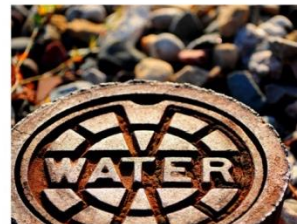


Project 4550

# Identifying Needs for Integrated Water Management

Lynn Williams Stephens, P.E., Brown and Caldwell

May 5, 2016



# Agenda

01

## IWM Today

Impacts and Drivers

Successful IWM Frameworks - 5 Case Studies

Diversifying Water Supplies

02

## Challenges to Implementation

Funding

Policy and Governance

Water Rights and Regulatory Hurdles

Technical Limitations

03

## Opportunities to Advance IWM

Economic Analysis Including Risks/Benefits

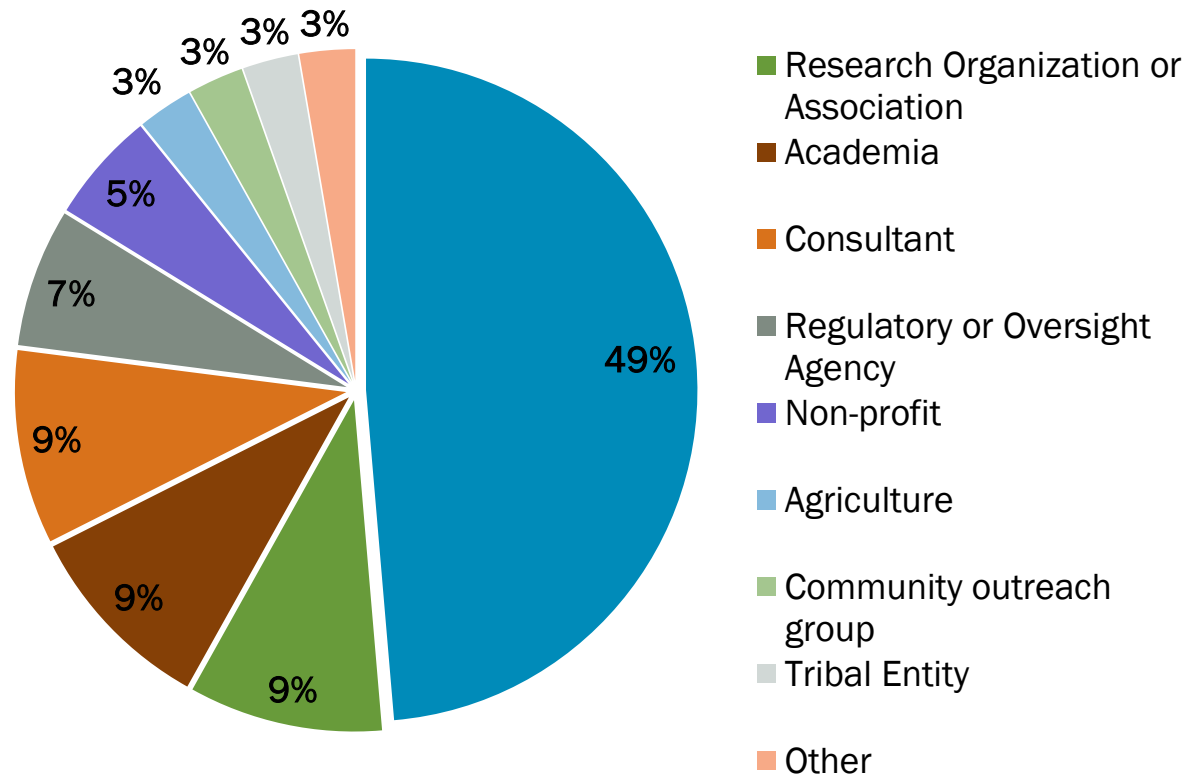
IWM Planning Tools

Nontraditional Sources

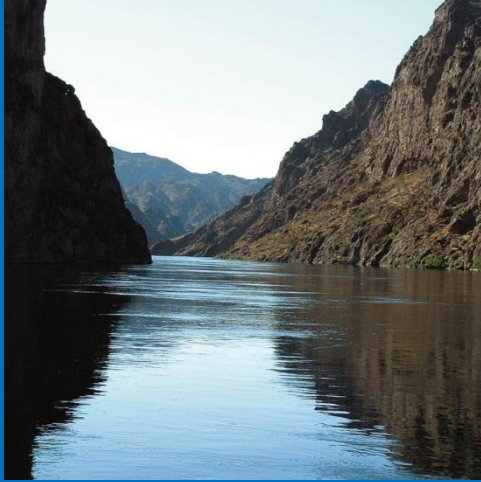
Future Research

# Background

- Literature review of more than 40 IWM research documents
- Survey, recently completed by 74 participants



01



# Integrated Water Management Today

# Water supply threats are demanding new water solutions...

- Challenges include:
  - Climate change impacts
  - Water shortages/drought
  - Catastrophic events
  - Degradation of water quality
  - Reliability and redundancy limitations
  - Population growth with reduced consumption
  - Demand for lower-cost solutions



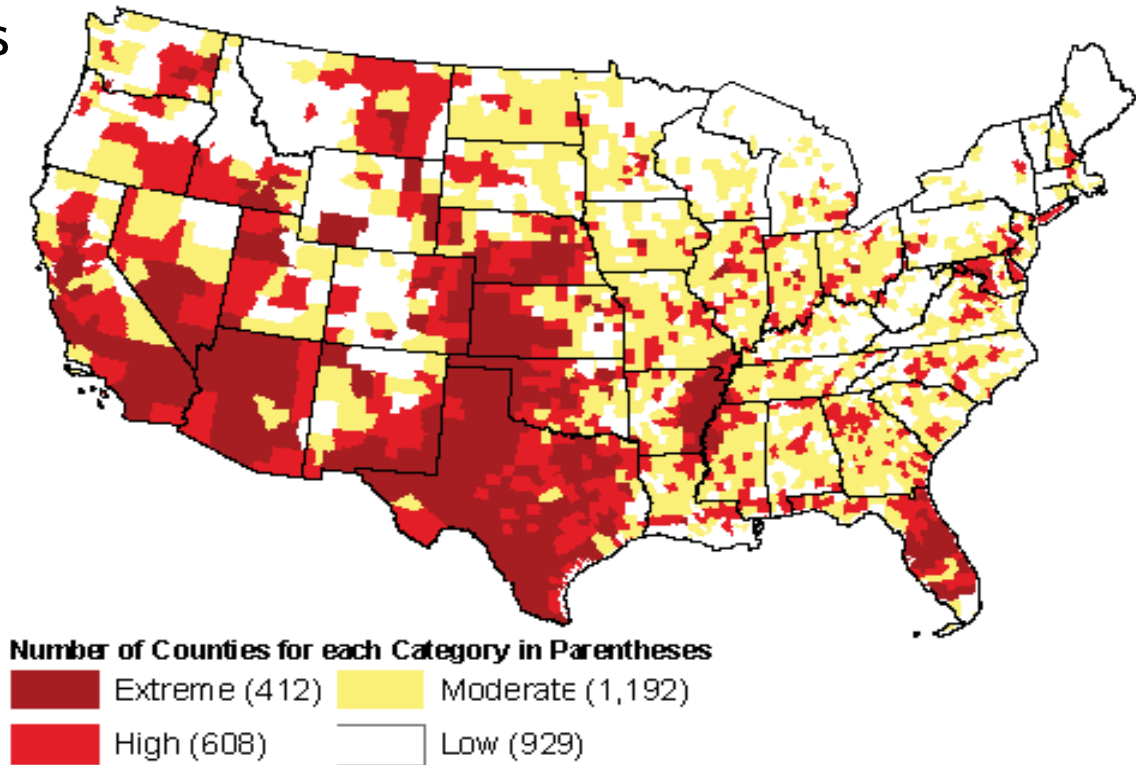
*Comparison of Lake Oroville, California from 2011 to 2014*

**...pushing water planners to look at alternative sources.**

# Greater awareness of the necessity for sustainable and reliable water infrastructure

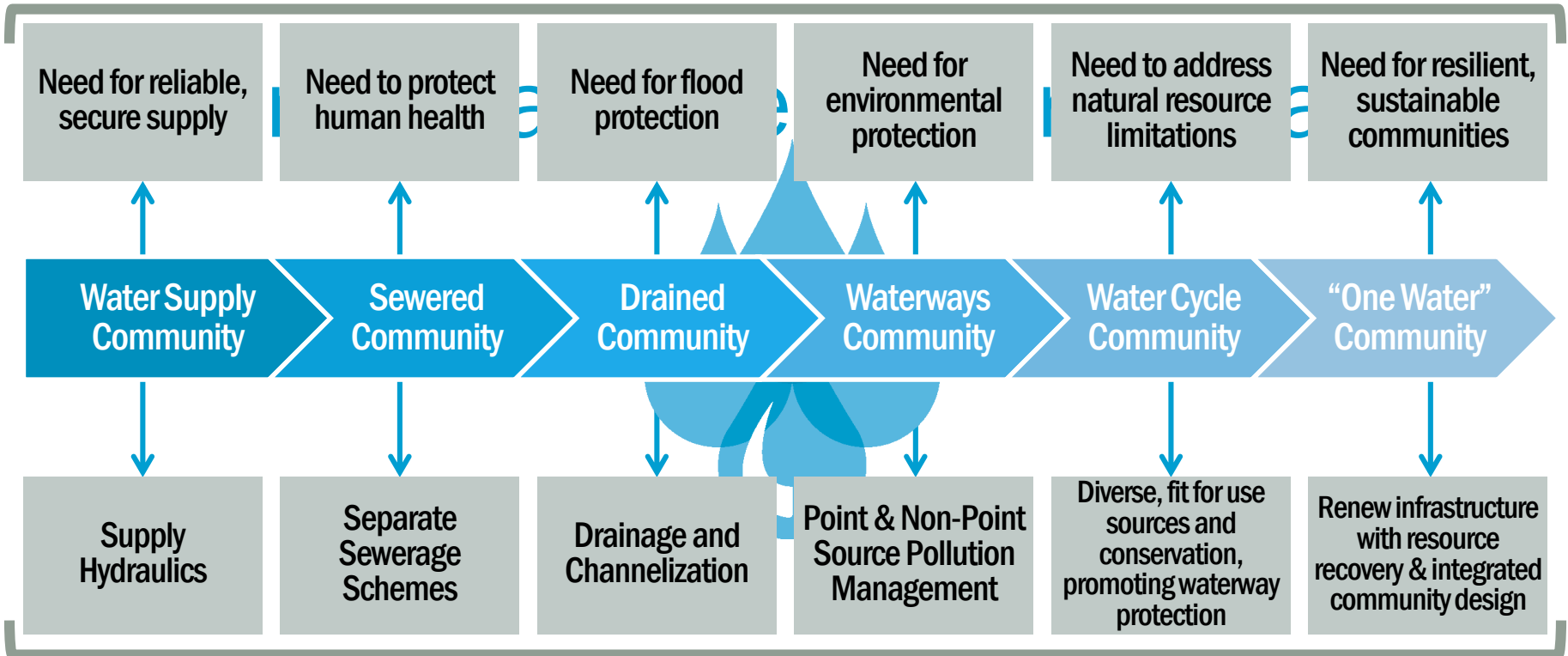
## Water Sustainability Index (2050) with Climate Change Impacts

- More than 1,100 counties at higher risk for water shortages by 2050 as a result of climate change



# New societal drivers are pushing evolution to an Integrated Water Management approach

## DRIVERS



## FUNCTIONS



**Integrated Water Management (IWM) is the concept of managing a community's water resources for long term resiliency and reliability while addressing public health as well as ecosystem needs.**



# IWM looks at the total system for long-term resiliency and reliability

- Key part is to identify risks (*similar to supply-chain risk analysis*) for water quantity and quality
  - find areas to close loops
  - increase efficiency
- Utilizing nontraditional sources of supply

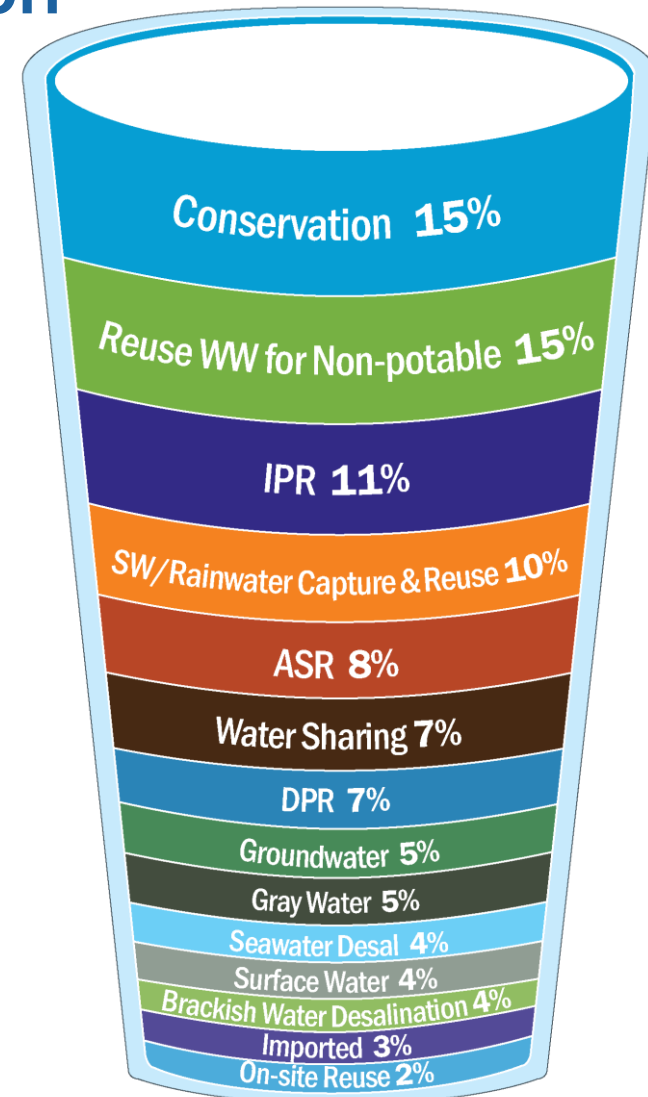


>70%

More than >70% of the survey respondents said that their communities participate in an IWM program.

# Survey results show multiple opportunities for future water supply diversification

- 44% of the respondents are planning on some form of reuse
- 8% of participants were interested in aquifer storage and recovery
- More utilities are looking to water diversification strategies



# A recent AWRA study outlines overriding IWM best practices

## Commitment to **Sustainability**

- evaluating water resources in the context of a watershed or basin

## Adaptive **Management**

- utilizing iterative processes to aid decision making in the face of uncertainty

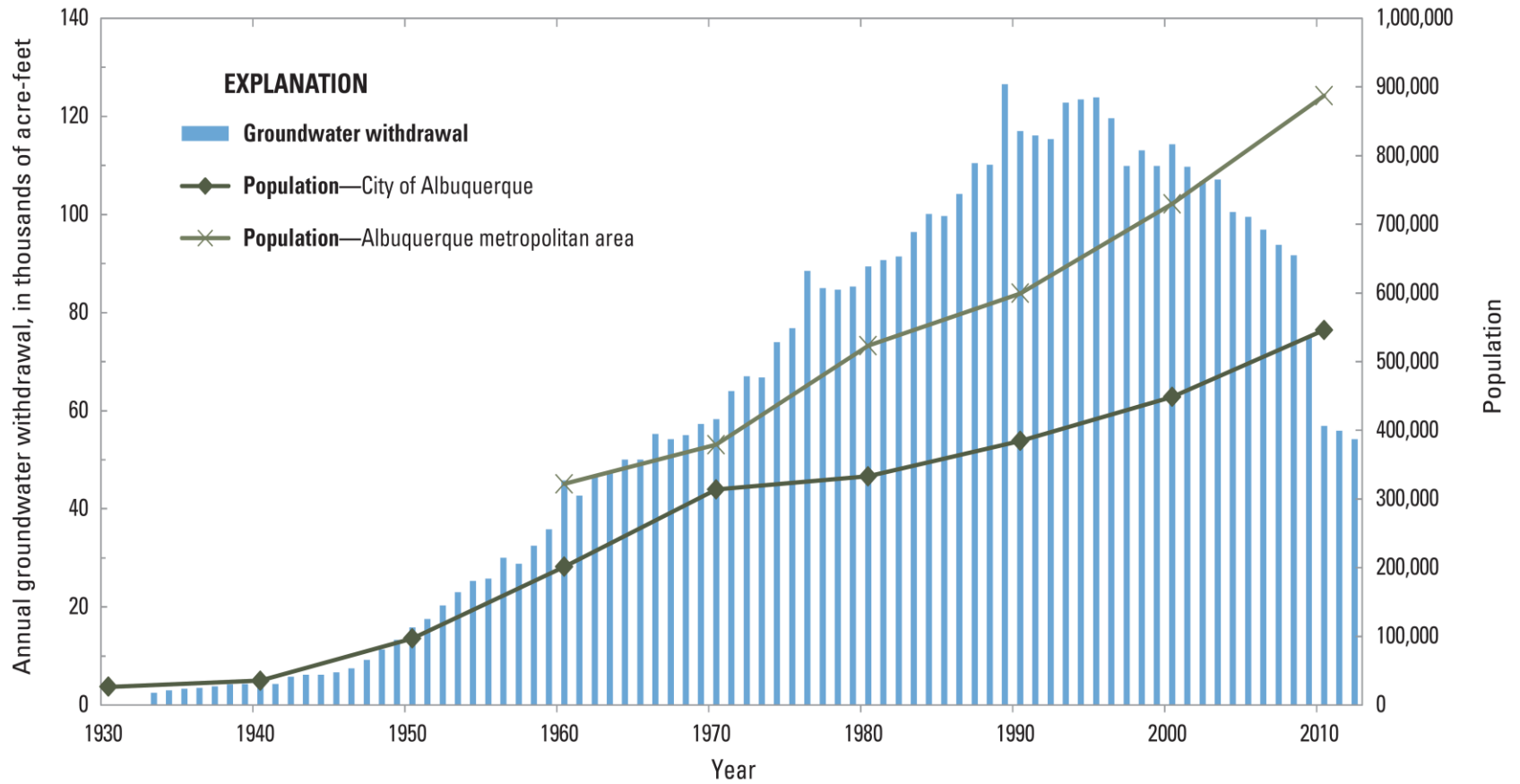
## Collaboration for **Integration**

- collaboration on modeling tools and data sharing protocols

## **Funding**

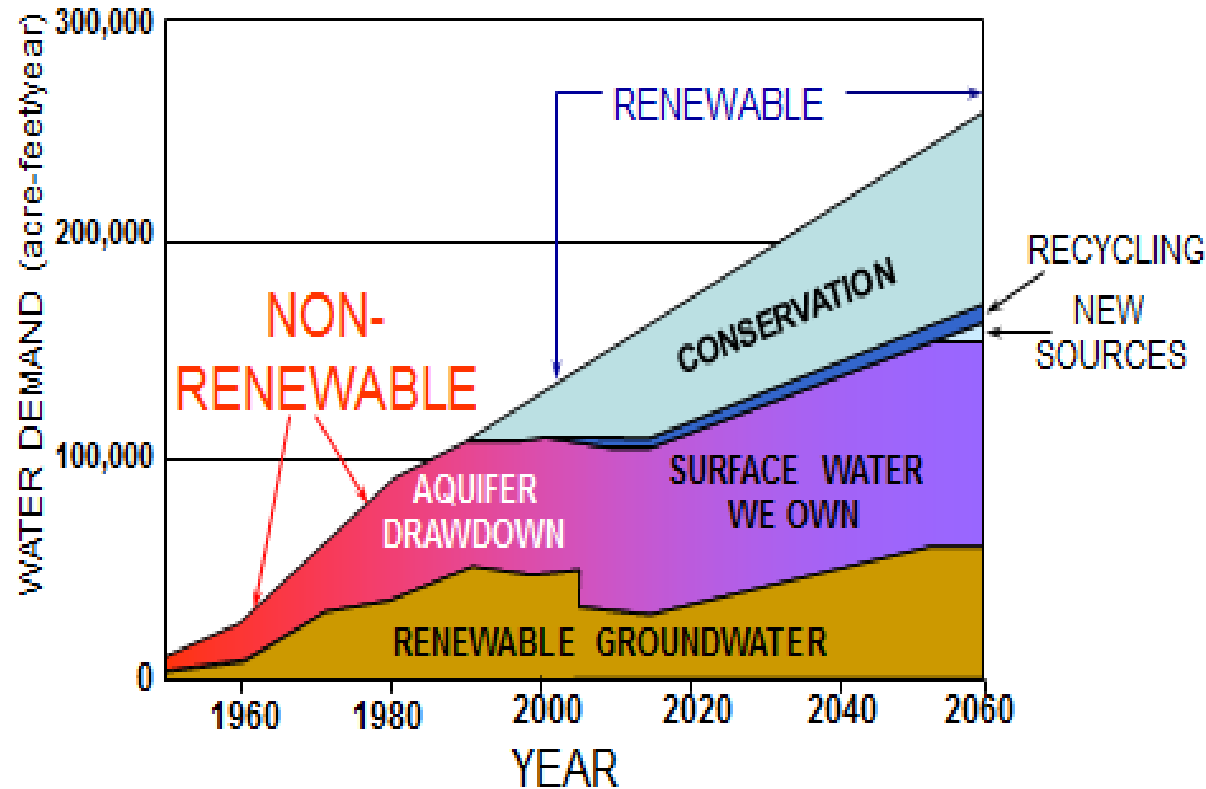
- identify funding resources and potential partnerships

# Case Study: Albuquerque's *Transition to a Sustainable Water Supply*

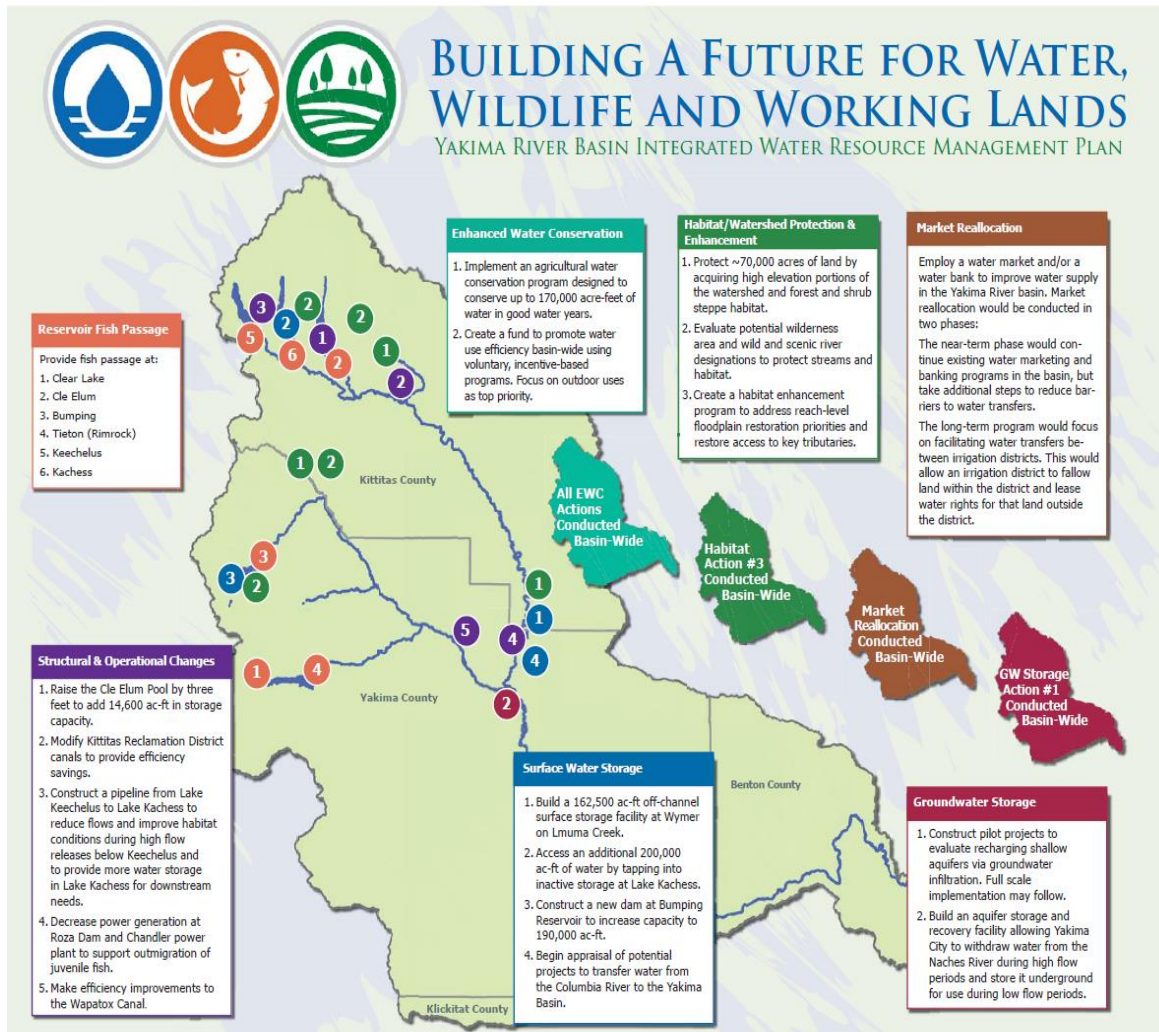


# Albuquerque's approach to a sustainable water supply

- Developed Water Resources Management Strategy
- Transition to more renewable water resources



# Yakima Basin's Integrated Water Management Plan to overcome a declining water supply

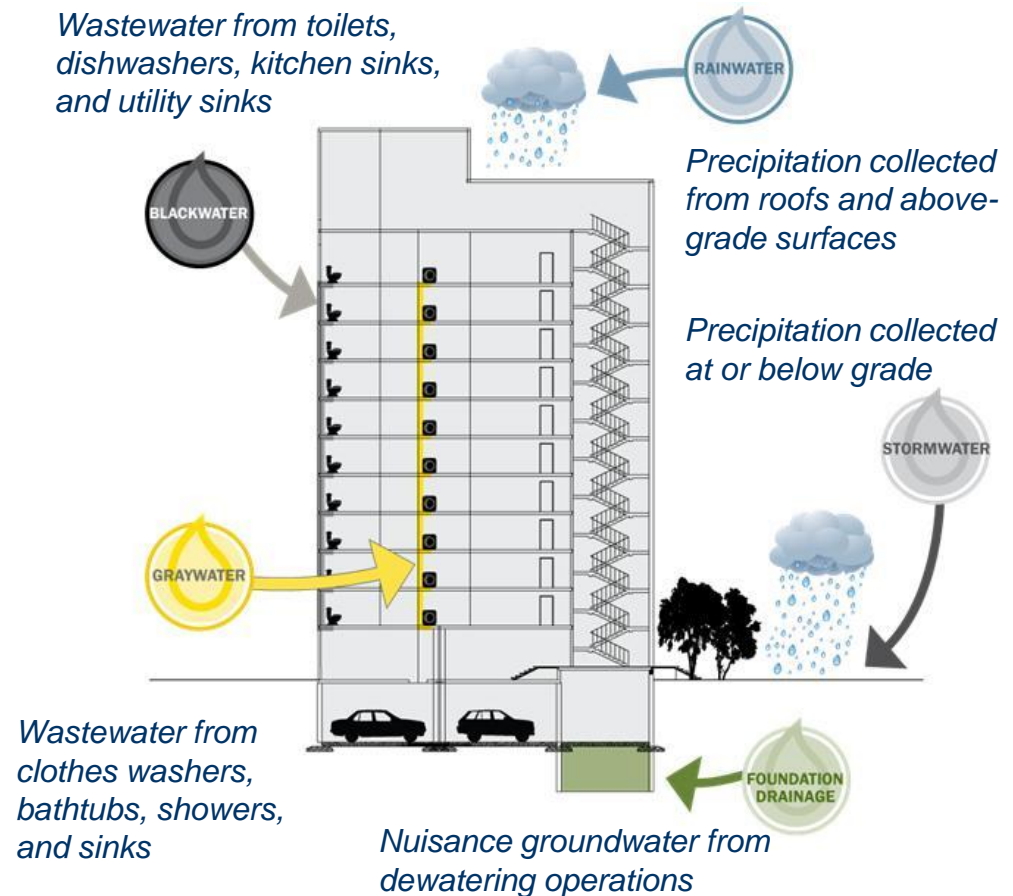


- Consensus-based solution
  - Ecology
  - U.S. Bureau of reclamation
  - Stakeholders
- IWM Plan
  - Enhanced conservation
  - Groundwater storage
  - Habitat/watershed protection and enhancement
  - Market reallocation

Sources: AWRA Policy Committee 2012, Ecology 2012, Sandison 2012

# San Francisco and Minneapolis are forging new ground and leading the way with onsite reuse

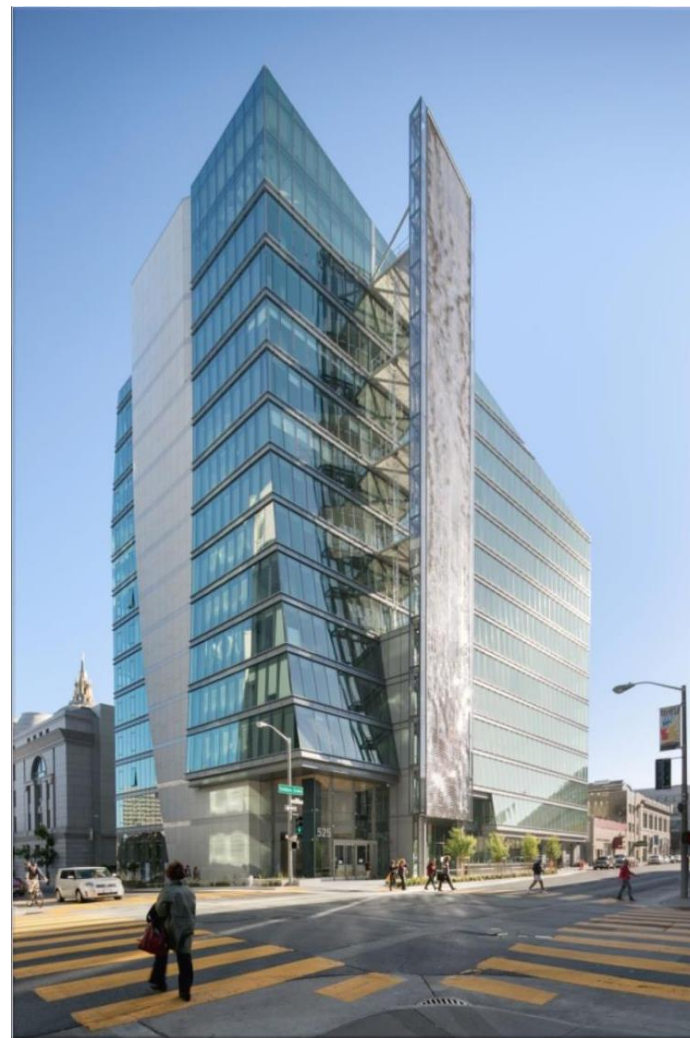
- Up to 50% water savings can be achieved in residential buildings
- Using non-potable water for toilets, cooling towers, and irrigation can save up to 95% of potable water demands in an office



Sources: Kehoe 2014, MPCA 2014, Ellis et al. 2009, Hatt et al. 2006, San Francisco Public Utilities Commission 2014 (WRF 4450)

# San Francisco's Non-potable Water Program

- New developments & major alterations over 40,000 SF
- Requires dual plumbing for irrigation, toilet/urinal flushing, and cooling
- Residential Graywater Program: Laundry-to-Landscape (L2L)
- On-site Reuse
  - Non-potable demands in multi-family and commercial buildings
- 2013 CA Plumbing Code Updates





# San Francisco's Non-potable Water Program

- City ordinance streamlines permitting process

SFPUC	SFDPH	SFDBI
Program Administration	Public Health	Construction
Review on-site non-potable water supplies & demands	Issue water quality & monitoring requirements	Conduct Plumbing Plan check and issue Plumbing Permit
Administer citywide project tracking & annual potable offset achieved	Review and approve non-potable engineering report	Inspect and approve system installations
Provide technical support & outreach to developers	Issue permit to operate on-site systems	
Provide financial incentives to developers	Review water quality reporting	

# “Sewer Water Beer Wins Oregon Regulator’s Approval”

- Clean Water Services is using advanced treated wastewater for brewing beer
- It’s the first time the state has considered allowing people to drink treated wastewater
- The Oregon Health Authority has already approved the utility’s request, citing “the high quality of the treated water, additional microbial reduction in the brewing process, and a low health risk overall.”



# Case Study: City of Quincy

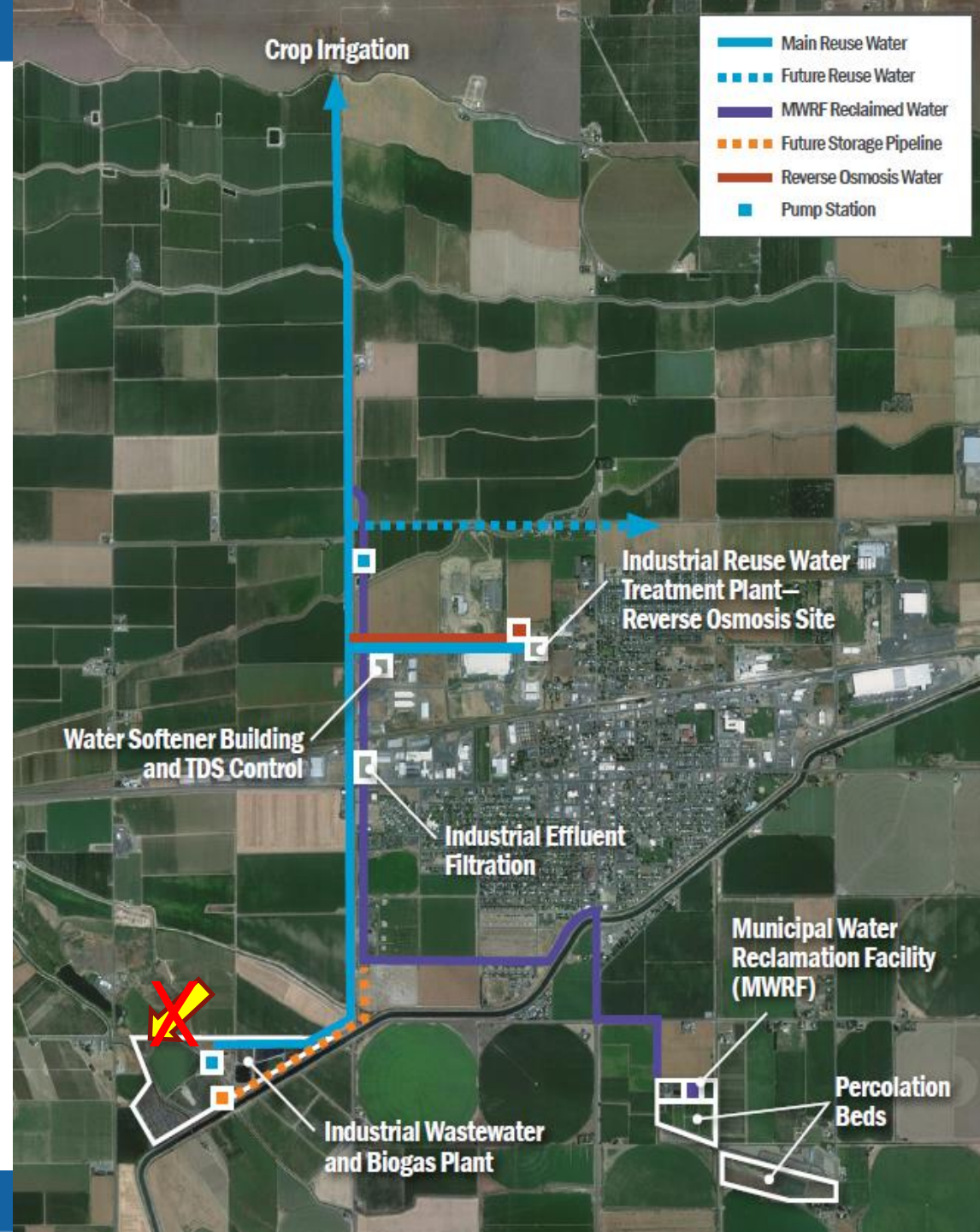


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WHERE AGRICULTURE MEETS TECHNOLOGY

# Quincy Water Reuse Utility

- The Quincy Water Reuse Utility is a city-wide, and beyond, utility that will recycle industrial and municipal wastewater for current water demands and long range needs.
- Includes advanced wastewater treatment technologies at two new locations in the city



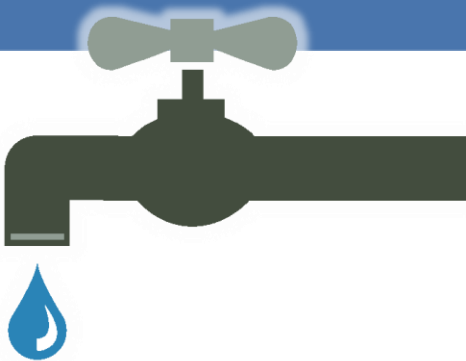
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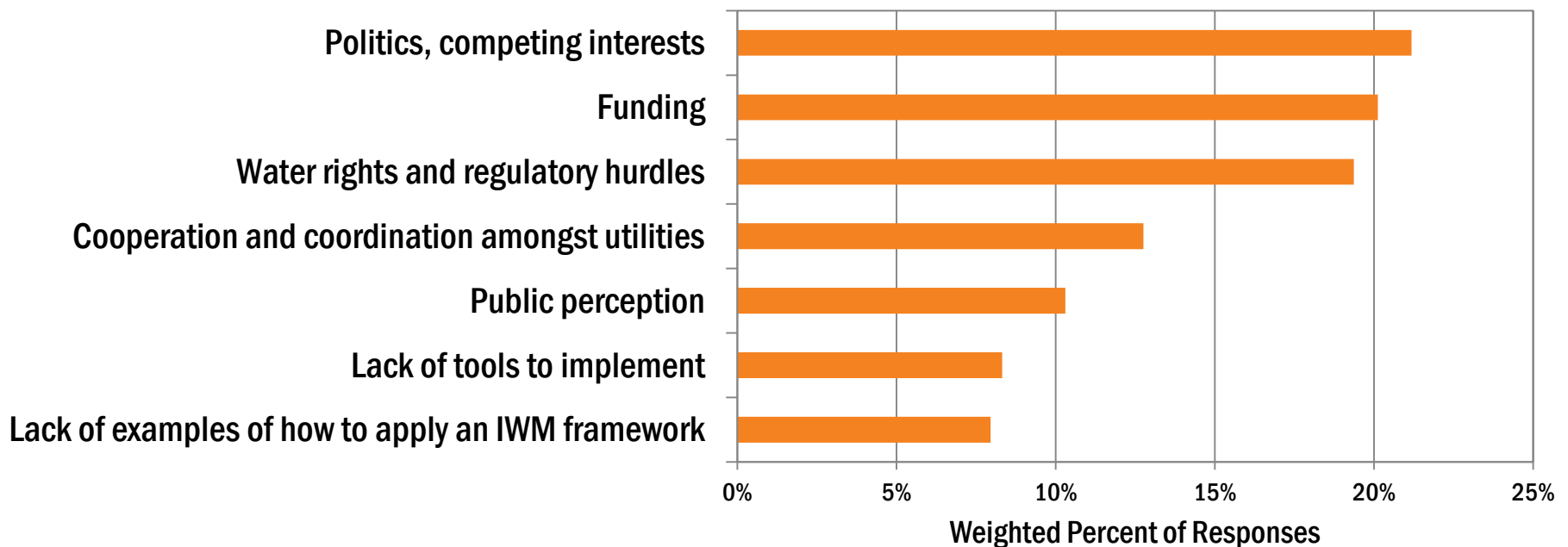


# Challenges to Implementation

# Key challenges

*Identified by survey participants are*

- 
- **governance,**
  - **funding, and**
  - **regulatory hurdles**



# Multifaceted technical challenges for new water supply options

With a move to nontraditional water supplies:

- Water reuse
- Aquifer storage/recovery
- Stormwater/rainwater
- Graywater
- Desalination

New challenges to understand:

- Contaminants of concern
- Appropriate water quality monitoring
- Appropriate regulatory standards for public health protection
- New O&M needs



03



# Opportunities to advance IWM



# What research or tools could help improve the regional water planning process?

- High need for **economic analysis and risk assessment tools**  
*(to demonstrate cost-benefits against risk to ease decision making)*

Economic analysis of various water sources

23%

Risk assessment strategies

19%

Decision-making tools

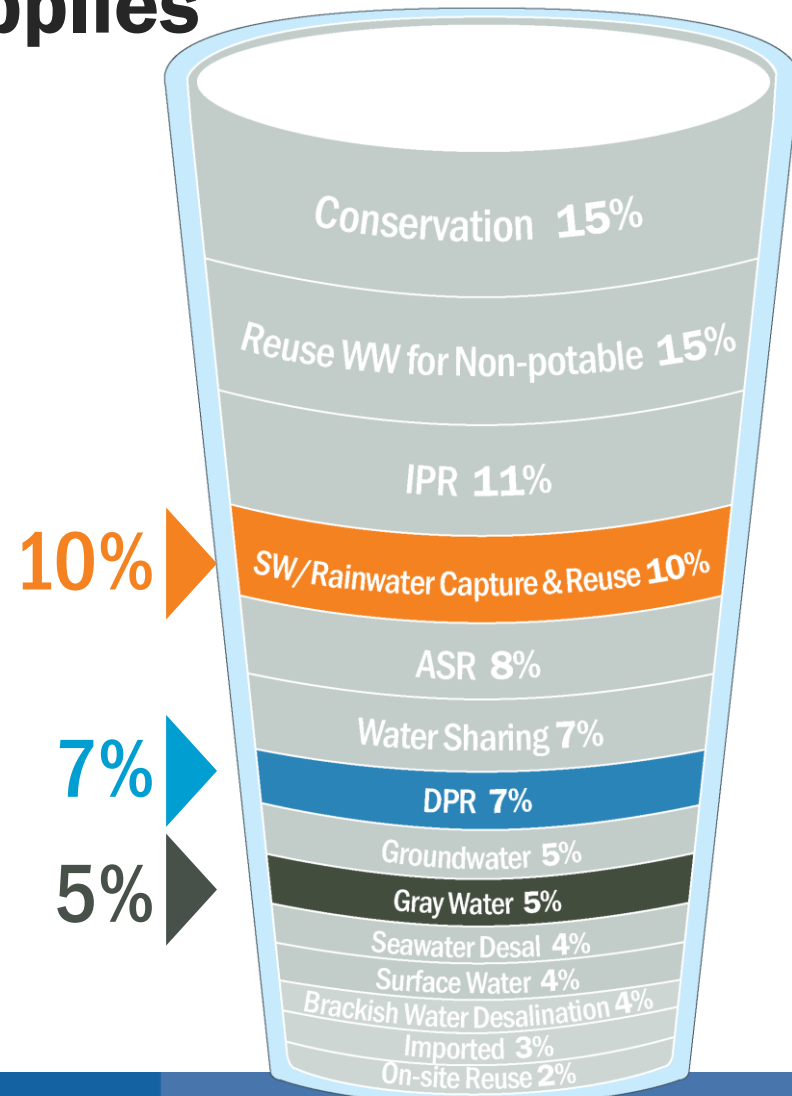
18%

Case studies

15%

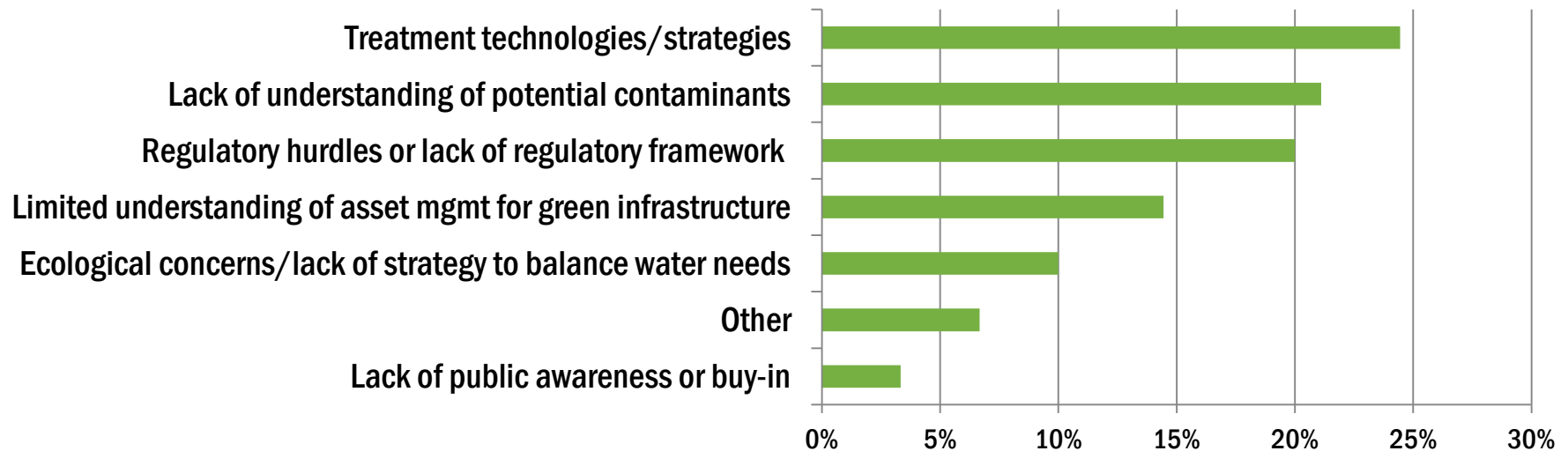
# Greater use of IWM will require more sophisticated assessment of the quality and quantity of source water supplies

According to the survey responses, **direct potable reuse, stormwater, and gray water** could be investigated more from water quality standpoints as well as **regulatory needs and public acceptance**



# Stormwater capture and reuse

- 31% of survey respondents felt a lot of research is needed
- 55% noted some aspects should be researched further



**Historically, we are over-engineering things. There is a lack of understanding and appreciation of natural system function. There is a lack of buy-in for true green infrastructure.**

# Gray Water

Education for homeowners  
on health concerns and O&M

51%

Lack of regulatory  
framework

30%



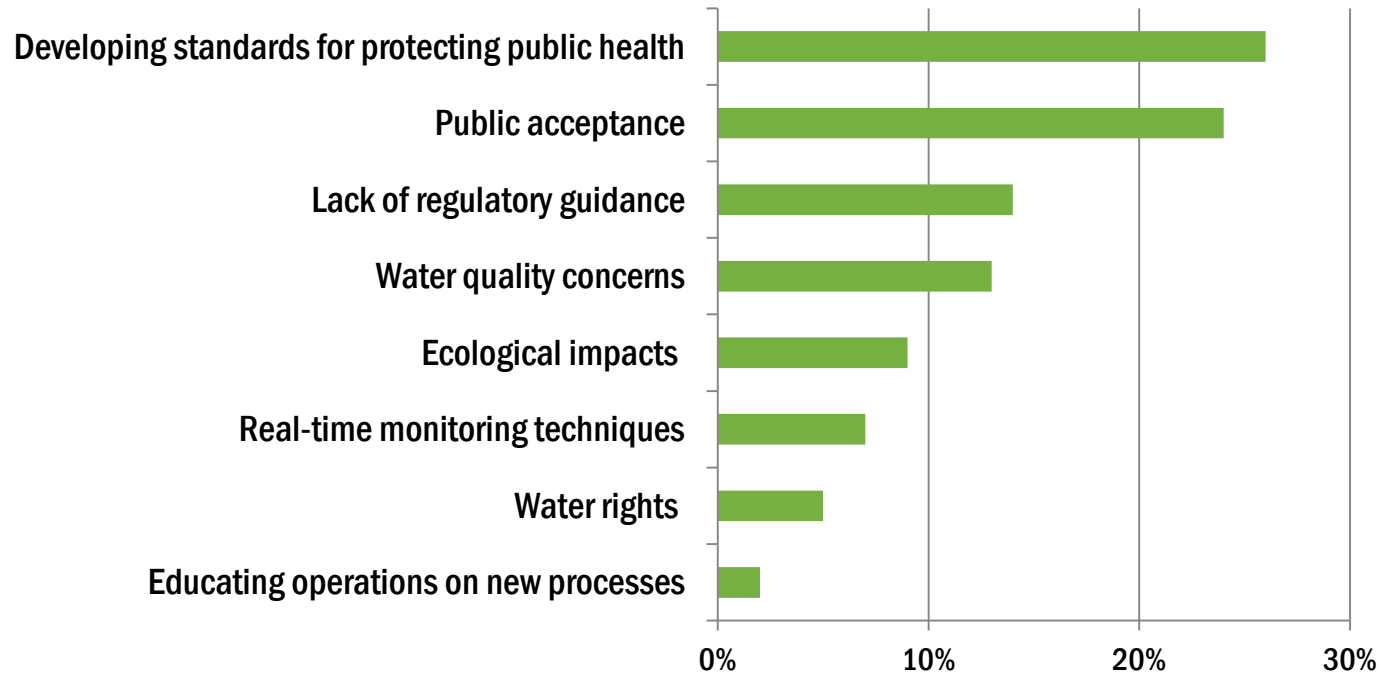
- 24% - a lot more research
- 65% - noted some aspects should be researched further

# DPR Future Research

- 14% - a lot of research is needed
- 75% - some aspects should be researched further



Source: City of San Diego Advanced Water Purification Facility



# Many projects in process to address DPR knowledge gaps

- Two recent publications have laid out the scientific research
- Addressing several key gap areas:
  - source control
  - selecting appropriate fail-safe monitoring techniques
  - sizing and design of engineered storage buffers
  - defining and assessing performance reliability
  - understanding impacts to distribution system stability
  - developing appropriate blending approaches.





# Integrated Water Management: Planning for Future Water Supplies

By 2019, enhance water utility implementation of integrated water management and water supply diversification, by evaluating water supply diversification efforts through an integrated water management approach, by improving water supply planning to be more integrated, resilient, and reliable, and by evaluating how new water supplies from nontraditional sources, can be protective of public and environmental health.

# Focus Area Projects Funded in 2015

1. WRF 4615: Framework for Evaluating Alternative Water Supplies: Balancing Cost with Reliability, Resilience, and Sustainability - \$225,000
2. WRF 4623: Integrating Land Use and Water Resources Planning to Support Water Supply Diversification - \$370,000
3. WRF 4660: Blueprint for One Water Planning



# Blueprint for One Water Planning – WRF 4660

- Survey

[https://www.surveymonkey.com/r/WRF\\_OneWaterPlanning](https://www.surveymonkey.com/r/WRF_OneWaterPlanning)

- 1.5-day Workshop

*“At DEP, close collaboration with other cities has been tremendously useful as we plan for imminent challenges like climate change, population growth, and emerging regulations. We look forward to this workshop as another opportunity to learn from each other and think anew about tools and innovative practices to best serve our cities today, and for generations to come.” - Emily Lloyd*



# Acknowledgements



////////////////////////////////////

This work was made possible through financial support of the Water Research Foundation, Brown and Caldwell (BC), and the following utility sponsors:

American Water Works Service Company, Inc.  
City of Baltimore  
City of Chandler  
Colorado Springs Utilities  
East Bay Municipal Utility District

Greater Cincinnati Water Works  
Los Angeles Department of Water and Power  
San Francisco Public Utilities Commission  
Seattle Public Utilities  
Tarrant Regional Water District

The advice of Research Manager, John Whitler, and the Project Advisory Committee (PAC) are appreciated.



# Project 4550

## Integrated Water Management: Planning for Future Water Supplies

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