Water Reuse for Agricultural Irrigation

Overview of WRF Projects

WateReuse Florida
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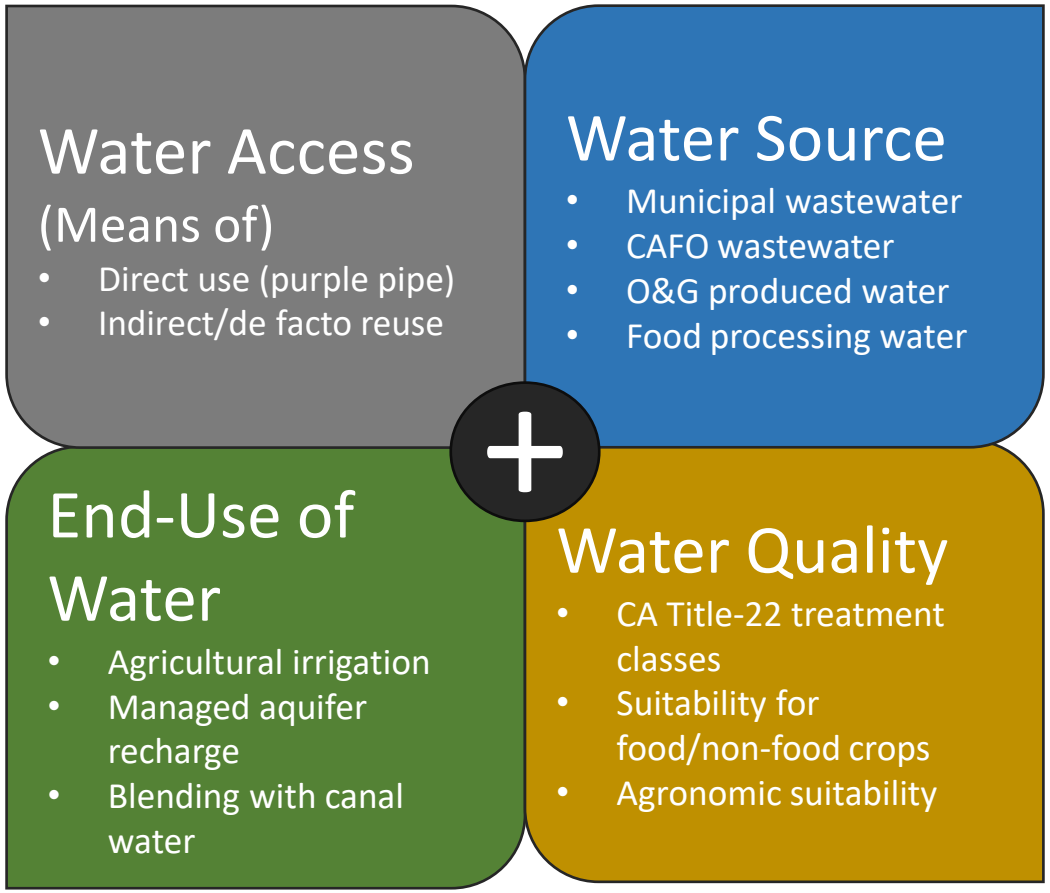
Presentation Overview

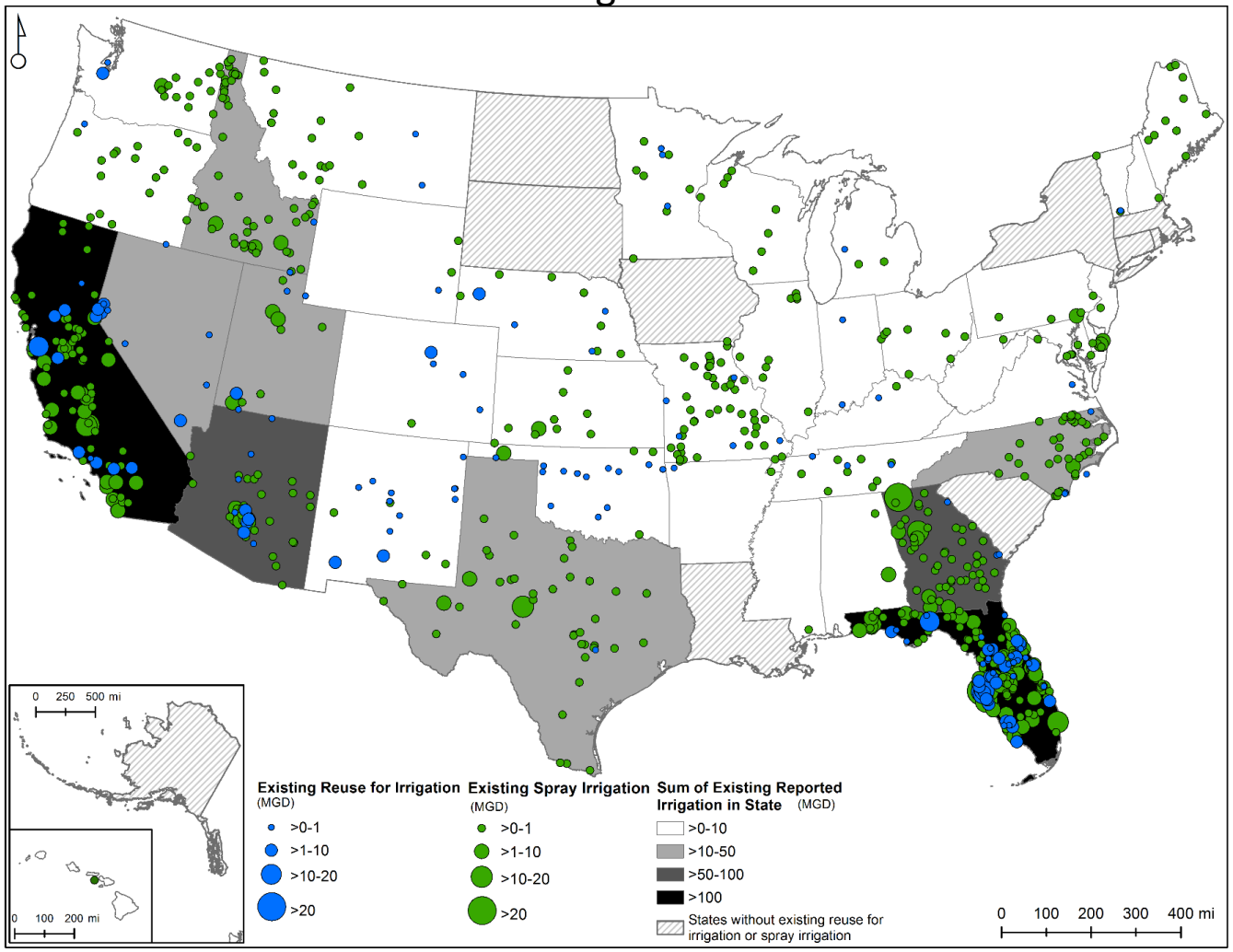
- Overview of Agricultural Water Reuse
- Summary of Three WRF Projects
  - Evaluating Economic and Environmental Benefits of Water Reuse for Agriculture (WRF 4829)
  - Addressing Impediments and Incentives for Agricultural Water Reuse (WRF 4956)
  - Potential for Oilfield Produced Water for Irrigation in California (WRF 4993)
- Questions

Describing Agricultural Water Reuse



Current extent of agricultural water reuse in the United States

EPA CWNS Data on Reuse for Irrigation

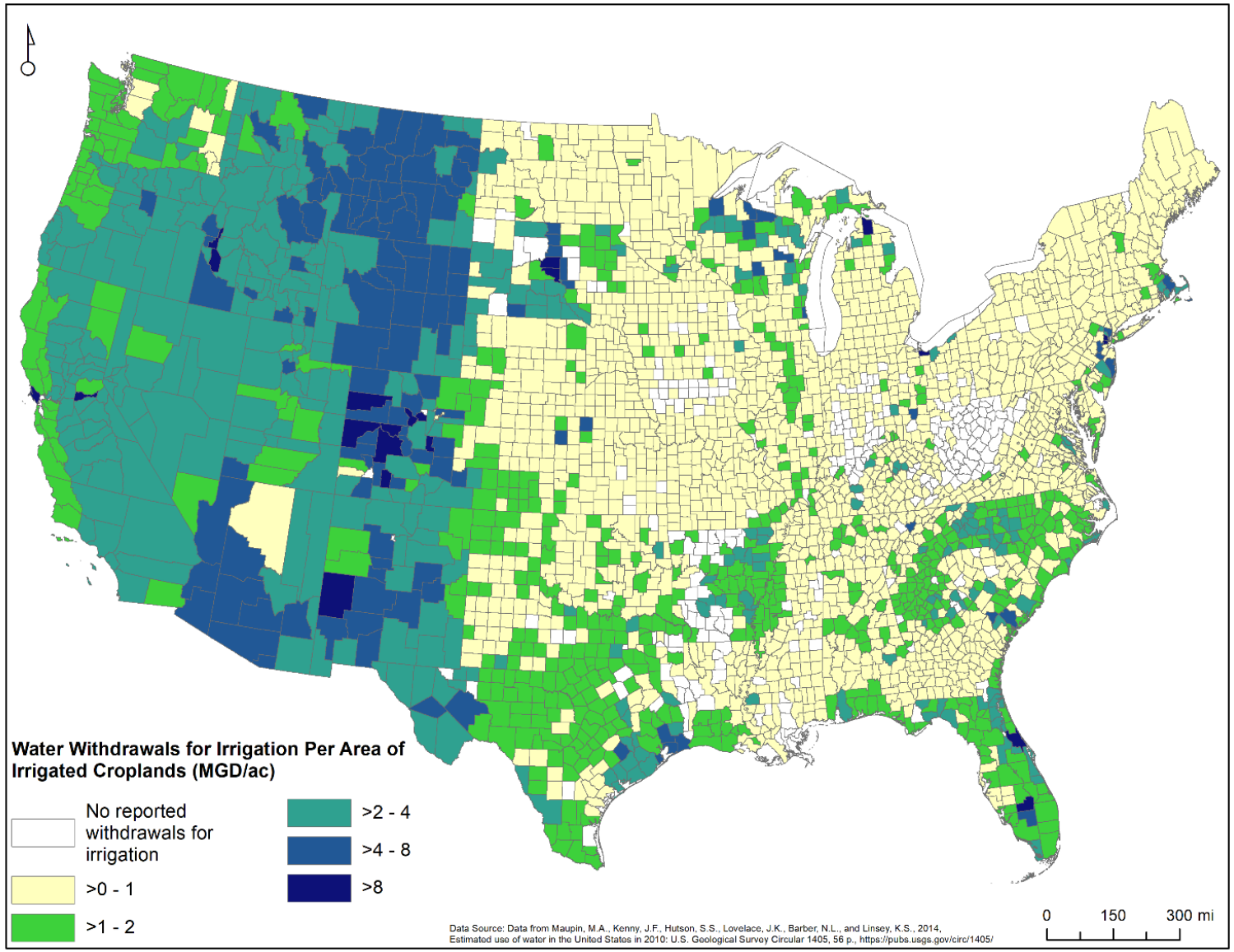


Agricultural water reuse is widespread, but uncommon.

1. 41/50 states reuse water for irrigation.
2. Only <<1% of WWTP and <2% of effluent produced is reused.

~33,000 MGD is not currently reused

Potential Agricultural Demand for Recycled Water



Source: Thebo (2021)

Water withdrawals for:

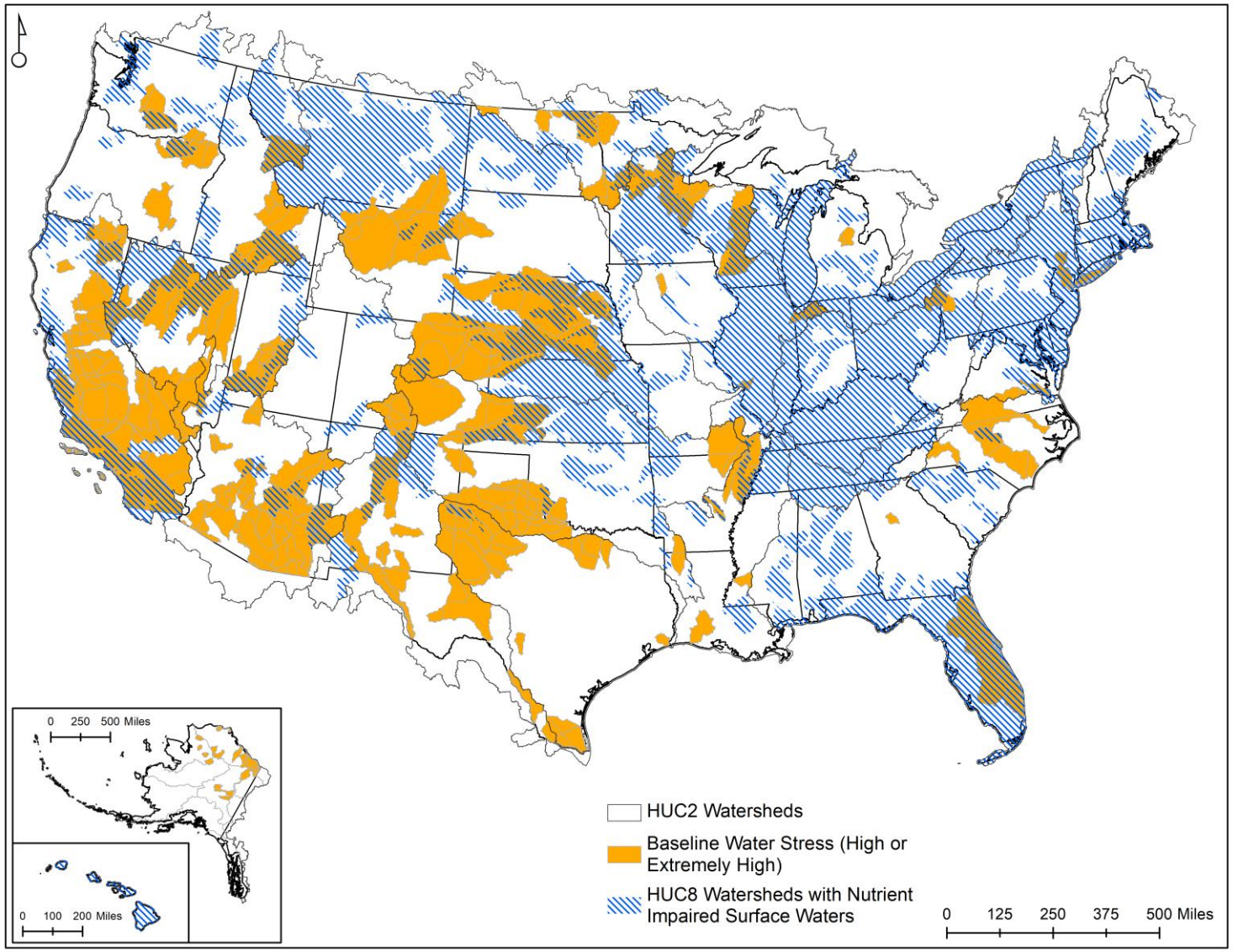
All irrigation = 118,000 MGD

Crop Irrigation >70,000 MGD

Source: USGS 2015

Un-reused effluent = ~27-47% of all water used for agricultural irrigation

Water Scarcity and Quality are Common Drivers



Data: Water Stress Indicator (WRI AQUEDUCT v3.0); 303(d) Listed Waters (USEPA)

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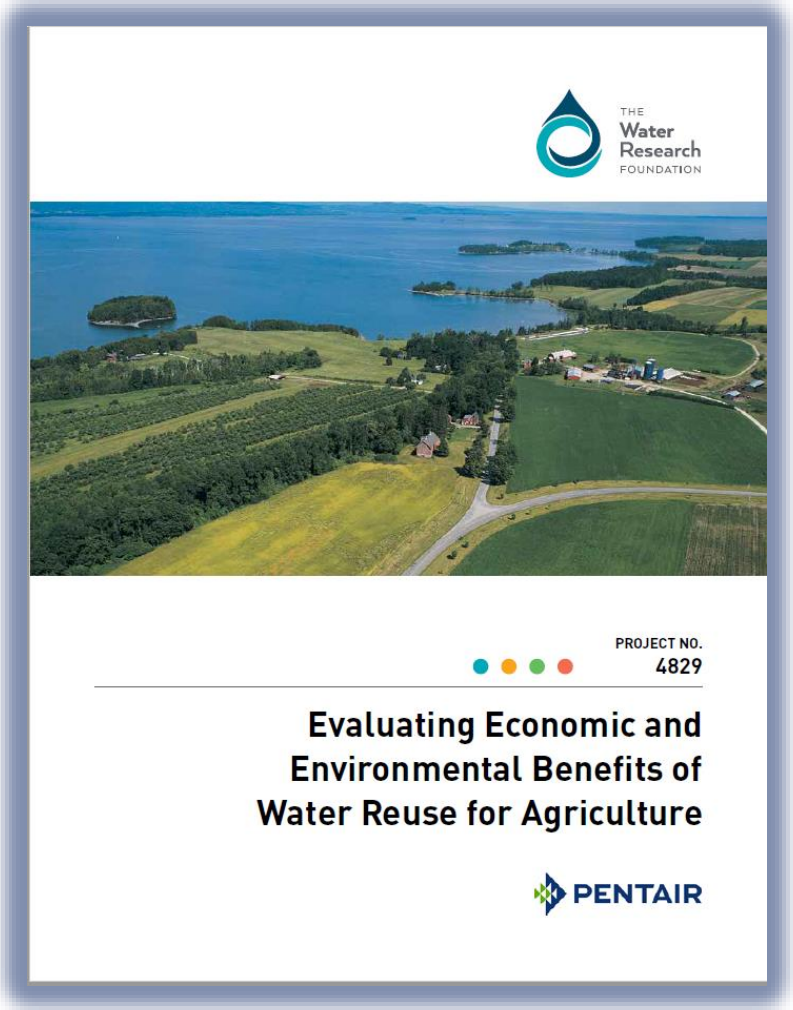
Comparison of (Select) WRF Ag Reuse Projects

Project	WRF #	Geography	Description	Resources
Agricultural Use of Recycled Water: Impediments and Incentives	4775	US + International	Led by Bahman Sheikh. Detailed overview of agricultural water reuse around the world. Assessment of the potential for agricultural reuse in the United States.	Comprehensive Report and Case Studies
Evaluating Economic and Environmental Benefits of Water Reuse for Agriculture	4829	US	Benefit/cost assessment identified as a key challenge in WRF 4775. Deeper dive into key benefits/costs + Development of BCA resources.	Report; Online Benefit Library; Cost-Benefit Analysis Resources
Addressing Impediments and Incentives for Agricultural Water Reuse	4956	US	Focus on identifying and assessing practical strategies for overcoming barriers to agricultural reuse.	Report; Case examples; Outreach Materials; Web mapping tool
Potential for Oilfield Produced Water (OPW) for Irrigation in California	4993	California	Assess current recycled water regulatory framework as a potential for OPW. Assess the potential for reuse of OPW in California.	Report; Web mapping tool

Evaluating Economic and Environmental Benefits of Water Reuse for Agriculture (WRF 4829)



WRF 4829 Aims and Objectives

Guiding Question:

- How can the multiple benefits and costs of agricultural water reuse projects be better assessed and incorporated into project planning?

Importance:

- Co-benefits engage diverse stakeholders
- Need to support improved identification and accounting of the full range of benefits and costs associated with projects

Project Objectives:

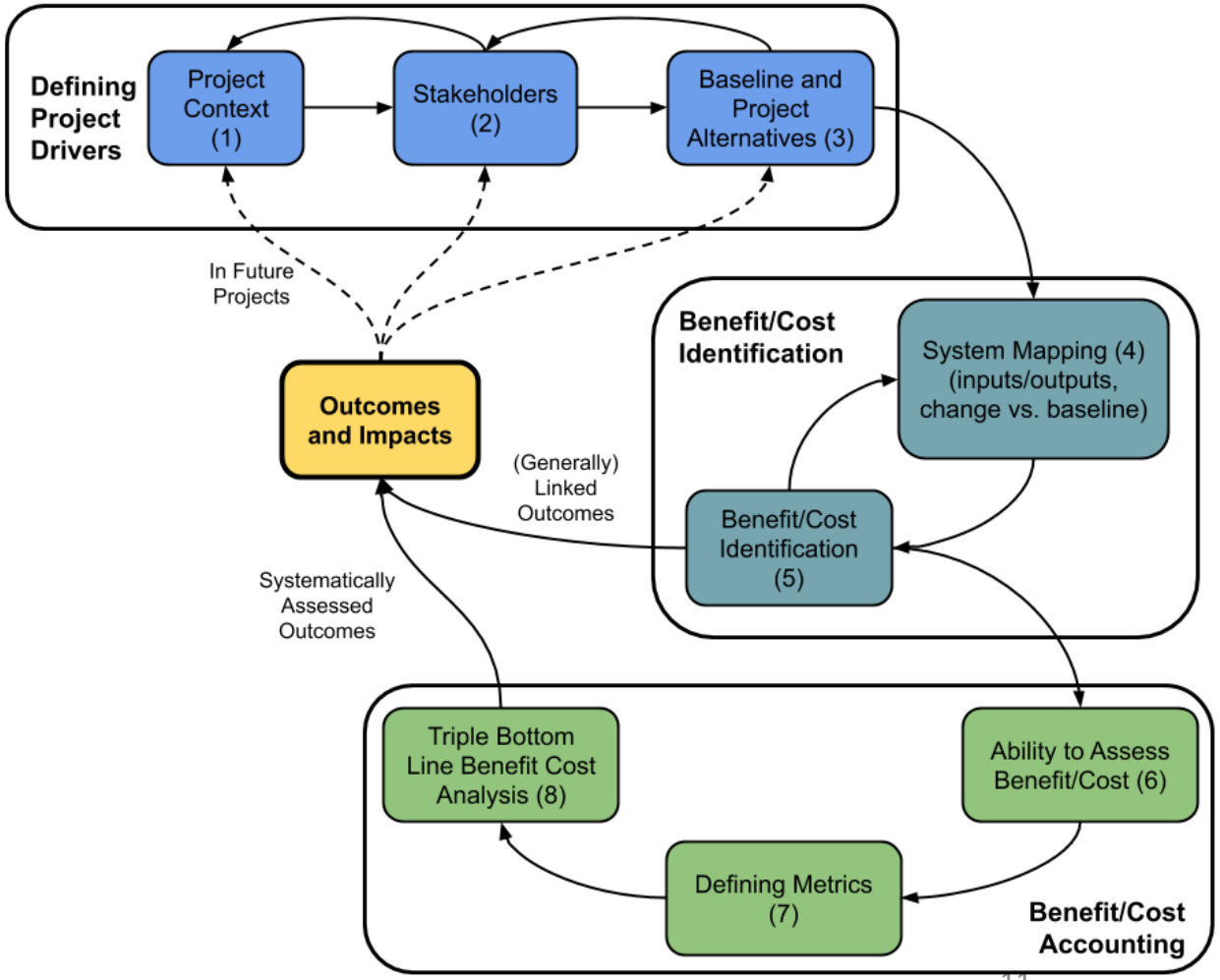
- Enumerate the direct and indirect economic, environmental, and social costs and benefits associated with agricultural reuse;
- Develop a qualitative framework for identifying and assessing the full range of quantifiable and non-quantifiable benefits and costs associated agricultural reuse;
- Apply the framework developed to evaluate community-scale case study scenarios; and
- Conduct a comparative triple bottom line cost-benefit analysis of the use of different classes of recycled water for agricultural irrigation.

WRF 4829 Key Findings

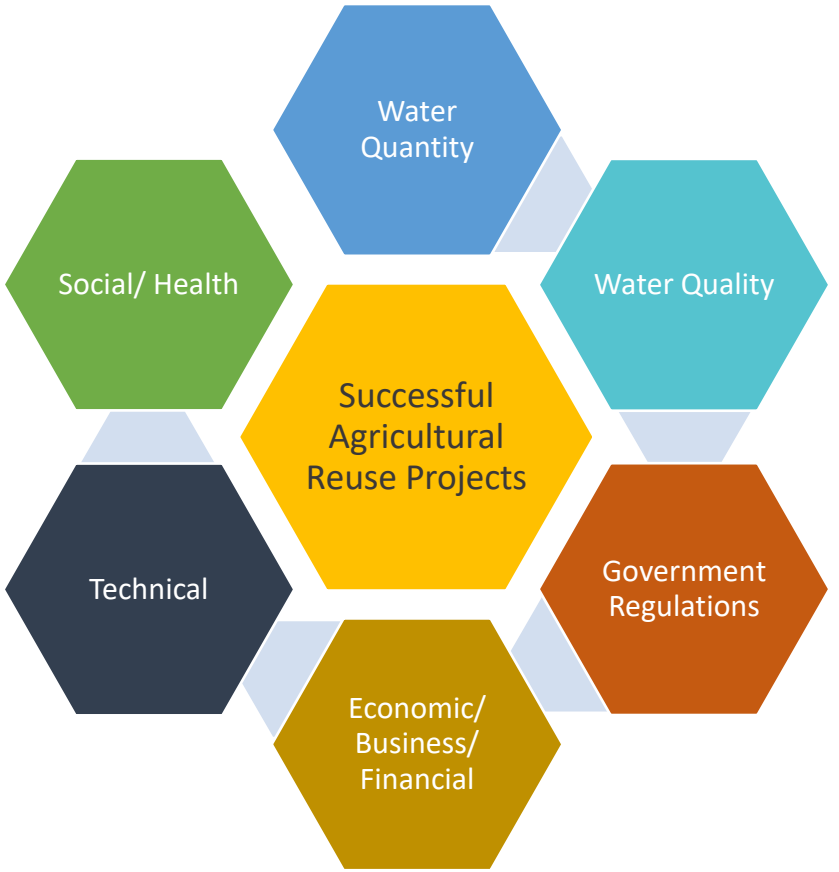
1. The potential benefits and beneficiaries of agricultural water reuse projects are numerous and diverse.
2. Well planned agricultural water reuse programs need not be technologically complex to provide significant water quantity and quality benefits to utilities, communities, and agricultural producers.
3. Matching the quality of the supply of recycled water available to the needs of local growers sits at the crux of minimizing costs and maximizing many of the benefits provided by agricultural water reuse projects.
4. Building resilience and reducing exposure to risks were commonly cited motivations for agricultural water reuse projects, with multiple benefits contributing to advancing these outcomes. However, these remain some of the most challenging benefits/tradeoffs to assess well and incorporate into benefit-cost analysis.
5. Future work evaluating the benefits of reuse must account for benefits not just at the project level, but also in aggregate such that the collective benefits of reuse projects can be integrated into the broader collective action efforts.

WRF 4829 Resources

- WRF Research Report
  - Summary of existing water reuse for agriculture
  - Discussion of water quantity and quality drivers
  - Framework for benefit identification, accounting, and valuation
  - Benefit identification case examples
  - Triple-bottom line cost benefit analysis
    - Benefit/cost tradeoffs of treating water to different levels
- Online benefit/cost library (https://bit.ly/37SR0VT)
  - List of all identified benefits and costs, sortable by driver, stakeholder, class



Addressing Impediments and Incentives to Agricultural Reuse (WRF 4956)



WRF 4956 Objectives and Tasks

Project Objectives

Phase I: Investigation and Data Collection (Year 1)

1) Investigate **practical solutions** to specific impediments identified in past WRF projects

2) Investigate and **compare the effectiveness** of different solutions

Phase II: Plan Development (Years 1 & 2)

Develop a **plan to overcome** the regulatory, health, public perception, and economic **barriers to expand the adoption** of water reuse for agricultural irrigation.

Phase III: Develop Solutions and Communications Plan for Overcoming Barriers (Year 2)

Provide real-world solutions to existing obstacles to agricultural water reuse for producers, regulators, and water utilities to consider such as communications guidance to support regulatory approval for growers, packers, shippers, auditors, state department of agriculture, FDA, USDA, etc.

Project Tasks

Phase I: Investigation and Data Collection

- Task 1: Develop a literature review assessing fit-for-purpose approaches
- Task 2: Investigate health risk concerns
- Task 3: Evaluate opportunities for increasing adoption of reuse for agricultural irrigation via government programs
- Task 4: Evaluate and characterize long-term impacts of agricultural water reuse for agricultural producers
- Task 5: Summarize and compare current best practices for successfully overcoming barriers to agricultural reuse

Phase II: Plan Development

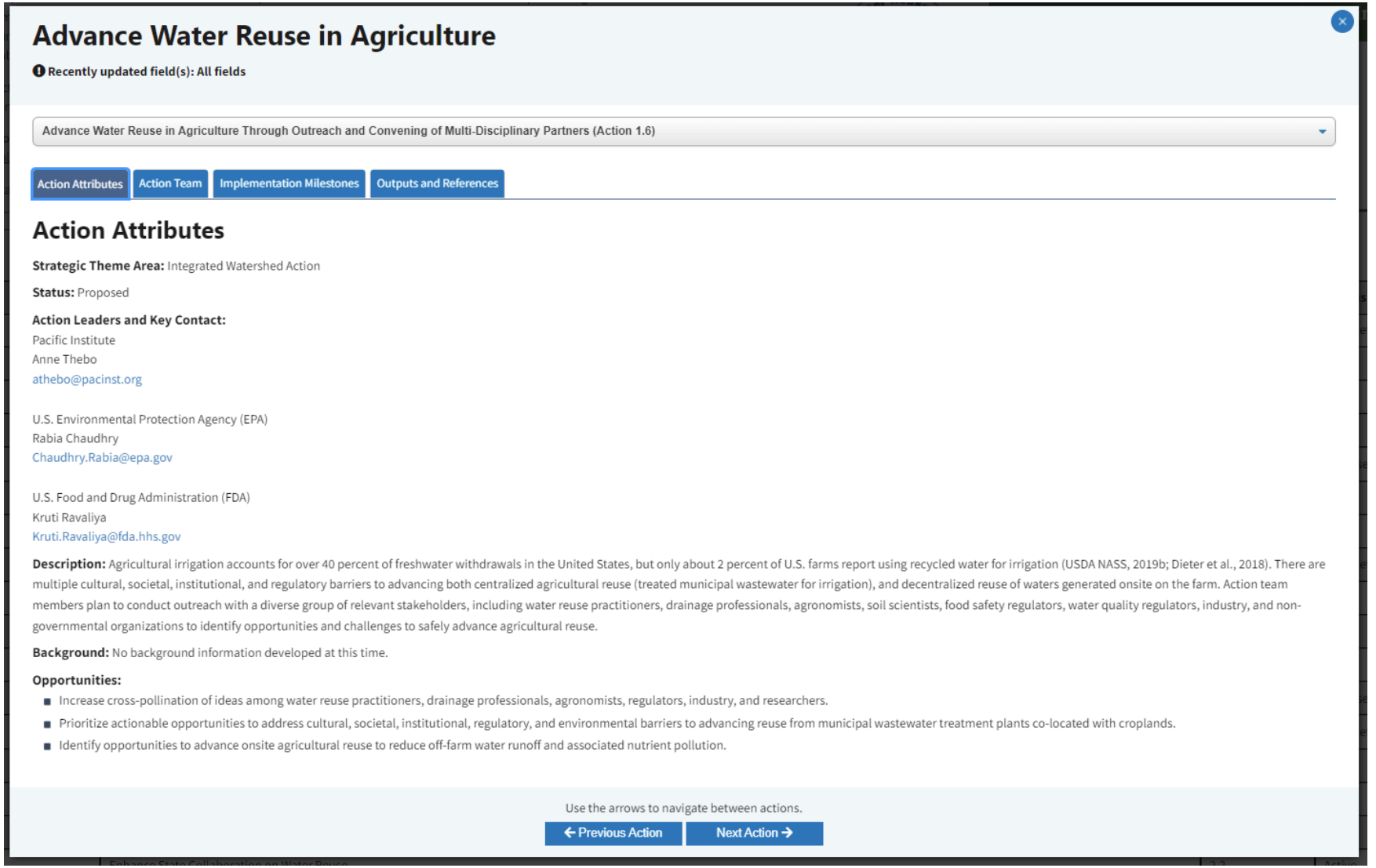
- Task 6: Plan for overcoming barriers to agricultural water reuse in diverse contexts
- Task 7: Case examples of successfully overcoming barriers to agricultural reuse

Phase III: Develop Solutions and Communications Plan for Overcoming Barriers (Year 2)

- Task 8: Plan outreach
- Task 9: Develop communications and outreach products

USEPA Water Reuse Action Plan (WRAP): Action 1.6

WRAP Action 1.6: Advance Water Reuse in Agriculture Through Outreach and Convening of Multi-Disciplinary Partners



Advance Water Reuse in Agriculture

Recently updated field(s): All fields

Advance Water Reuse in Agriculture Through Outreach and Convening of Multi-Disciplinary Partners (Action 1.6)

Action Attributes | Action Team | Implementation Milestones | Outputs and References

Action Attributes

Strategic Theme Area: Integrated Watershed Action

Status: Proposed

Action Leaders and Key Contact:

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Description: Agricultural irrigation accounts for over 40 percent of freshwater withdrawals in the United States, but only about 2 percent of U.S. farms report using recycled water for irrigation (USDA NASS, 2019b; Dieter et al., 2018). There are multiple cultural, societal, institutional, and regulatory barriers to advancing both centralized agricultural reuse (treated municipal wastewater for irrigation), and decentralized reuse of waters generated onsite on the farm. Action team members plan to conduct outreach with a diverse group of relevant stakeholders, including water reuse practitioners, drainage professionals, agronomists, soil scientists, food safety regulators, water quality regulators, industry, and non-governmental organizations to identify opportunities and challenges to safely advance agricultural reuse.

Background: No background information developed at this time.

Opportunities:

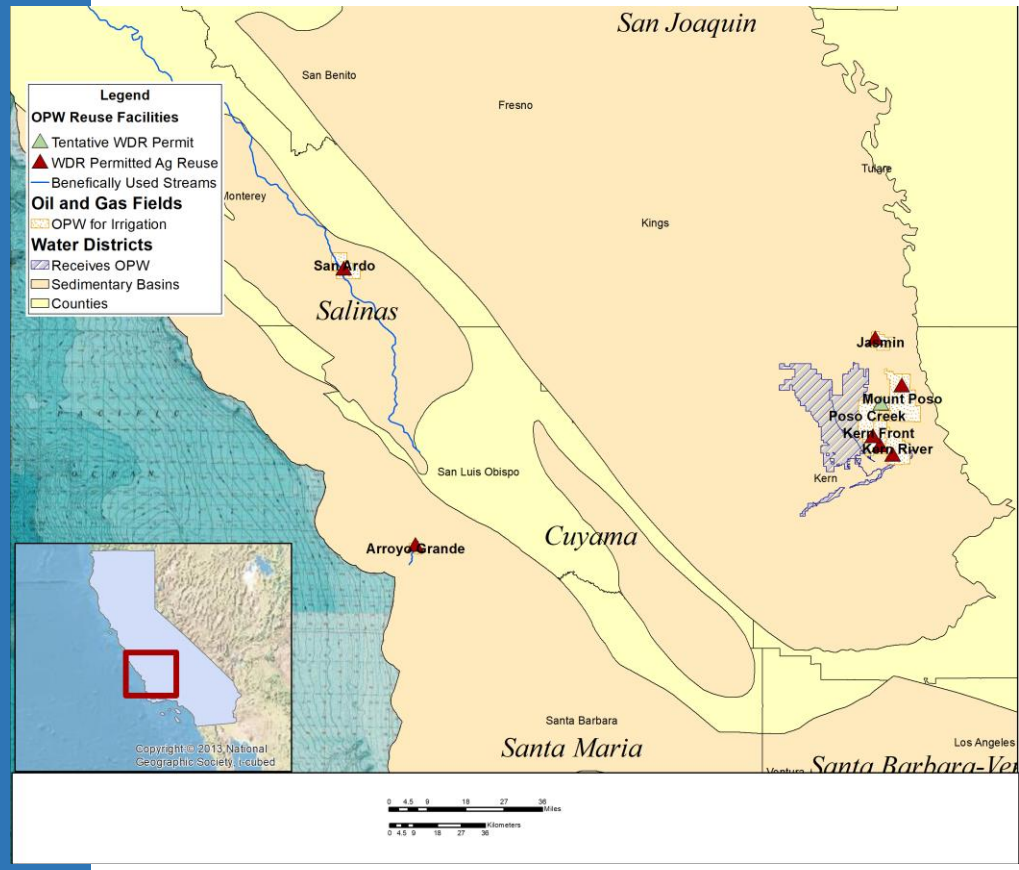
- Increase cross-pollination of ideas among water reuse practitioners, drainage professionals, agronomists, regulators, industry, and researchers.
- Prioritize actionable opportunities to address cultural, societal, institutional, regulatory, and environmental barriers to advancing reuse from municipal wastewater treatment plants co-located with croplands.
- Identify opportunities to advance onsite agricultural reuse to reduce off-farm water runoff and associated nutrient pollution.

Use the arrows to navigate between actions.

← Previous Action | Next Action →

https://www.epa.gov/waterreuse/national-water-reuse-action-plan-online-platform?action=1.6

Potential for Oilfield Produced Water for Irrigation in California (WRF 4993)



Source: Feinstein and Shimabuku (2021)

WRF 4993 Objectives

Objectives:

1) Evaluate Title-22 recycled water regulations as a science and policy template for Oilfield Produced Water (OPW) reuse.

2) Develop a geospatial model and map of potential for OPW reuse.

Project Motivations:

- Growing attention towards alternative supplies (beyond recycled water)
- Questions around data sufficiency to support a Title-22 type regulatory framework
- Understand scale of potential for OPW reuse

Key Lessons from Past/Current WRF Projects

- Drivers and benefits of agricultural reuse are diverse
- Successful agricultural reuse projects have:
  - Champions
  - Bring together diverse stakeholders
  - Create win-win situations
- Greater consideration of the co-benefits of agricultural reuse projects can help:
  - Bring more diverse stakeholders to the table
  - Create opportunities for innovative co-funding models
- Fit-for-purpose approaches can help tailor projects to the needs and TMF capacity of communities
- Significant opportunities for expanding agricultural reuse:
  - In both water scarce and water abundant regions
  - In large, medium, and small communities

But project drivers and barriers vary across regions

Monterey One Water, California (Source: Google Earth)

Thank You

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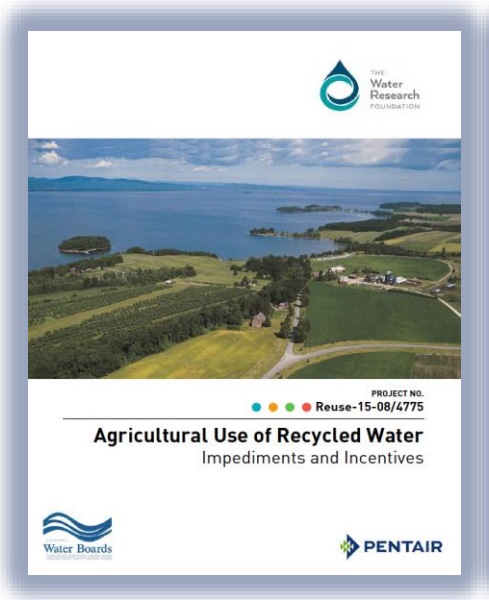

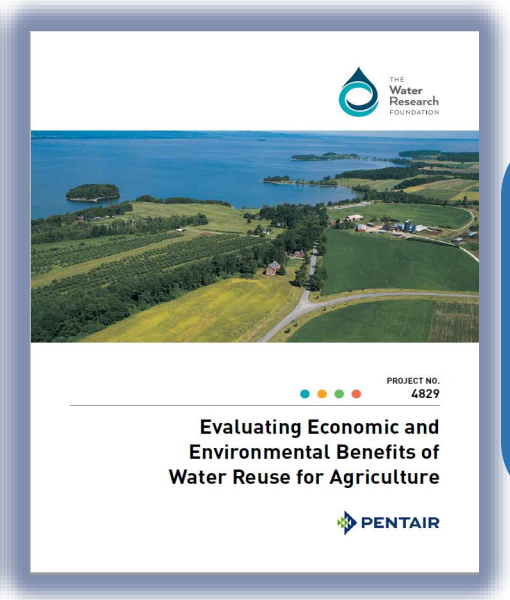

Addressing Impediments and Incentives for Agricultural Reuse (4956)

Summer 2023

Potential of Oilfield Produced Water for Irrigation in California (4993)

Fall 2022

Drivers, Incentives, and Impediments to Agricultural Reuse

Class	Incentives/Drivers	Barriers/Impediments
Water Quantity	Access to a **reliable source of water** that is sometimes managed outside of existing water rights systems.	1) **Uncertainties** around quantities of water available for reuse; 2) **Demand** for recycled water during **non-growing season** can be limited; and 3) Wastewater effluent can be a significant fraction of **instream flows**, particularly in arid regions and small rivers.
Water Quality	1) Facilitate **permit compliance** with discharge permits (for environmental protection); **2) Protect** sensitive aquatic **ecosystems**; and 3) Reduce **seawater intrusion**.	Concerns and uncertainty around **emerging contaminants**, **pathogens**, **TDS/salinity**, and other constituents.
Government Regulations	1) Government **targets and/or mandates** for increasing reuse; 2) Flexible frameworks that facilitate **fit-for-purpose use**.	Challenges of **permitting and uncertainty** about regulations
Economic/ Business/ Financial	State and federal **financing and grant programs**	**Cost** of financing treatment upgrades, distribution networks, and/or operation and maintenance.
Technical	Not cited as a major driver or barrier in SIARA, but utilities are anticipating more stringent regulations on CECs and ARBs and may need to modify treatment processes to comply.	
Social/Health	Social concerns such as public perception of crops irrigated with recycled water or public health concerns were generally not a major issue for any stakeholder groups in past work, but was a barrier in the past and may continue to be a challenge in states with a shorter history of agricultural reuse.	

Source: Summarized from WRF 4775

Task 7: Case Examples of Successfully Overcoming Barriers to Agricultural Water Reuse

- 15 case examples
- Utilities, growers, regulators, and communities
- Focus on overcoming barriers and fit-for-purpose reuse
- Interactive, story-map to highlight success stories

Summary of Potential Case Examples

Proposed Case Studies	Geographic Region	Key Characteristics
Modesto and Turlock*	California	Blending tertiary recycled water with existing canal supplies.
Monterey One Water*	California	Multiple sources of water reused; Avoiding seawater intrusion.
Oxnard*	California	High quality reuse for food crops; Overcoming grower impediments to reuse.
Fresno	California	Supplying multiple qualities of water for agricultural reuse.
Northwest DEP Water Management District	Florida	Extensive, long-term agricultural reuse program in a non-arid region.
Florida Water Reuse Inventory	Florida	Nation's most comprehensive state inventory of water reuse.
Monsanto Maui Piilani Farm	Hawaii	Offsetting irrigation water withdrawals.
Water Reuse Task Force	Hawaii	Water scarcity drivers of reuse
Topeka, Kansas	Great Plains	Recent health-impact assessment and planning work.
Idaho/Hayden, ID*	Intermountain West	Long-standing reuse program in small and medium communities.
Denver, CO*	Intermountain West	Role of water rights in recycled water programs.
Baltimore, MD	Mid-Atlantic	Long-standing, planned reuse program in non-arid region.
Clean Water Services, OR	Pacific Northwest	Environmental and water quality drivers of agricultural reuse.
Tennessee Valley Authority	Southeast	Indirect reuse in a non-arid region.
Phoenix, AZ	Southwest	Indirect reuse in an arid region.