

Direct Potable Reuse: A New Frontier for Arizona

Robert R. McCandless, PE
Brown and Caldwell

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WaterReuse Association

Vision

Arizona's recycled water authority.

Mission

We advocate, educate and provide leadership for responsible use of recycled water.

Values

Responsibility: In all we do

Education: For all

Utilization: Right water for right use

Sustainability: Social, economic, environmental

Efficiency: Optimal use of all water resources

Water Reuse Drivers: A Global Context

	Water Reuse Capacity (AF/yr)	Reclaimed Water as % of Total Water Supply	Policy Drivers	Scarcity Drivers	Environmental Drivers
Israel	510,000	20%			
Singapore	80,783	30%			
United States	3,400,000	3%			
Florida	955,000	4%			
California	807,000	2%			
Texas	482,000	3%			
Arizona	504,000	7%			

Source: Mekorot, PUB, WaterReuse Association, Florida DEP, CA State Resources Control Board, United Nation's University Institute for Water, Environment and Health, TWDB, Arizona Water Resources Development Commission, Bluefield Research

Legend



high impact



Strong impact

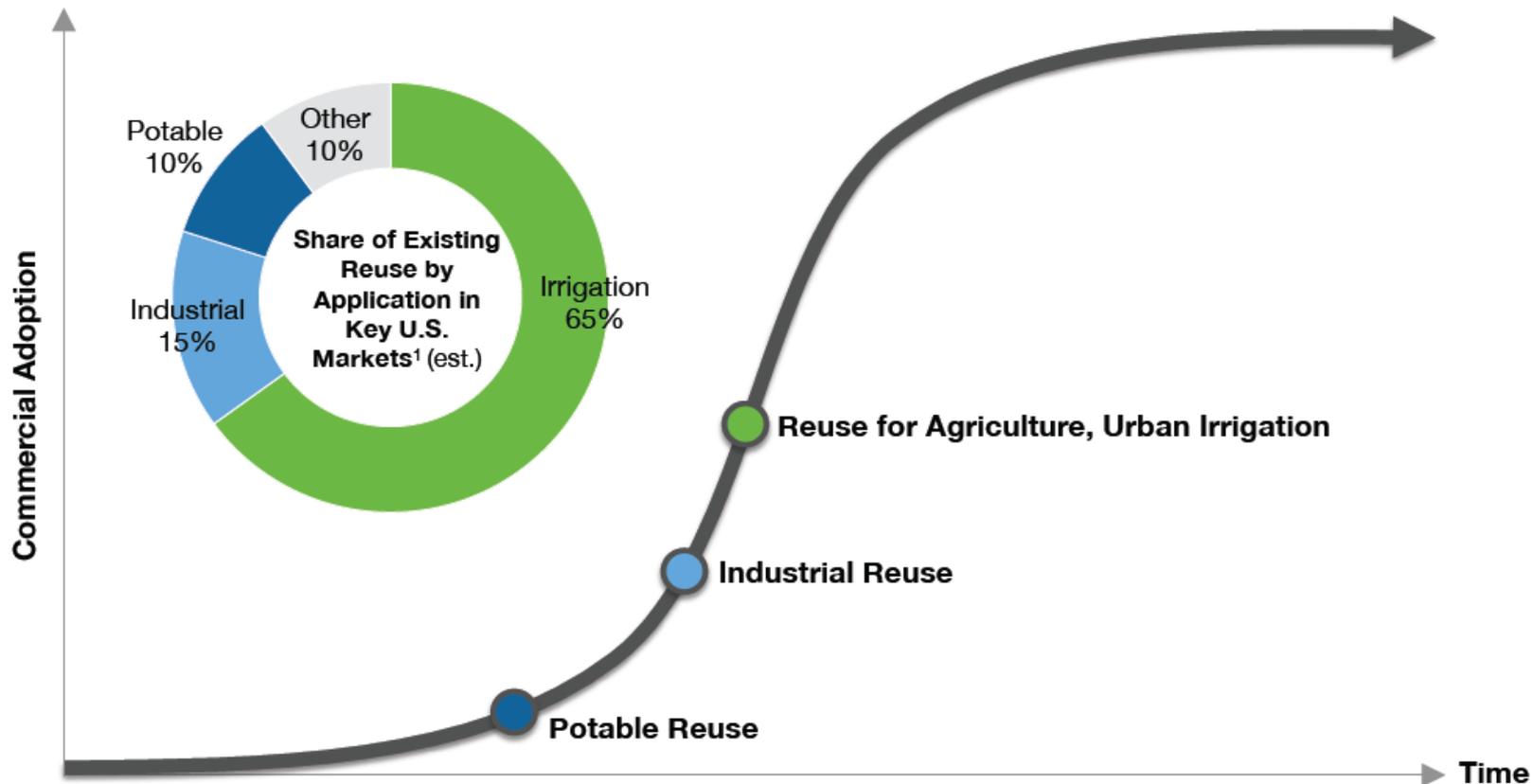


medium impact



low impact

Water Reuse Adoption Curve in the US

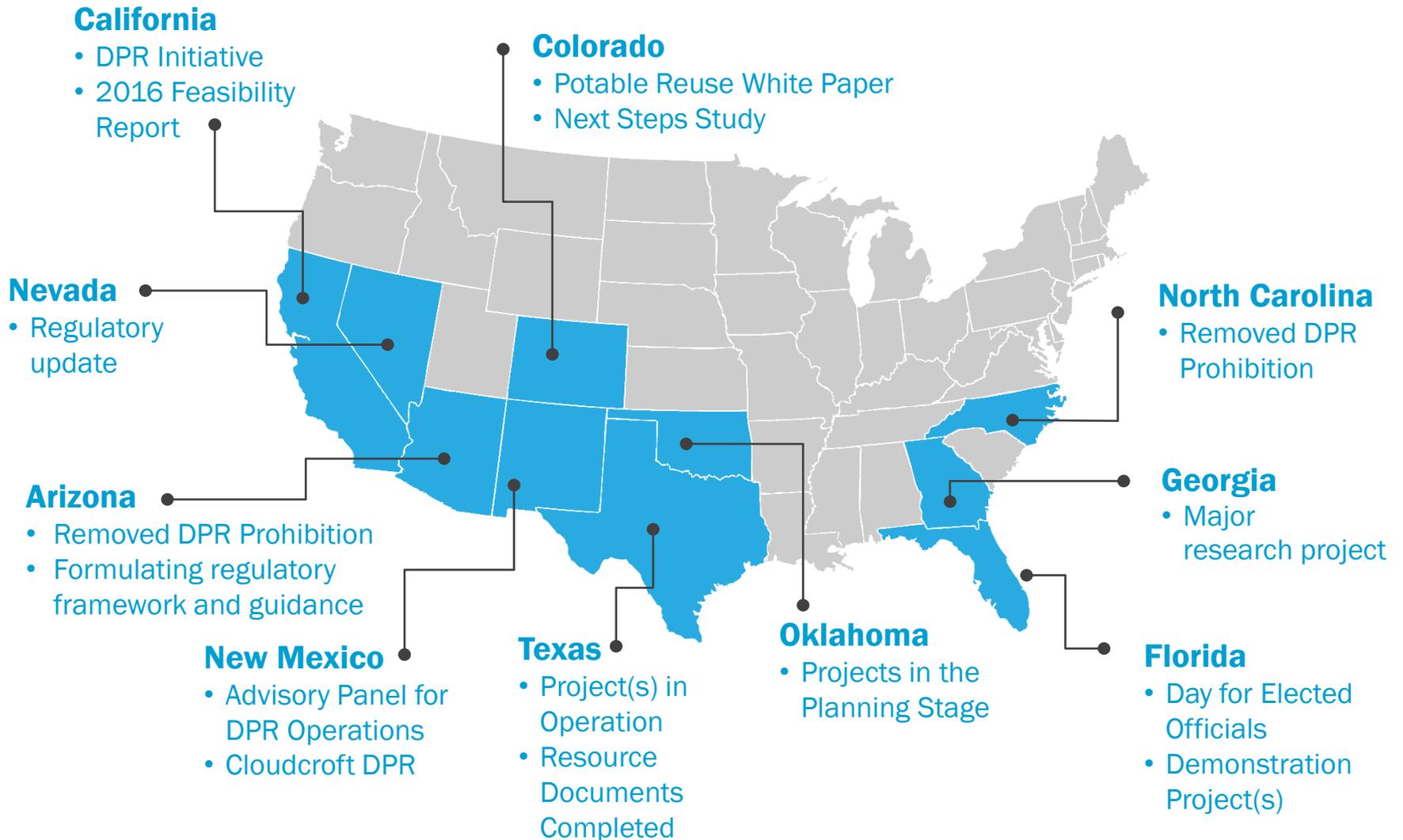


Source: Florida DEP Water Reuse Program, CA State Resources Control Board, Bluefield Research

¹ Key U.S. markets defined as Arizona, California, Florida, Texas.

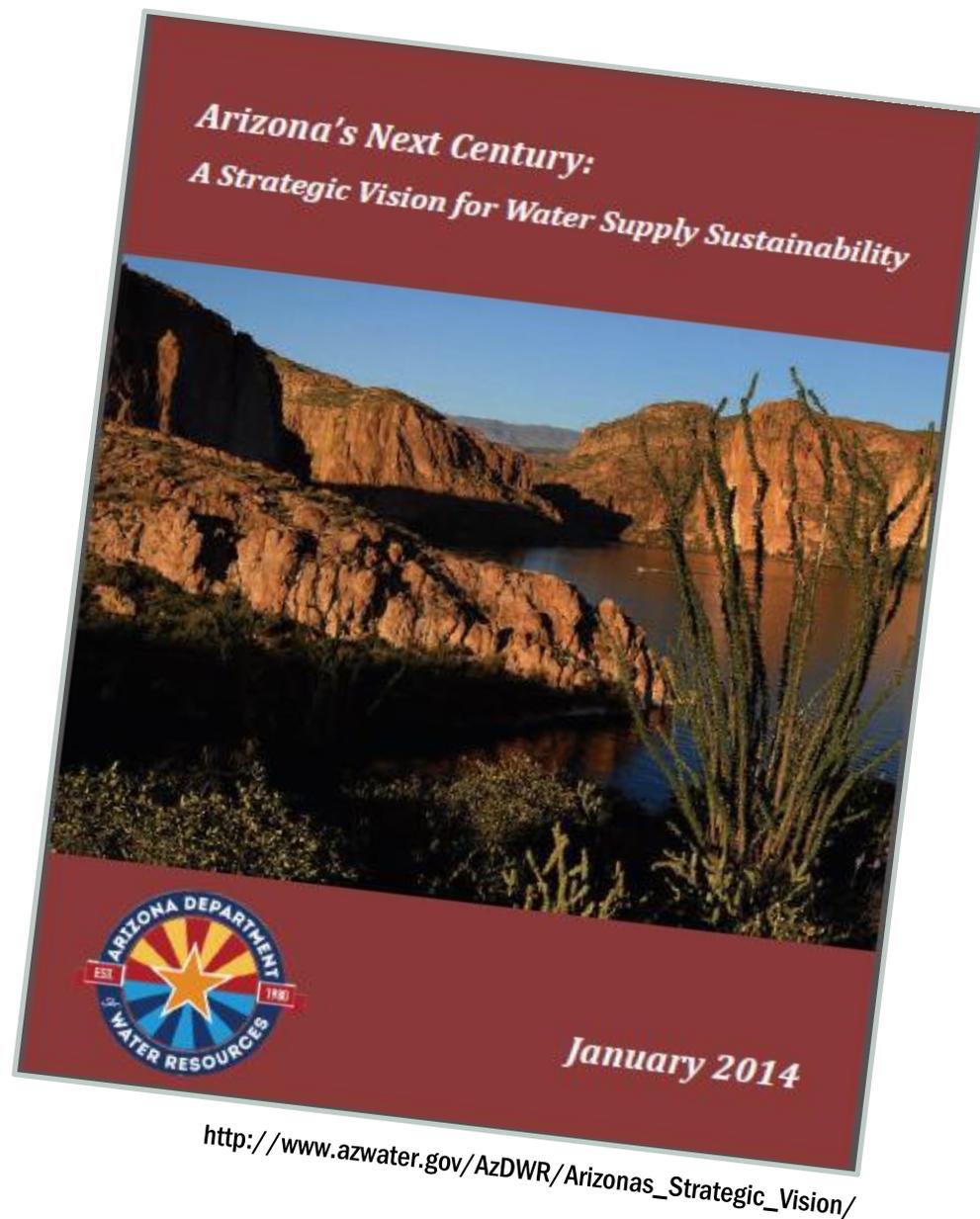
Companies and municipalities are investing in water reuse to hedge against rising water rates, supply risk (e.g. drought), and wastewater discharge regulations.

How States Are Progressing



Arizona's Water Needs

- The need within 25-100 years is **0.9 to 3.2 MAF**
- “As demands increase and water supplies become more stretched, the need to explore and invest in direct potable reuse for drinking water supplies will become necessary.”



Statistics on Arizona Water Reuse

- 98 largest permitted WWTP's (>1 mgd)
 - 33% of all WWTPs in Az
 - 95% of all WW flow (844 mgd or 100,000 afy)
 - 93% distribute reclaimed water for reuse or aquifer recharge
 - 56% distribute Class A+ water

End Use Method	# of WWTP's (>1mgd)	# Sole Method Used
Direct Reuse	91	18
Aquifer Recharge	53	4
Surface Water Discharge	45	2

Statistics on Arizona Water Reuse

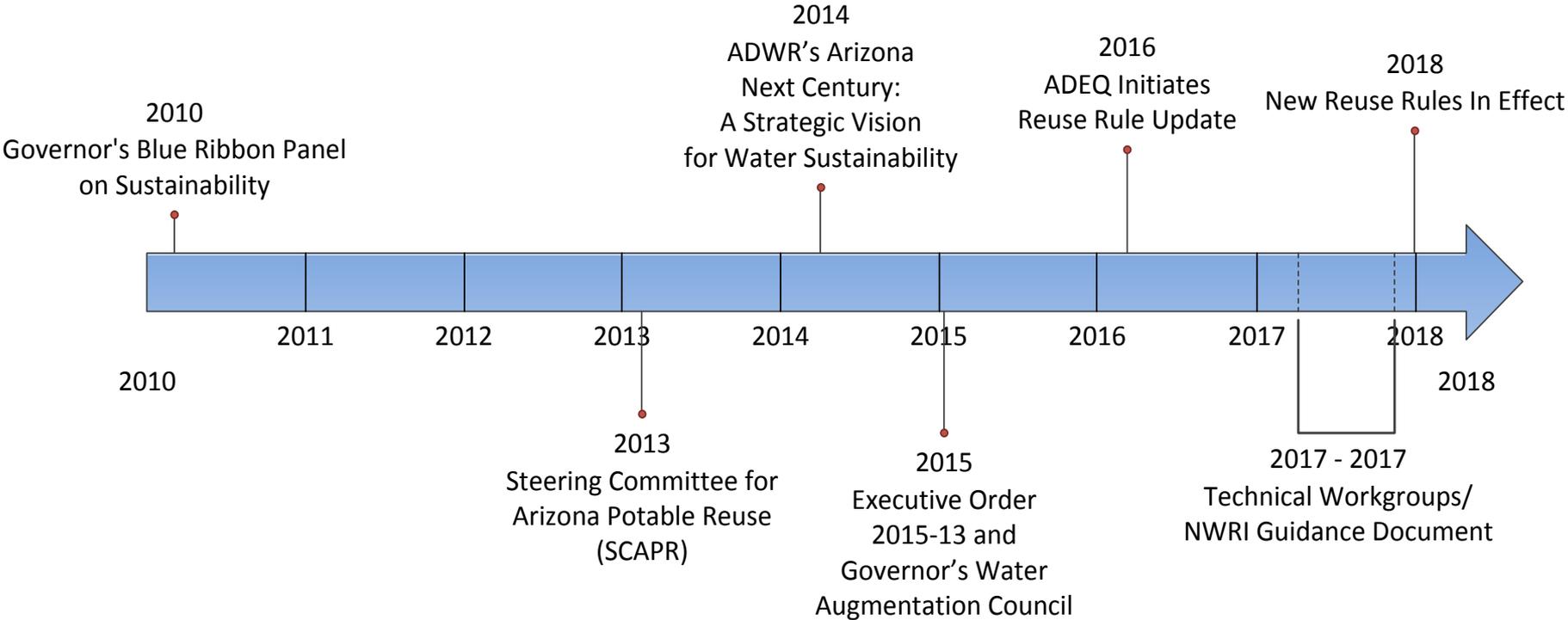
Reclaimed Water Quality	# of WWTPs	Percent
Denitrified (A+ and B+)	75	76%
Pathogen free (A and A+)	56	57%
Denitrified and Pathogen free (A+)	54	55%

Use of Treated Wastewater/Reclaimed Water (by volume)	
Reused	
Power	22%
Agriculture	22%
Aquifer Recharge	21%
Environmental	11%
Landscape/Turf Irrigation	6%
Discharged (uncommitted)	18%

But we can (and must) do more....

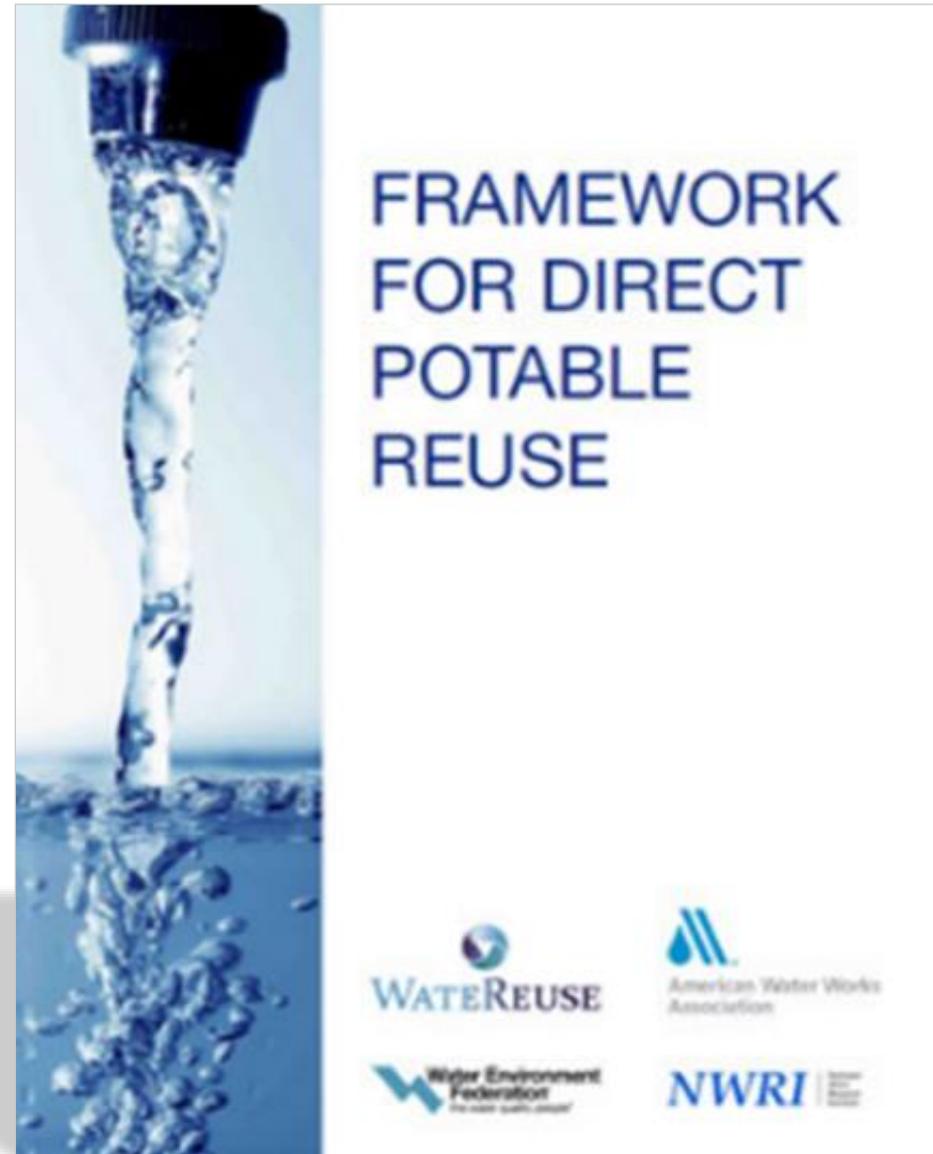
- Drought resilience
- Resource reliability
- Transition to higher-valued reclaimed water end uses
 - Think augmentation of supplies for drinking water
- Increased utilization, particularly off-season use

Big Changes Take Time



Framework for DPR

- Published by:
WaterReuse (2015)
- Sponsors: WaterReuse,
AWWA, WEF
- Developed by: NWRI
expert panel
- Available at:
www.watereuse.org

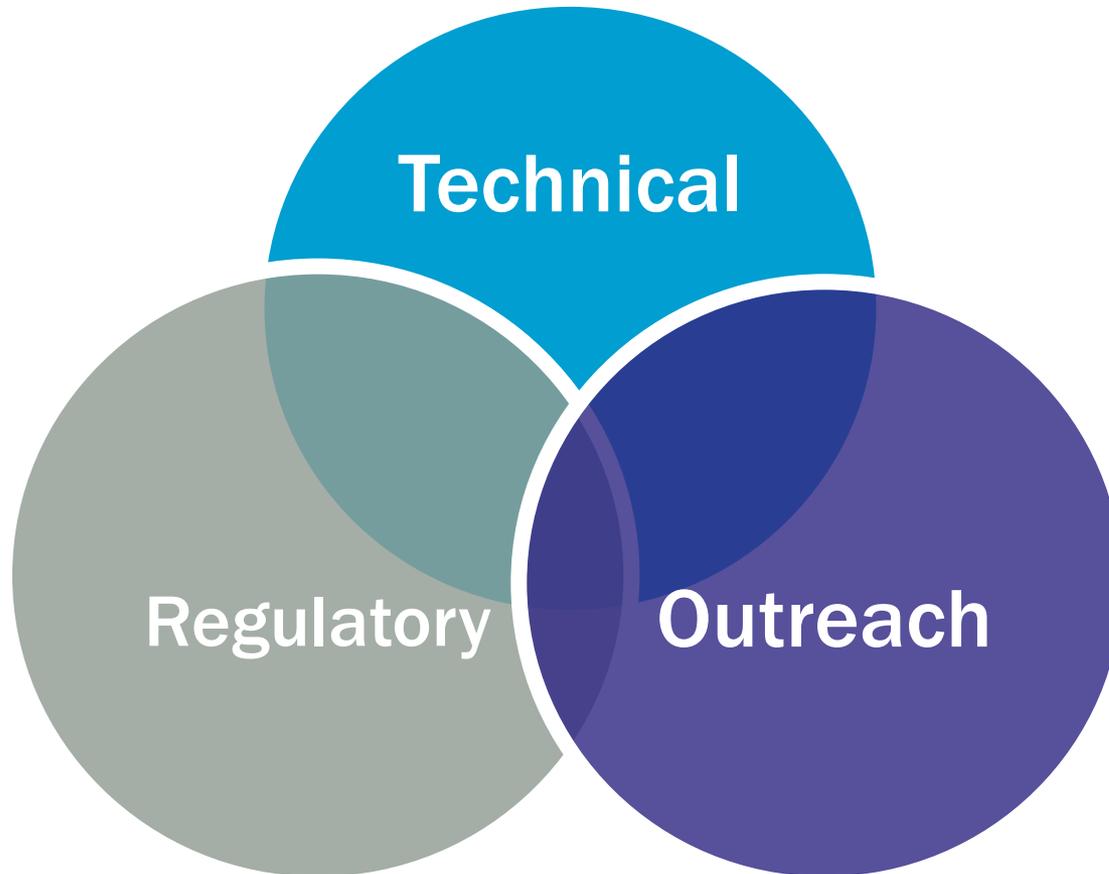




Goals

1. Develop science-based recommendations
2. Protect public health
3. Provide a path for permitting DPR projects in Arizona

Key Components of DPR



Framework Document Topics

1. Rescind DPR prohibition
2. Applications
3. Outreach
4. Source control
5. Public Health Protection
6. Water quality classes
7. Microbial control
8. Log removal targets
9. Chemical control
10. Advanced Treatment
11. Wastewater optimization
12. Employ BADCT
13. Treatment performance
14. Long-term monitoring
15. Critical Control Points
16. Facility operations
17. TMF Capacity
18. Other considerations



1. Rescind DPR Prohibition

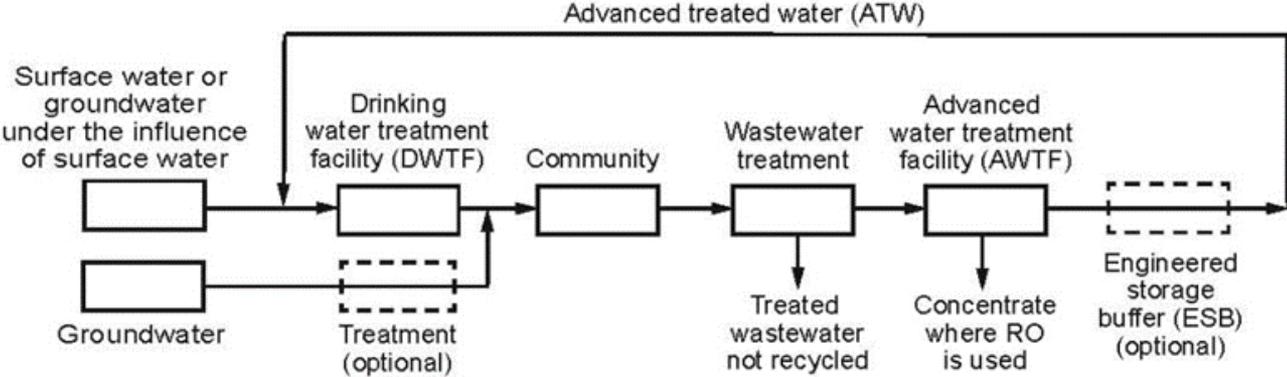
- ✓ Effective January 1, 2018

2. Applications

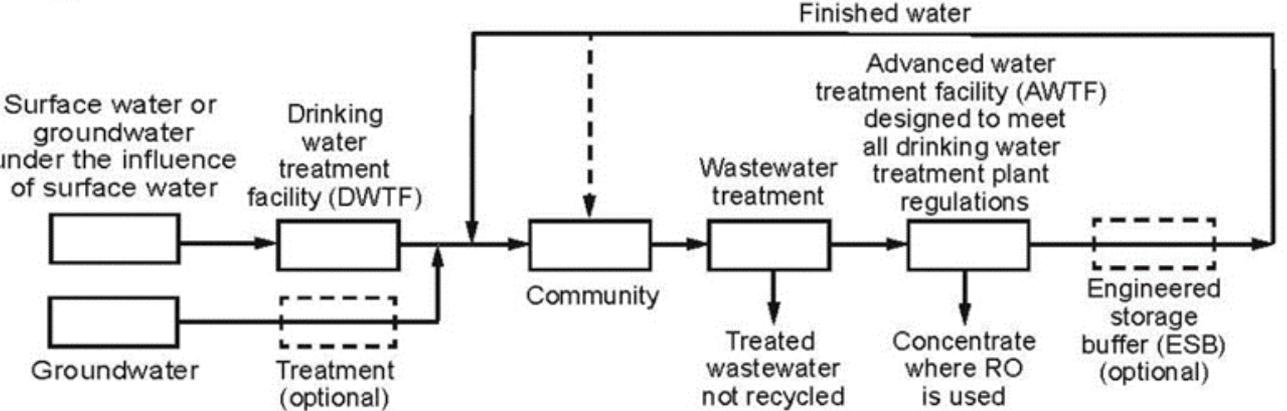
Specific Recommendations

- Address both raw water augmentation and treated drinking water augmentation. (Regulation)
- Modify to cover surface water augmentation, which involves augmenting reservoirs, lakes, and water conveyance structures with advanced treated recycled water. (Regulation)

Flow Diagrams for DPR



(a)



(b)

Figure courtesy of Tchobanoglous et al. (2015)

3. Outreach

- **What?** Outreach programs are strategic, transparent, and thorough.
- **Why?** Public confidence and support is critical.
- **Specific Recommendations:**
 - Develop specific guidance for agencies interested in implementing DPR projects **(Guidance/Permitting)**
 - Help assure the public that potable water produced from wastewater through DPR is adequately protective of public health. **(Guidance/Permitting)**
 - Utilities develop a robust public outreach program to build awareness, trust, confidence, support, and acceptance of the DPR project. **(Guidance/Permitting)**

5. Public Health Protection

- **What?** Demonstrate public health protection based on treatment technologies, treatment performance, and monitoring.
- **Why?** Potable reuse involves a highly impaired source – wastewater. Regulators require that a certain level of risk protection is achieved and the public will need confidence.
- **Specific Recommendations:**
 - Pathogen control (viruses, protozoa, and bacteria)
 - Chemical control (regulated and unregulated)
 - Treatment technologies and monitoring (indicators and surrogates)

8. Log Removal Targets

- 2-log reduction = 99%
- 3-log reduction = 99.9%, typical for drinking water treatment of bacteria
- 4-log reduction = 99.99%, typical for drinking water treatment of viruses
- 10-log = 99.9999999% (for *Giardia* cysts, and *Cryptosporidium* in CA PR)
- 12-log reduction = 99.999999999% (for viruses in CA PR)

8. Log Removal Targets

Specific Recommendations

- Pathogens removal or inactivation goal of 10^{-4} annual risk of infection. Consistent with SDWA rules and with other potable reuse efforts (i.e., California and Texas). **(Regulation)**
- A multiple barrier treatment approach required. **(Regulation)**
- Both the California and Texas criteria approaches should be considered for maximum flexibility. **(Regulation)**
- Burden of proof for log removal credits placed on the utility in the form of a project proposal. **(Guidance/Permitting)**
 - A Design Report should be required through regulation. **(Regulation)**
 - The requirements of a project proposal can be addressed in guidance/permitting. **(Guidance/Permitting)**

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9. Chemical Control

Specific Recommendations

- Three-tiered approach (**Regulation**):
 - **Tier 1** – SDWA and State Requirements (including DBPs and nitrate)
 - **Tier 2** – Unregulated Chemicals (including CECs) of Interest from the Standpoint of Public Health (including NDMA)
 - **Tier 3** – Unregulated Chemicals (Including CECs) that Are Useful for Evaluating the Effectiveness of Organic Chemical Removal by Treatment Trains.
 - The details for implementing the requirement can be set in guidance/permitting. (**Guidance/Permitting**)
- Monitor for Nitrate in the advanced water treatment system. (**Regulation**)
- Sensitive and specific analytical methods. (**Guidance/Permitting**)
- Conduct comprehensive analytical studies on the types and quantities of chemicals present in the treated wastewater. (**Guidance/Permitting**)

9. Chemical Control

- **What?** Salinity and individual constituents.
- **Why?** Salinity is not a public health issue, but salinity must be managed to maintain acceptable aesthetics and suitable for intended uses.
- **Specific recommendations:**
 - Salinity is often a regional issue.
 - Include salinity as a consideration in planning and design.
 - Understand the long-term changes in salinity.
 - Removing salinity requires advanced treatments such as RO.

10. Advanced Water Treatment

- **What?** Involves unit processes (a range exists) for treating wastewater effluent to produce a drinking water source of supply.
- **Why?** Must meet regulatory review (pathogens and chemicals) and public scrutiny.
- **Specific Recommendations:**
 - Include a bypass from the outlet of the AWTF into the sewer system or recycled back to the start of the treatment process. **(Guidance or Permitting)**
 - Pilot testing or demonstration studies. **(Guidance or Permitting)**
 - Best Available Demonstrated Control Technology (BADCT) approach **(Guidance or Permitting)**

15. Monitoring, Instrumentation and Process Control

Specific Recommendations:

- Startup performance monitoring reported to ADEQ for approval. **(Regulation)**
- Water quality monitoring for each major treatment process and product water quality. **(Regulation)**
- Rapid surrogate measures to measure pathogen reduction performance. **(Guidance or Permitting)**
- If DPR system cannot attain target pathogen credits, facility should be shut down or out-of-specification water diverted to another system (i.e., the sewer). **(Guidance or Permitting)**

16. Facility operation

Specific Recommendations:

- Grade 4 level of certification as a water treatment plant operators. (Regulation)
 - The number of operators required and level/types of certification (Guidance or Permitting)
 - Lead operators and Operator of Record should be Grade 4 water treatment operator. (Guidance or Permitting)
- An O&M plan. (Regulation)
 - Procedures for initial startup, annual startup, shutdown, asset management, and O&M. (Guidance or Permitting)
 - Include regulatory compliance sampling and monitoring. (Guidance or Permitting)

16. Facility operation

Specific Recommendations:

- Required reporting: (1) start-up reporting, (2) DPR system reporting added to drinking water reporting, and (3) an annual report. **(Regulation)**
- A response plan to off-specification water. **(Regulation)**
- Emergency Operation Plan and the Emergency Response Plan, including alternative sources of water. **(Guidance or Permitting)**
- Staffing 24/7 unless an operational electronic remote sensing system provides real-time data, appropriate alarms, and automatic response. **(Guidance or Permitting)**

17. TMF capacity

- **What?** Technical, Managerial, and Financial Capacity – ability of a water utility to provide safe and dependable water (required by SDWA)
- **Why?** Regulators can assess a utilities potential or existing weaknesses to provide safe and reliable advanced treated water.
- **Specific recommendations:**
 - Build on existing capacity develop program for public water supplies
 - Expand current TMP program to address DPR
 - Ability to review small systems

Discussion

