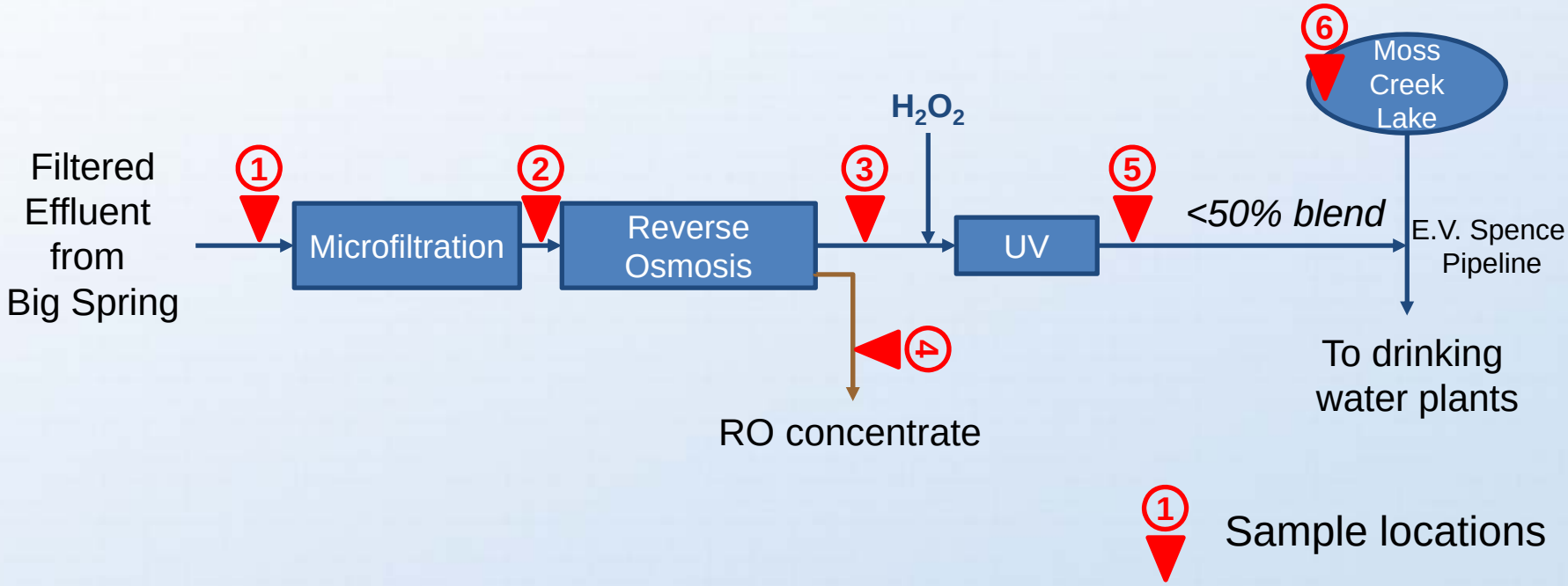


DPR in Big Spring (TX)



Colorado River Municipal Water District
Raw Water Production Facility

Raw Water Production Facility in Big Spring Provides Supply Diversification



Study Sponsored by:

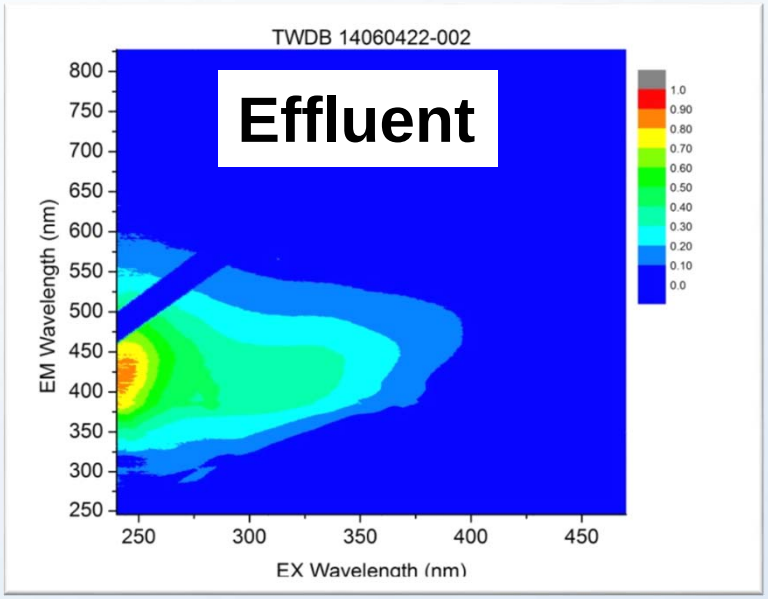
Texas Water Development Board

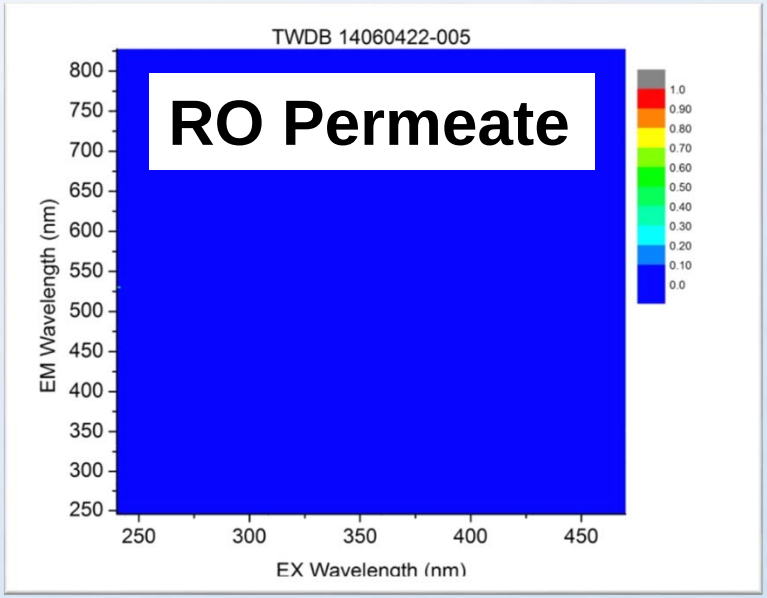
WateReuse

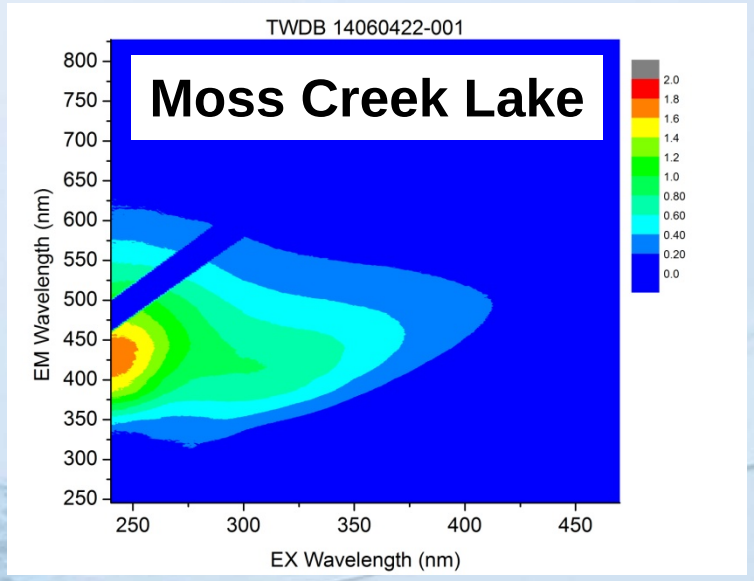
Research Partners:

- *Carollo Engineers*
- *Trussell Technologies*
- *University of Texas*
- *Southern Nevada Water Authority*
- *Nalco Company*
- *Hazen & Sawyer*

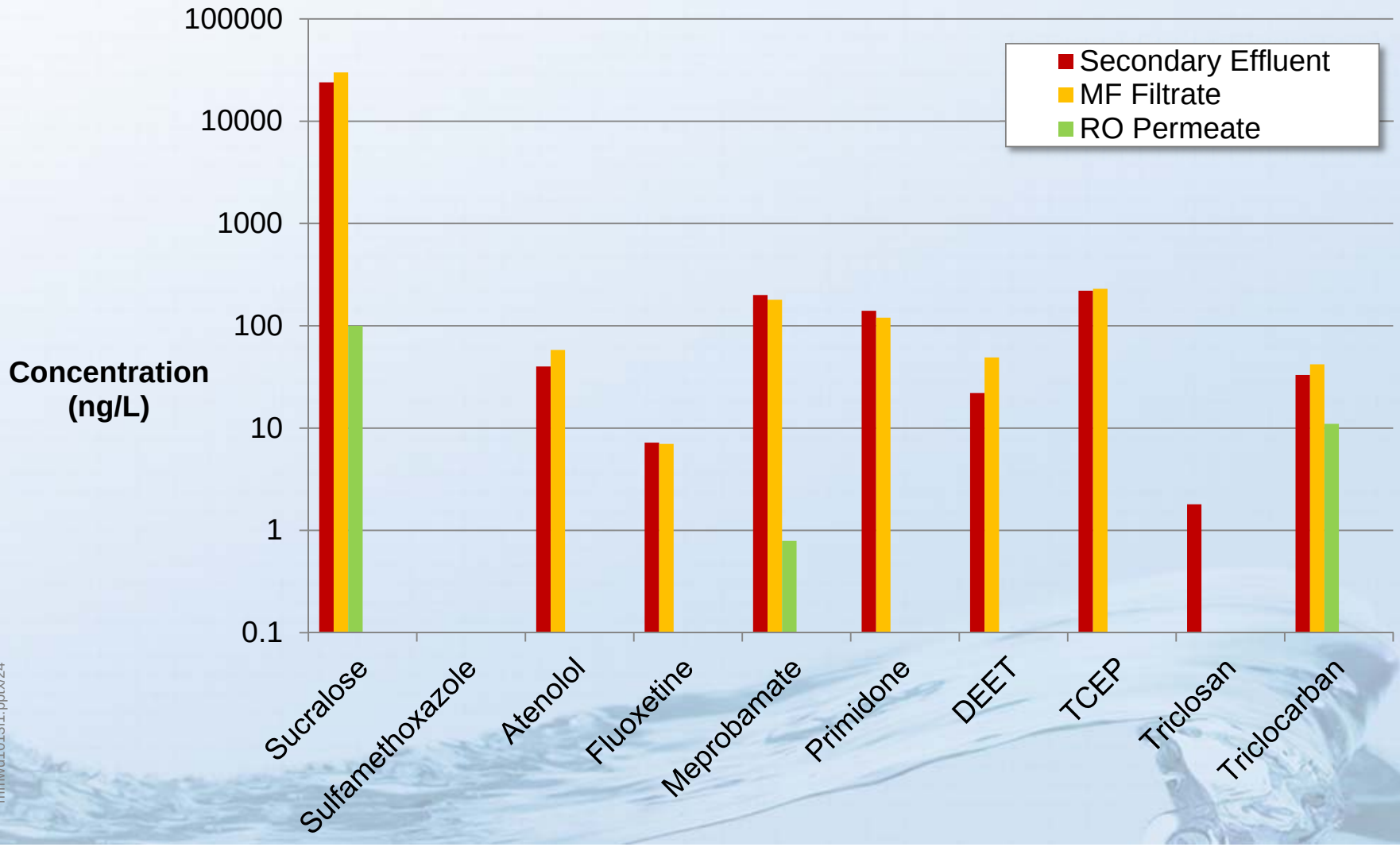
Fluorescence Images Tell a Good Story



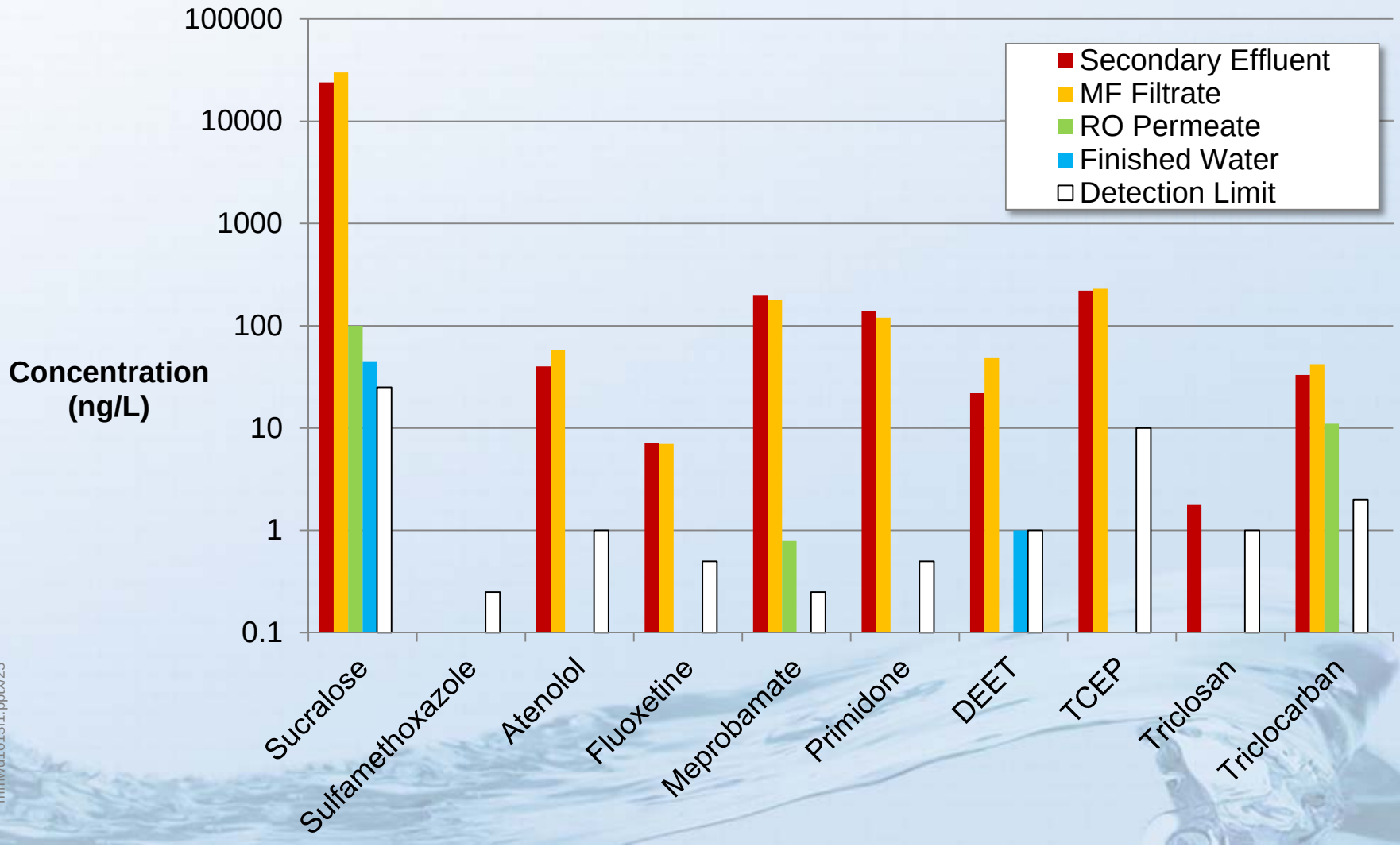




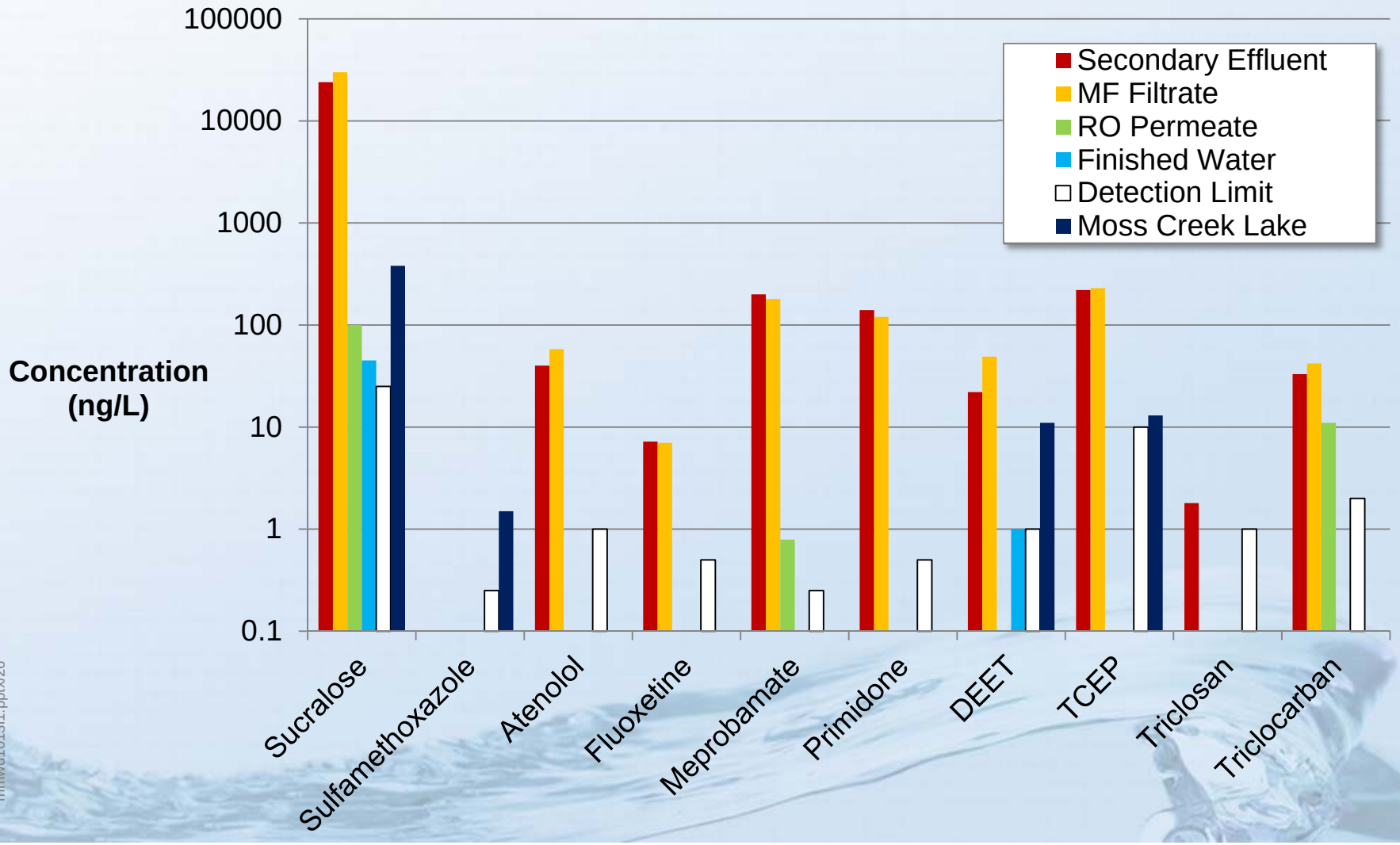
RO Achieves Robust Removal of Trace Organics (Pharmaceuticals etc.)



AOP Finishes the Job



DPR Finished Water Improves Blended Water Quality wrt Trace Organics



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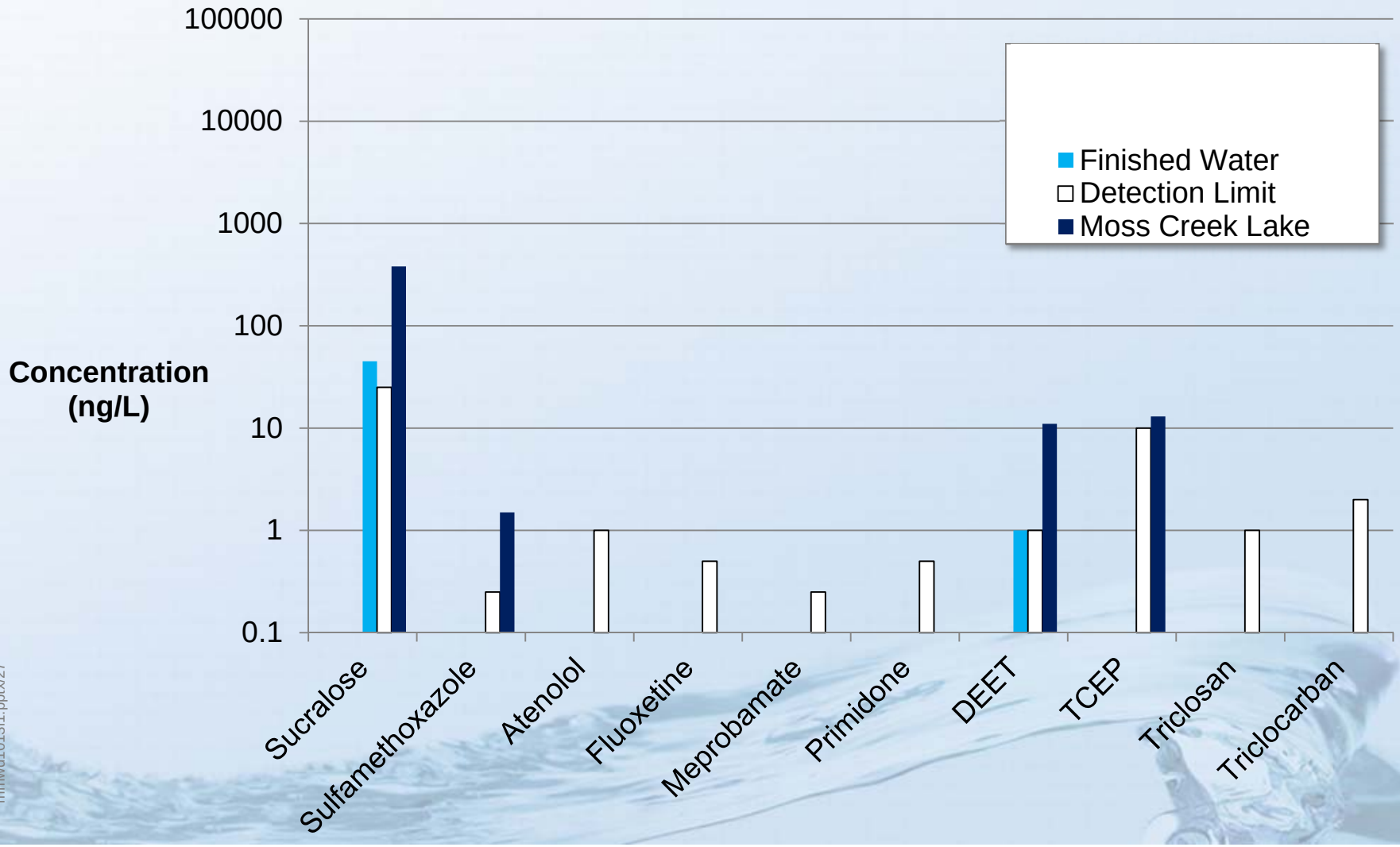
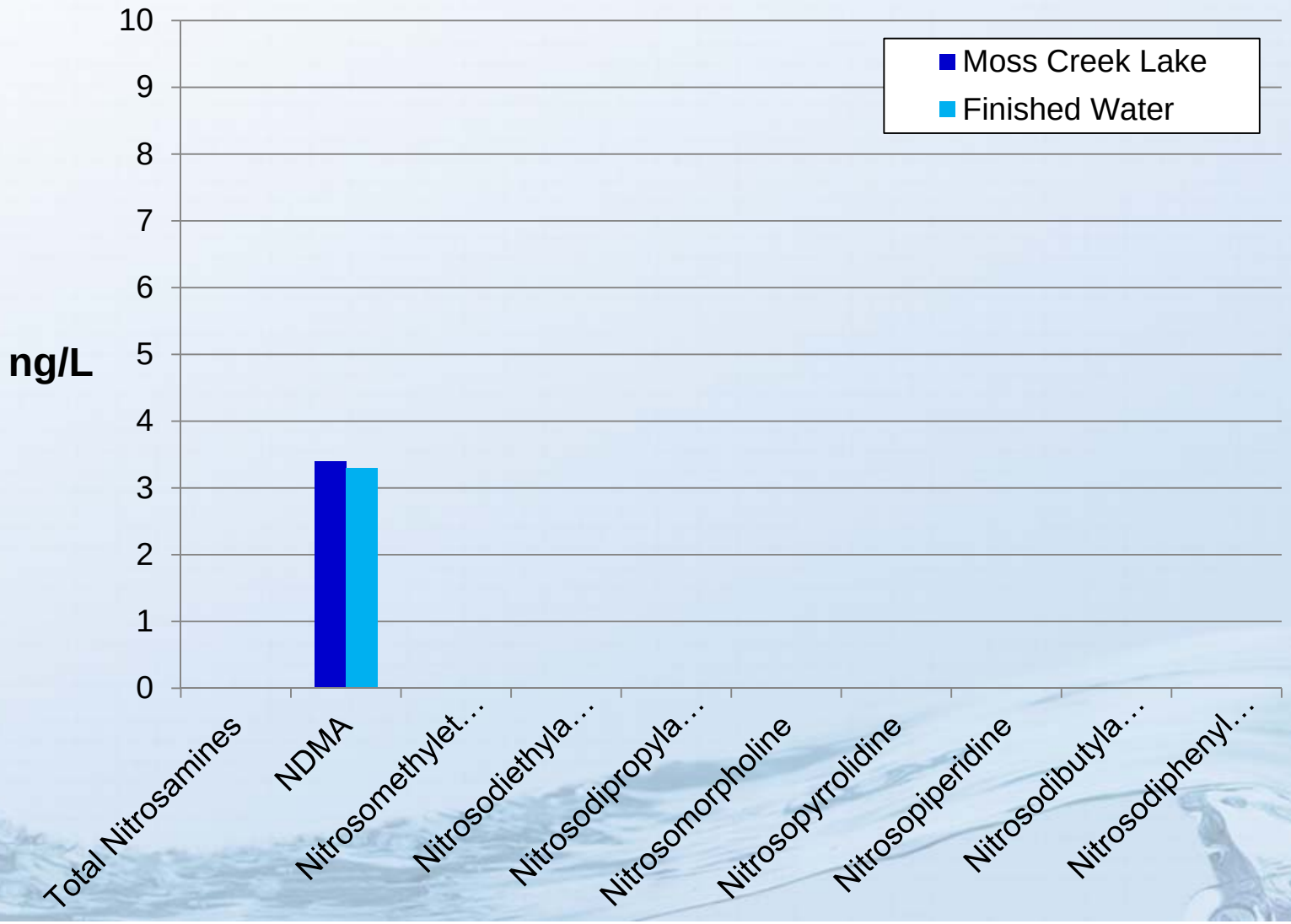
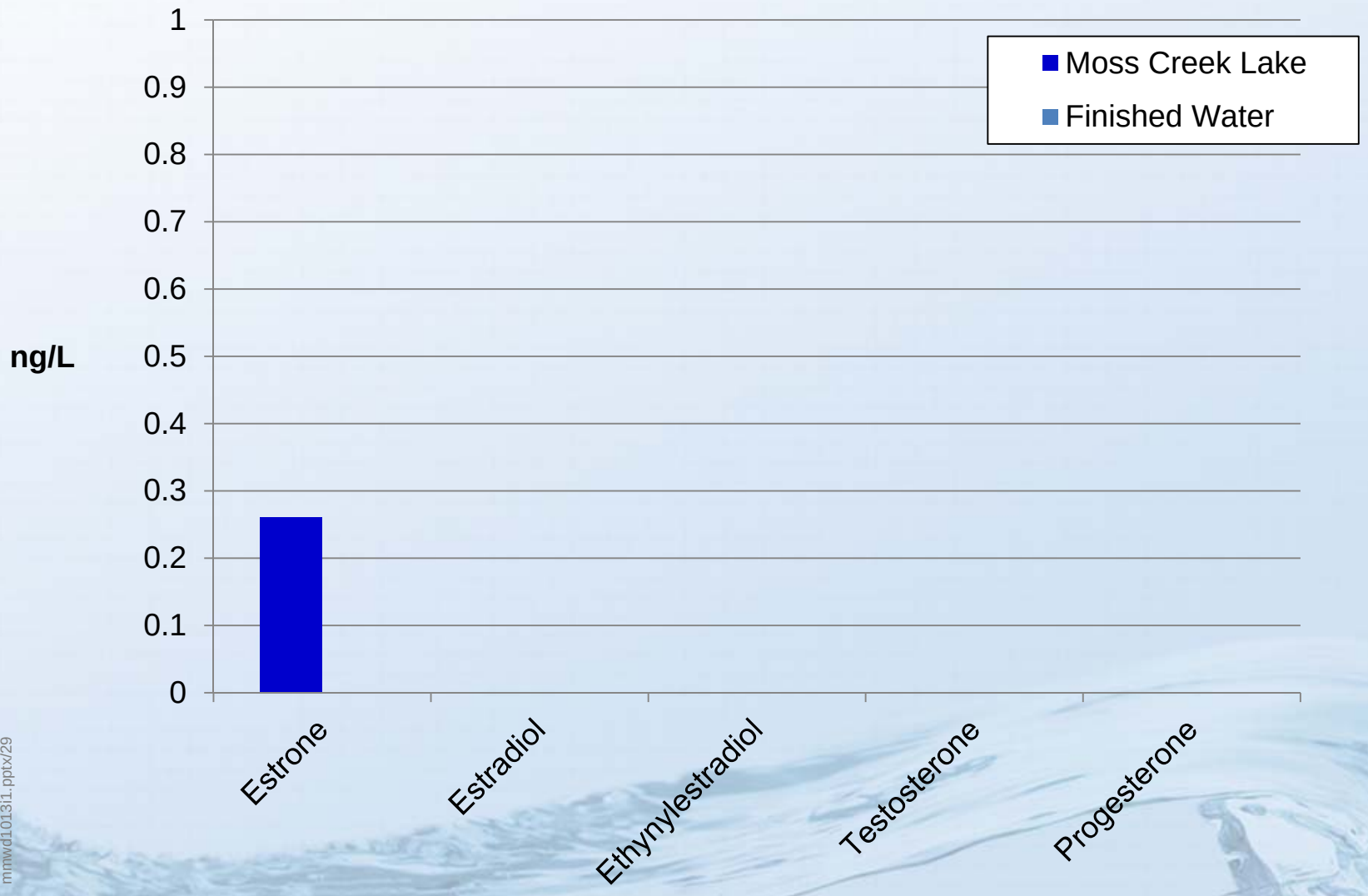


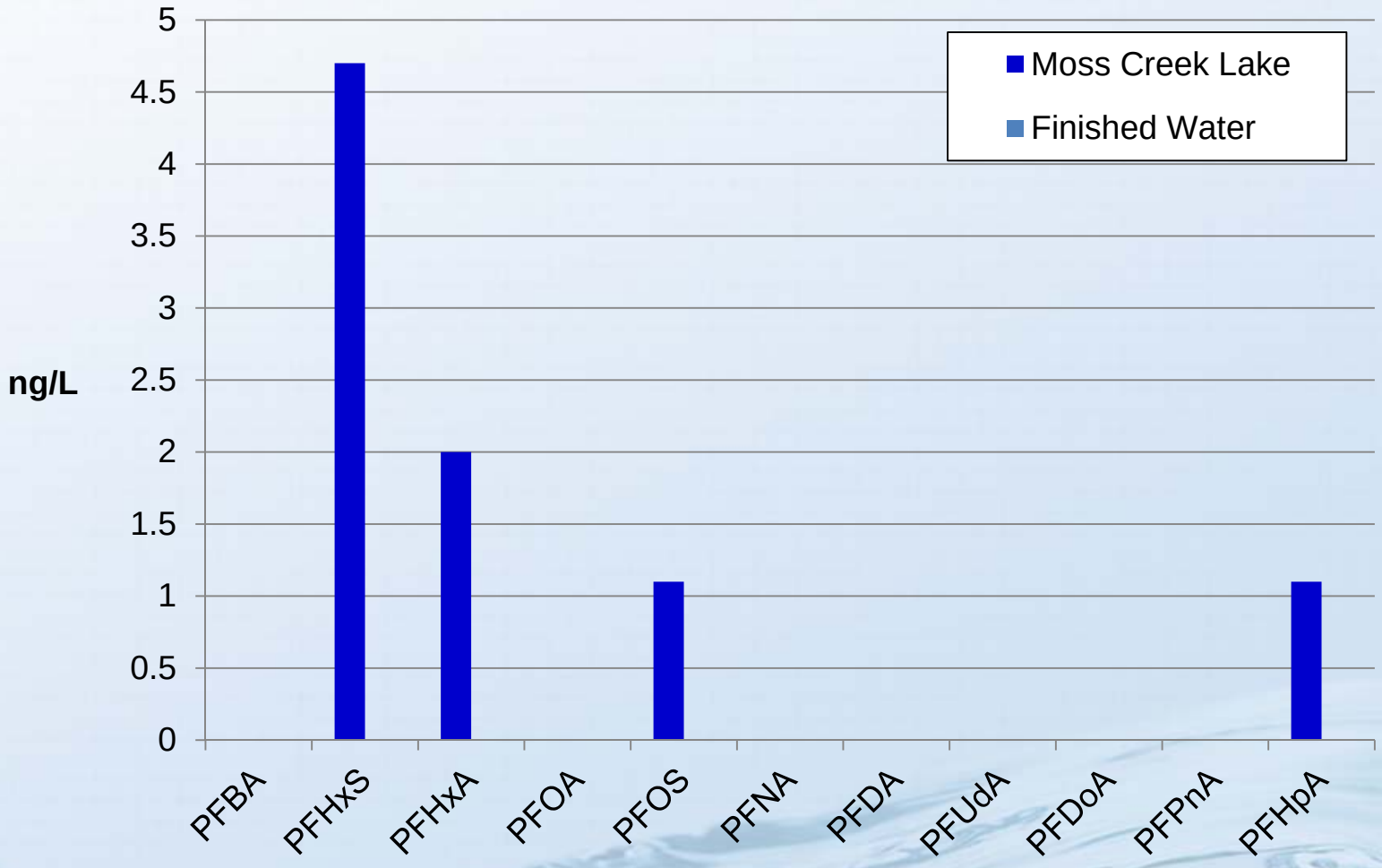
The Story is similar for Nitrosamines…



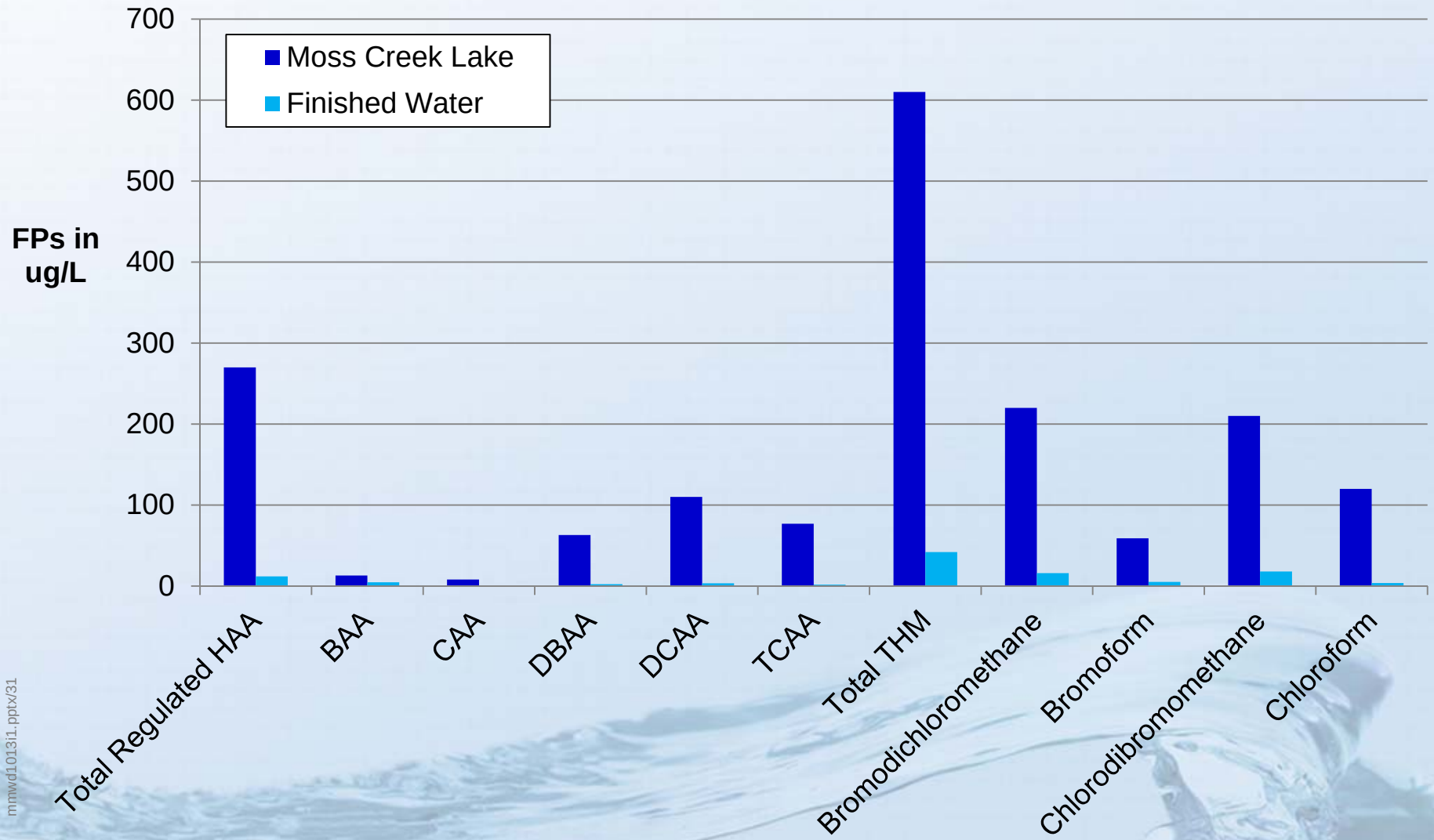
… and Estrogens…

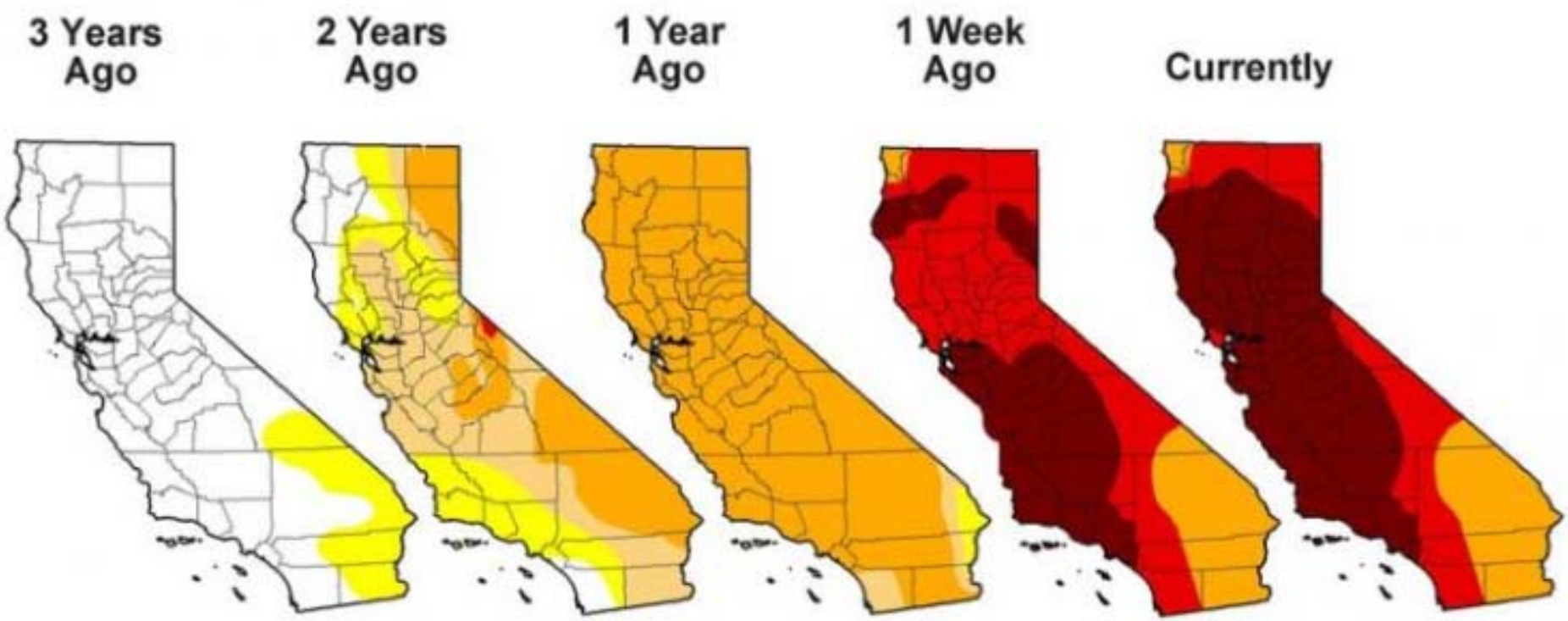


… and Perfluorinated Chemicals…

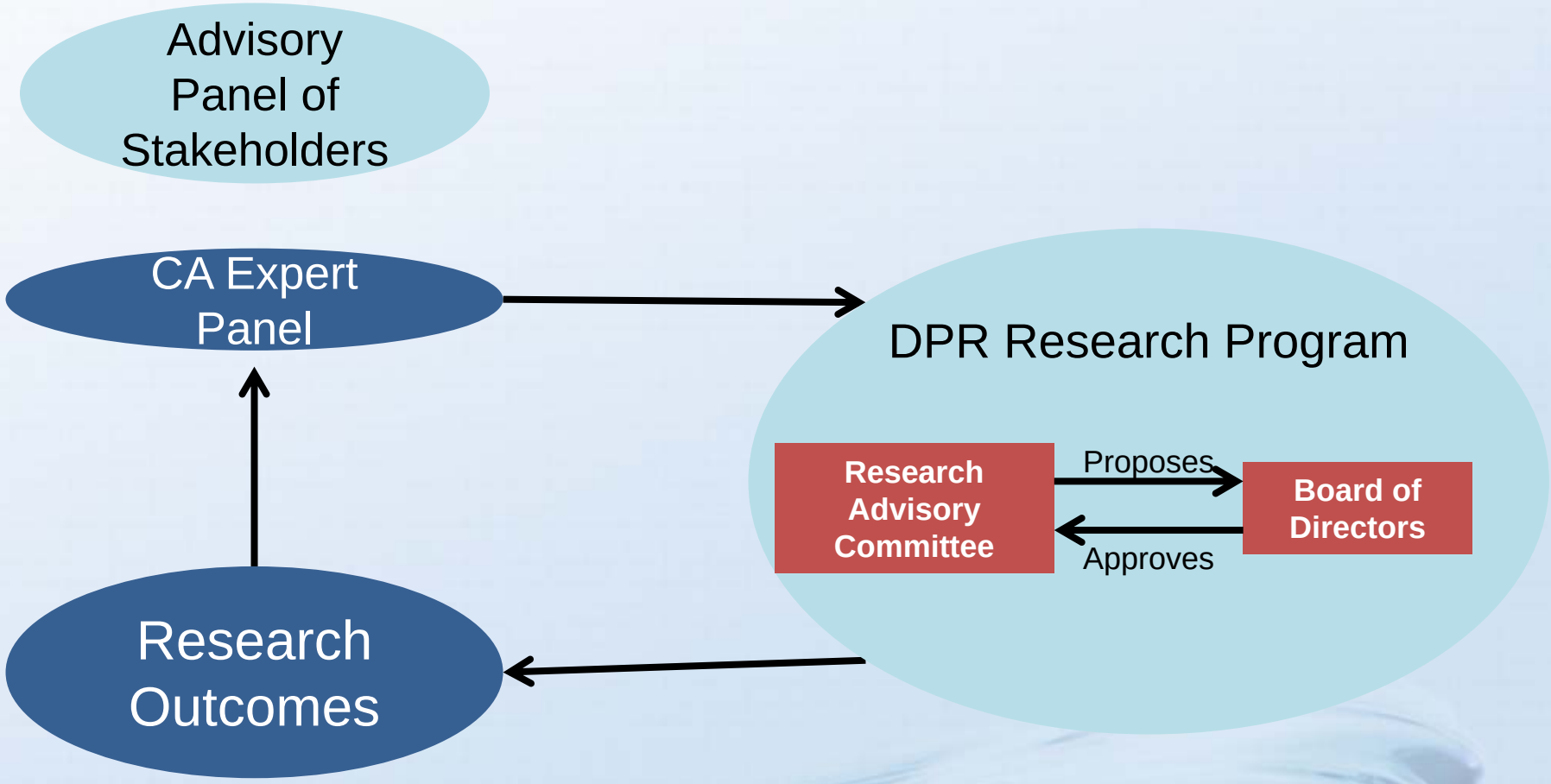


Formation Potential Tests Illustrate the DBP Advantage of RWPF Water

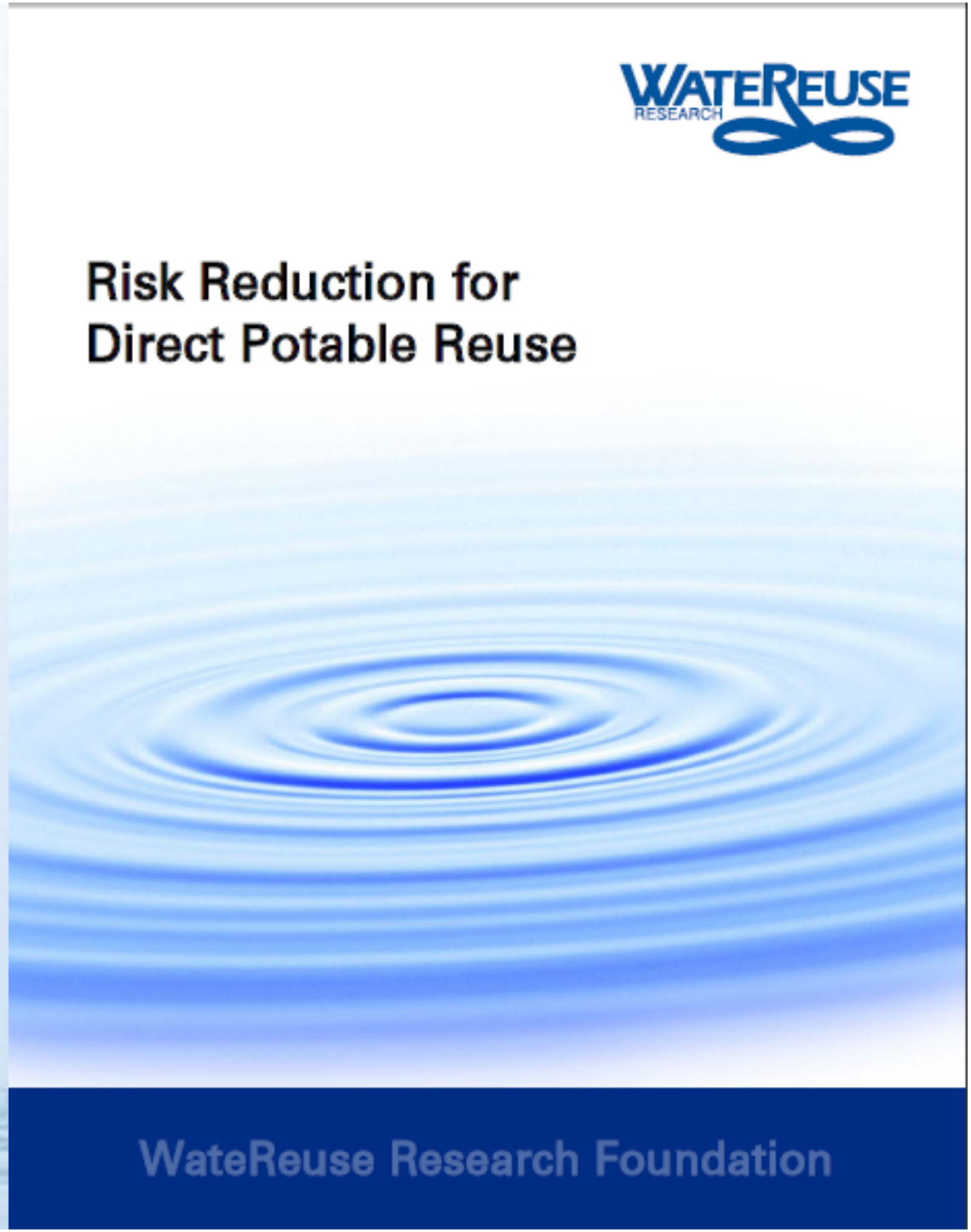



3 Years Ago
2 Years Ago
1 Year Ago
1 Week Ago
Currently

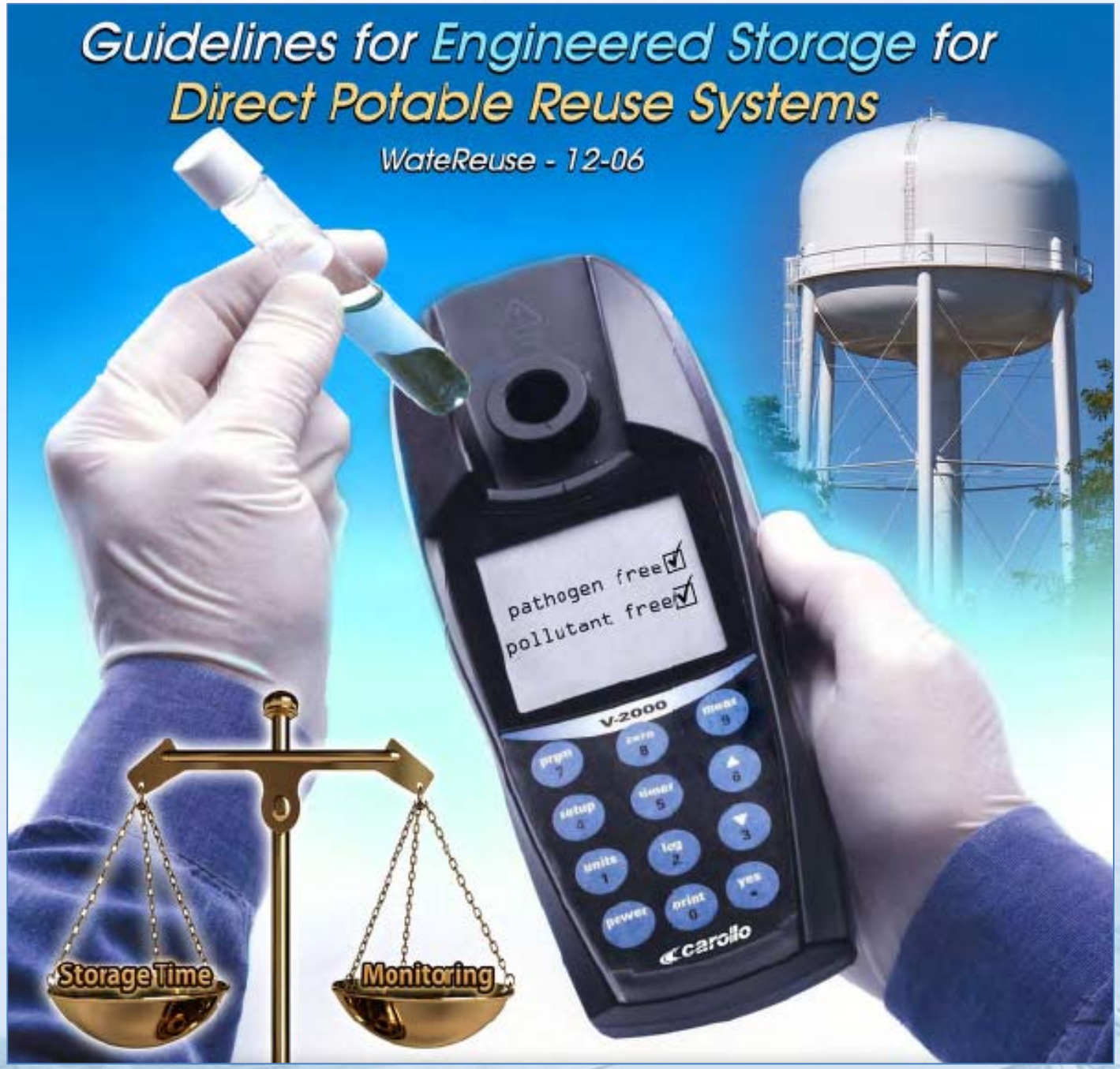
WateReuse DPR Research Program and Expert Panel



WRRF 11-10 is the first published WRRF report on how to safely implement DPR



Our Structural Partners (Cal State) Taught Us About the Risk Related to Complex and Coupled Systems


Guidelines for Engineered Storage for
Direct Potable Reuse Systems
WateReuse - 12-06
pathogen free
pollutant free
V-2000
Storage Time
Monitoring

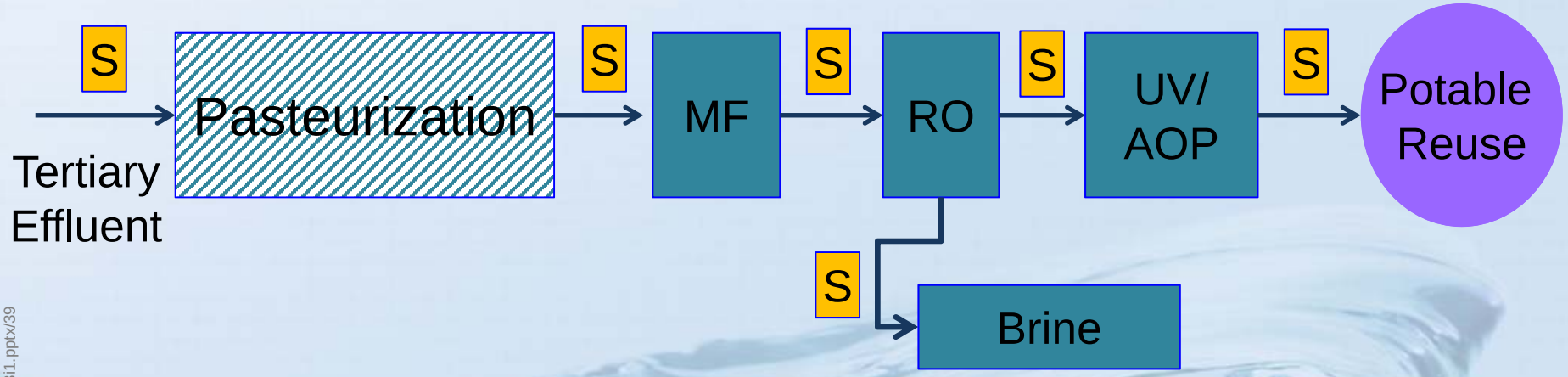
Ventura Case Study

City of Ventura

- Limited local water supply
- Consent Decree to divert wastewater

Technical Feasibility

- Potable Reuse Demonstration Plant (as part of WaterRF 4536)
  - Develop preliminary RO design criteria
  - Evaluate treated water quality
  - Novel Pasteurization Research
  - Novel RO research
  - Novel UV AOP research




Pasteurization
MF
RO
UV/AOP
VenturaWaterPure
Demonstration Facility
VENTURA WATER
Trusted life source for generations

Public Acceptance

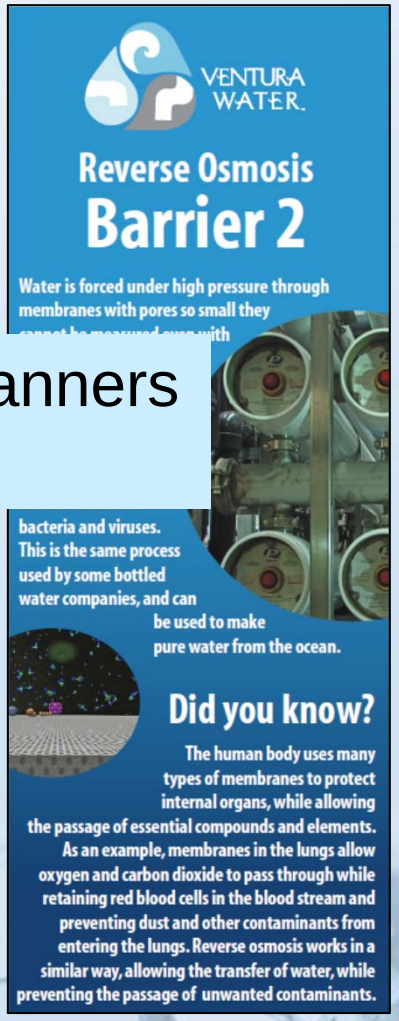
http://www.cityofventura.net/water/sustainable-water

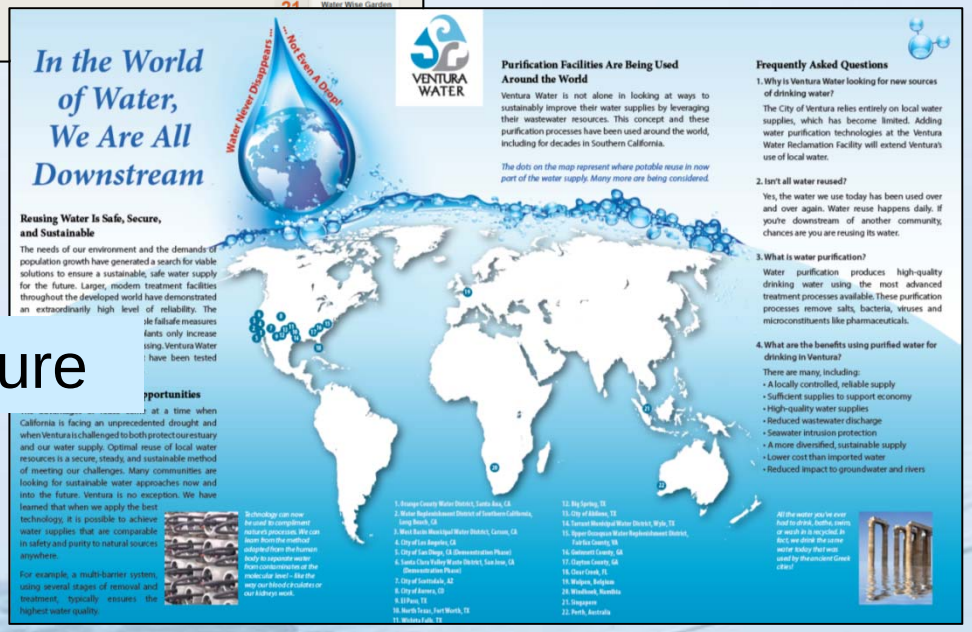
Webpage

Social Media

Banners

Brochure

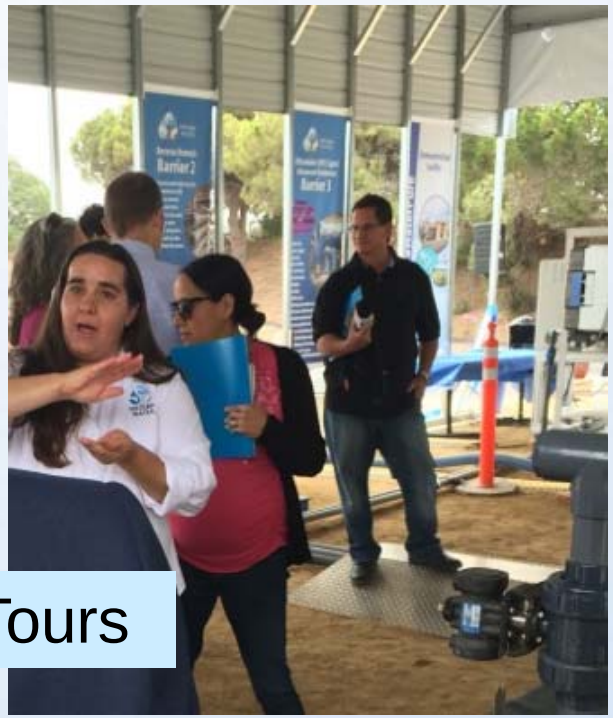




Ventura Water Pure Demonstration Gets Glowing Media Reviews

http://abc7.com/news/ventura-company-making-wastewater-drinkable/859119/

Public Tours and Survey



Tours

Pre-Tour

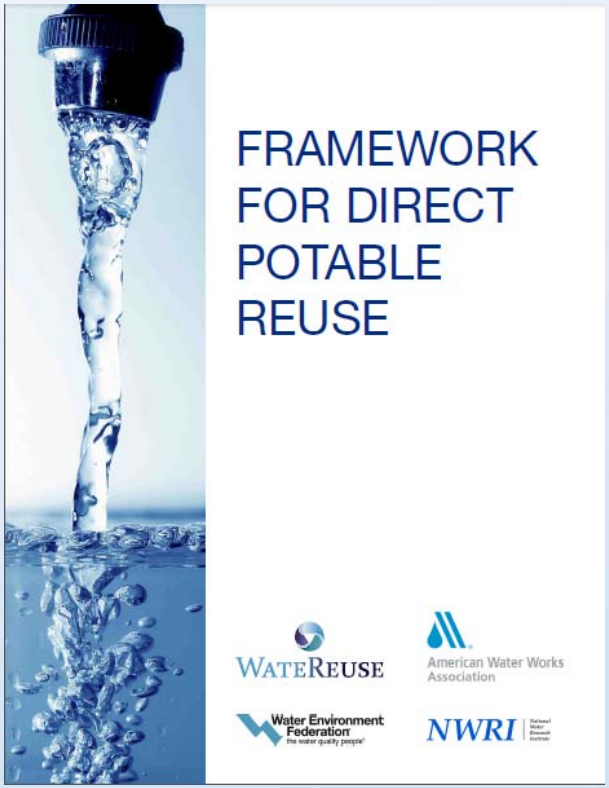
1. How much do you feel you know about Ventura's water sources?
2. How do you feel about adding recycled water to our drinking water supply?
3. What concerns do you have about this water supply, if any?

Post-Tour

1. How informative was the tour today?
2. Is there any additional information you think should be included in the tour?
3. Having learned more, how do you feel now about the idea of adding recycled water to our drinking water supply?

- Generally more support than opposition
- Post-tour opinion is more supportive

DIRECT POTABLE REUSE FRAMEWORK DOCUMENT



NATIONAL WATER RESEARCH INSTITUTE
Fountain Valley, California

FRAMEWORK DOCUMENT
INDEPENDENT ADVISORY PANEL

George Tchobanoglous, Panel Chair
Joseph “Joe” Cotruvo
James “Jim” Crook
Ellen McDonald
Adam Olivieri
Andrew “Andy” Salveson
R. Shane Trussell

NATIONAL WATER RESEARCH INSTITUTE
Fountain Valley, California

ORGANIZATION OF DPR FRAMEWORK DOCUMENT

1. Introduction
2. What is Direct Potable Reuse?
3. Key Components of a Successful/Sustainable DPR Program
4. Public Health Protection
5. Source Control Programs
6. Wastewater Treatment
7. Advanced Water Treatment
8. Purified and Finished Water Management
9. Monitoring and Instrumentation Requirements
10. Residuals Management
11. Facility Operation
12. Public Outreach
13. Future Developments

Conclusion

- Drought conditions are pushing IPR and DPR projects throughout the Western US
- Continued evolution of treatment and monitoring allows for the safe implementation of potable reuse on a large scale
- National and regional regulatory guidance is now available

A Toast to Your Health!