

# Implementing the 21<sup>st</sup> Century Water Strategy

**Newsha Ajami, PhD**

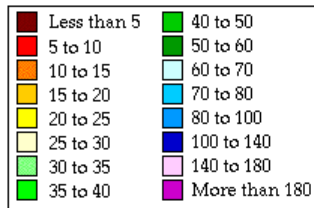
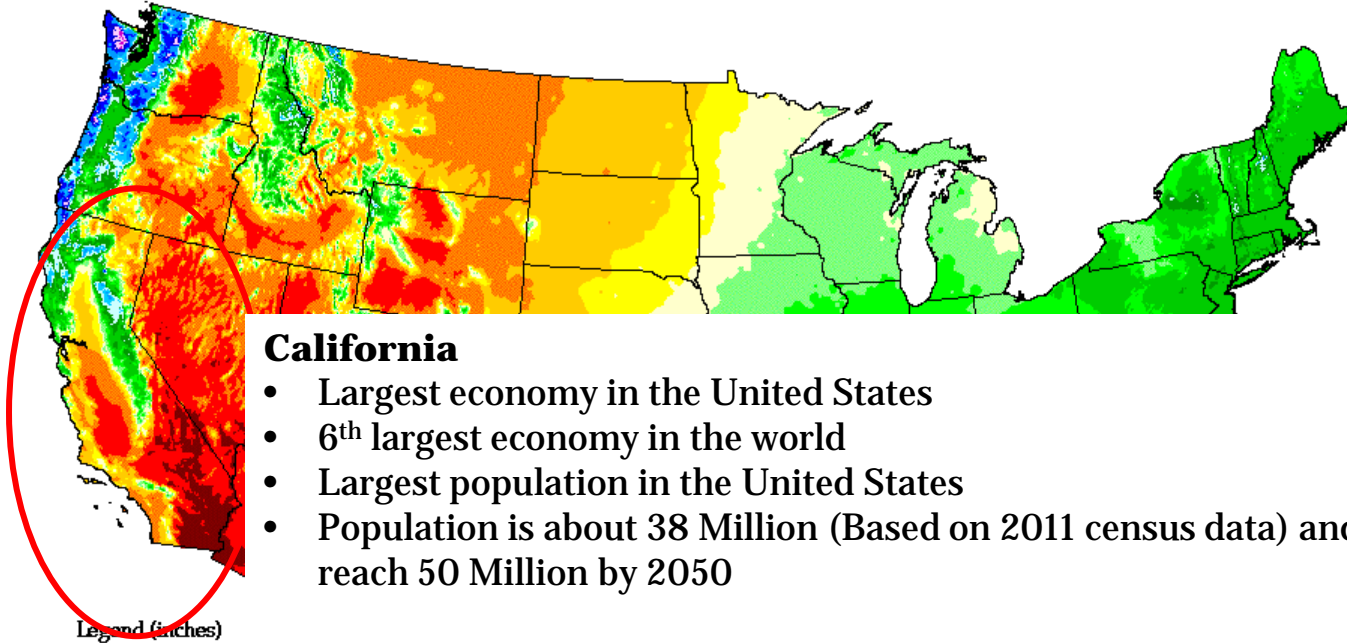
Woods Institute for the Environment  
Stanford University

Santa Ana River Watershed Conference  
May 25, 2017

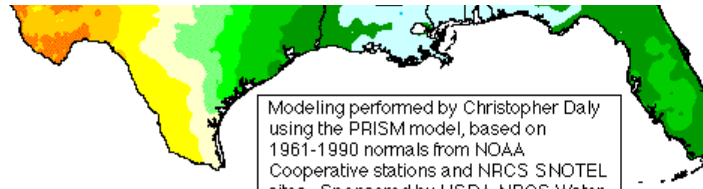


# Annual Average Precipitation

United States of America



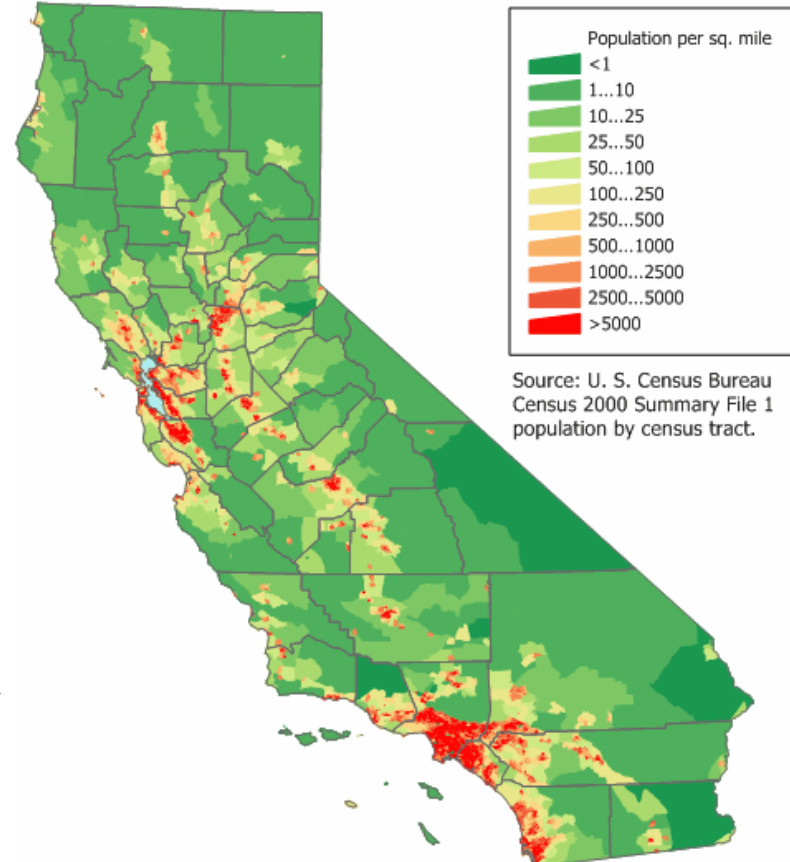
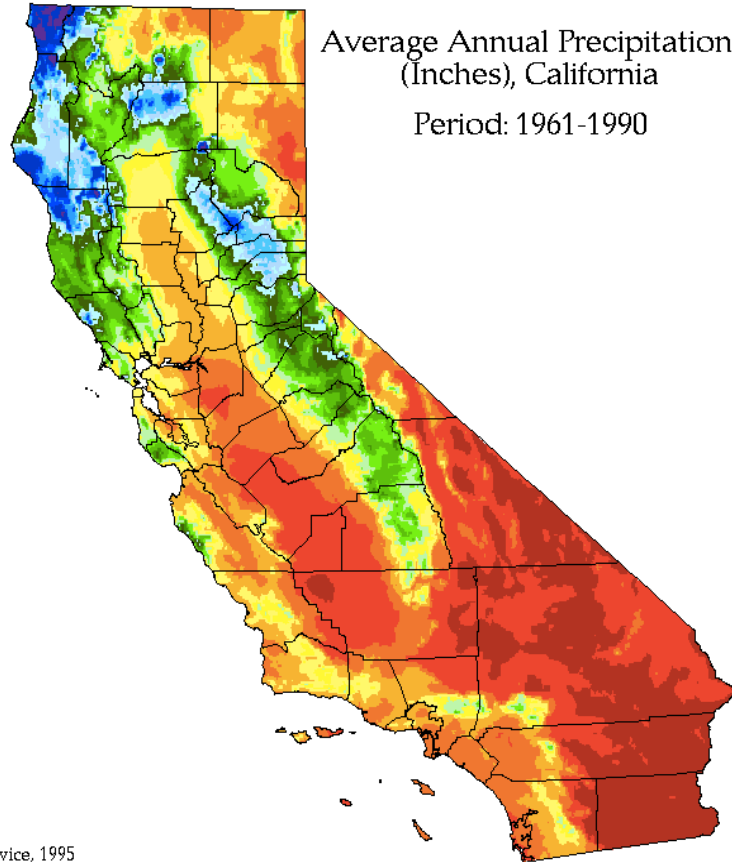
Period: 1961-1990

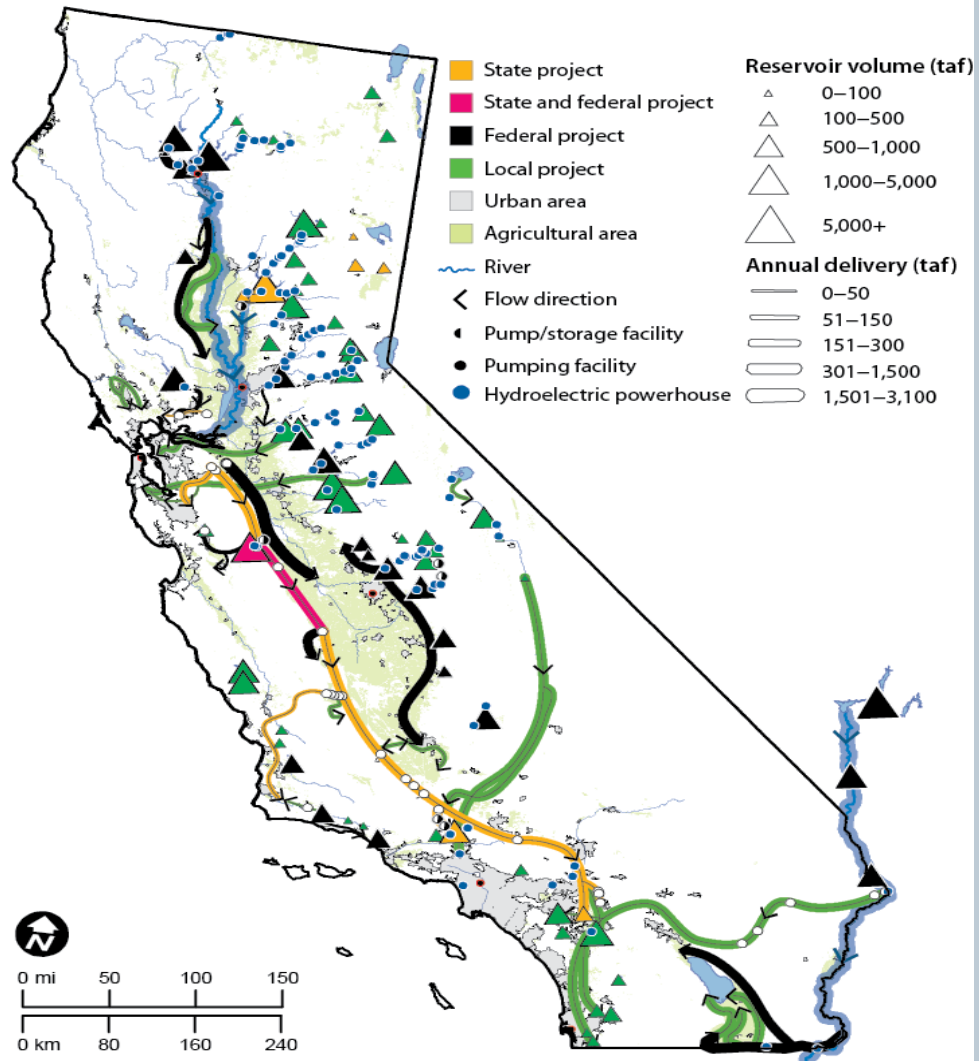


Modeling performed by Christopher Daly using the PRISM model, based on 1961-1990 normals from NOAA Cooperative stations and NRCS SNOTEL sites. Sponsored by USDA-NRCS Water and Climate Center, Portland, Oregon.

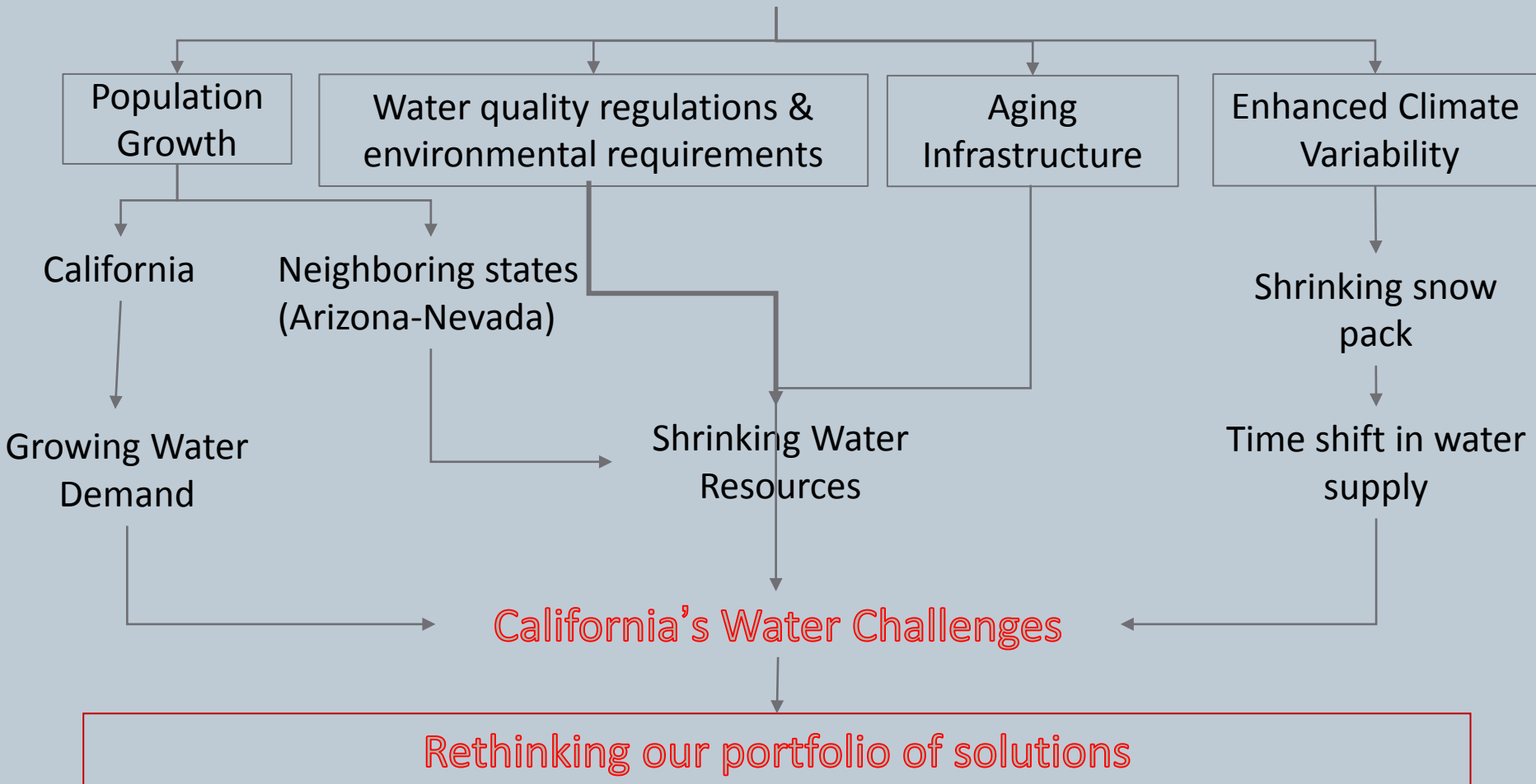
Oregon Climate Service  
George Taylor, State Climatologist  
(541) 737-5705

# Water Resources vs. Population Distribution





# California is dealing with



# Paradigm Shift in the Water Sector

- Big data
- Information Technology
- Modern platforms and decision making tools
- Innovative Financing Mechanisms

Population Growth, Aging Infrastructure, Climate Change, and Stricter Environmental Regulations

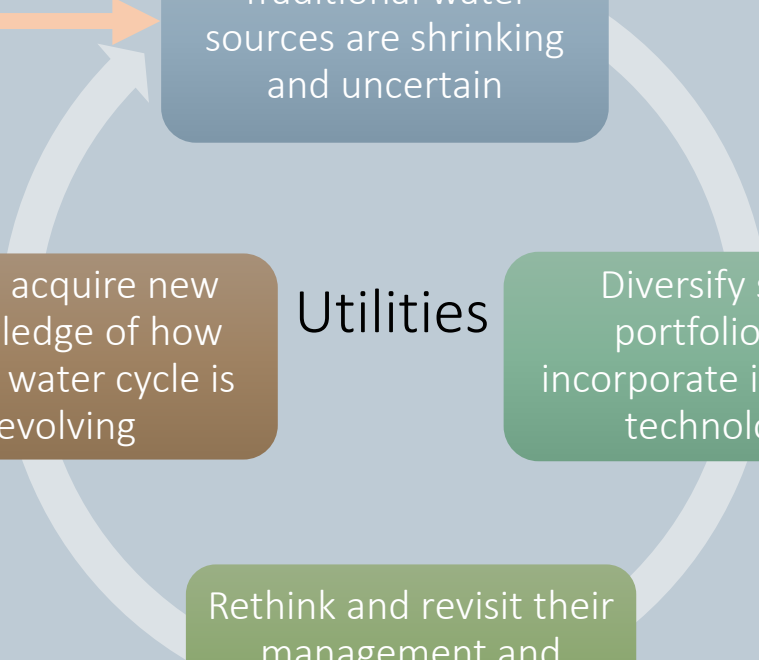
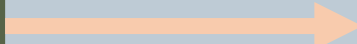
Traditional water sources are shrinking and uncertain

Must acquire new knowledge of how urban water cycle is evolving

Utilities

Diversify supply portfolios and incorporate innovative technologies

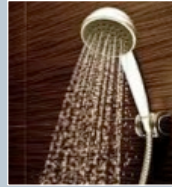
Rethink and revisit their management and governance tools





## Rethinking Supply

- Source protection and watershed management
- Stormwater capture
- Graywater systems
- Treated wastewater
- Conjunctive use
- Desalination



## Rethinking Demand

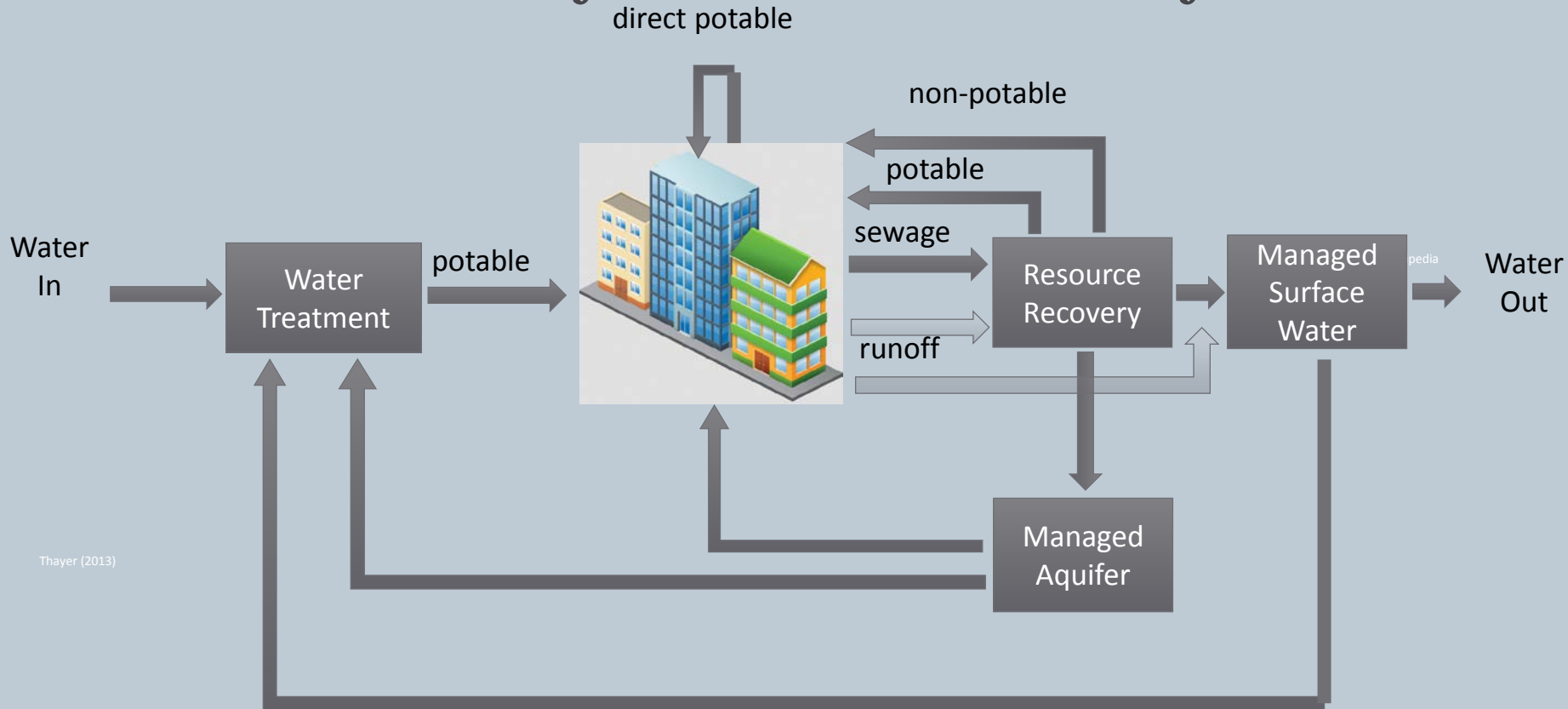
- Reduce waste and increase efficiency,
- Rethink economic priorities
- Education and outreach strategies



## Rethinking Governance

- Water data monitoring and collection
- Cross-sector resource management
- Regional water management
- Financing

# 21<sup>st</sup> Century Urban Water Use Cycle



Thayer (2013)

Source: David Sedlak



Centralized

Decentralized

Infrastructure

## Paradigm Shift in the Water Sector

Traditional management strategies are no longer appropriate

Traditional top-down management strategies are no longer appropriate

Customer behavior is changing, end-users are playing a more vital role

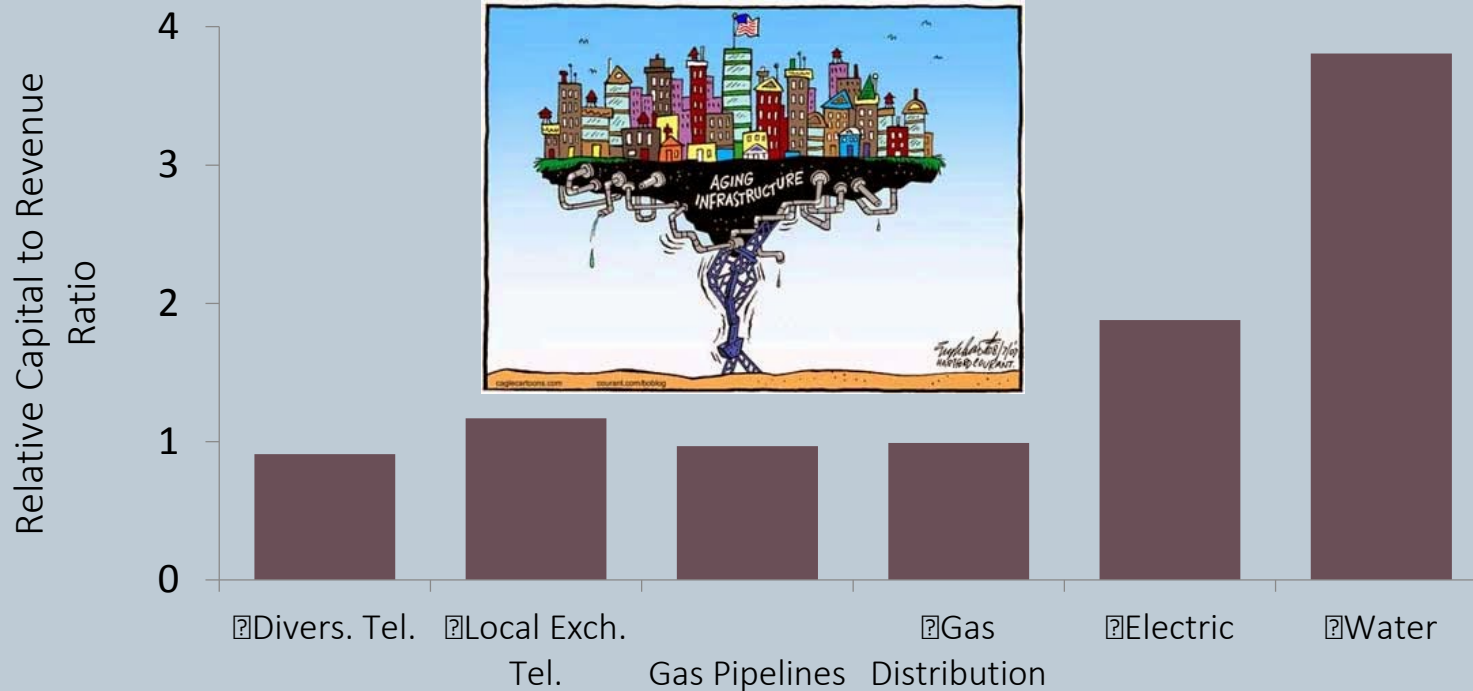
Role of utilities is shifting both within the water sector and with their customers



Price

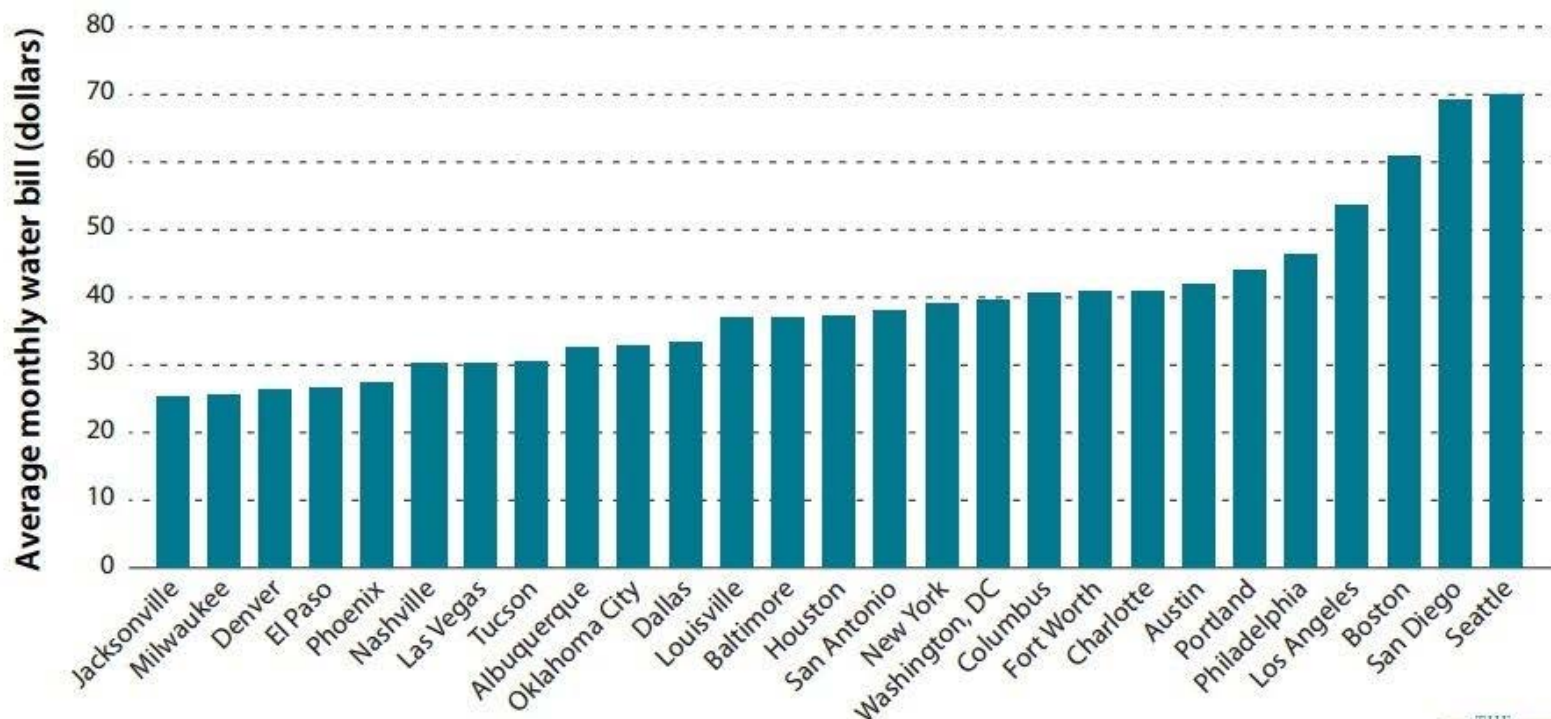
# A Hidden System

Relative capital investment to revenue for several utility services in the US



# Average Monthly Water Bill in Large U.S. Cities, 2010

Typical household water bills in large U.S. cities range widely from \$25 per month to \$70 per month.

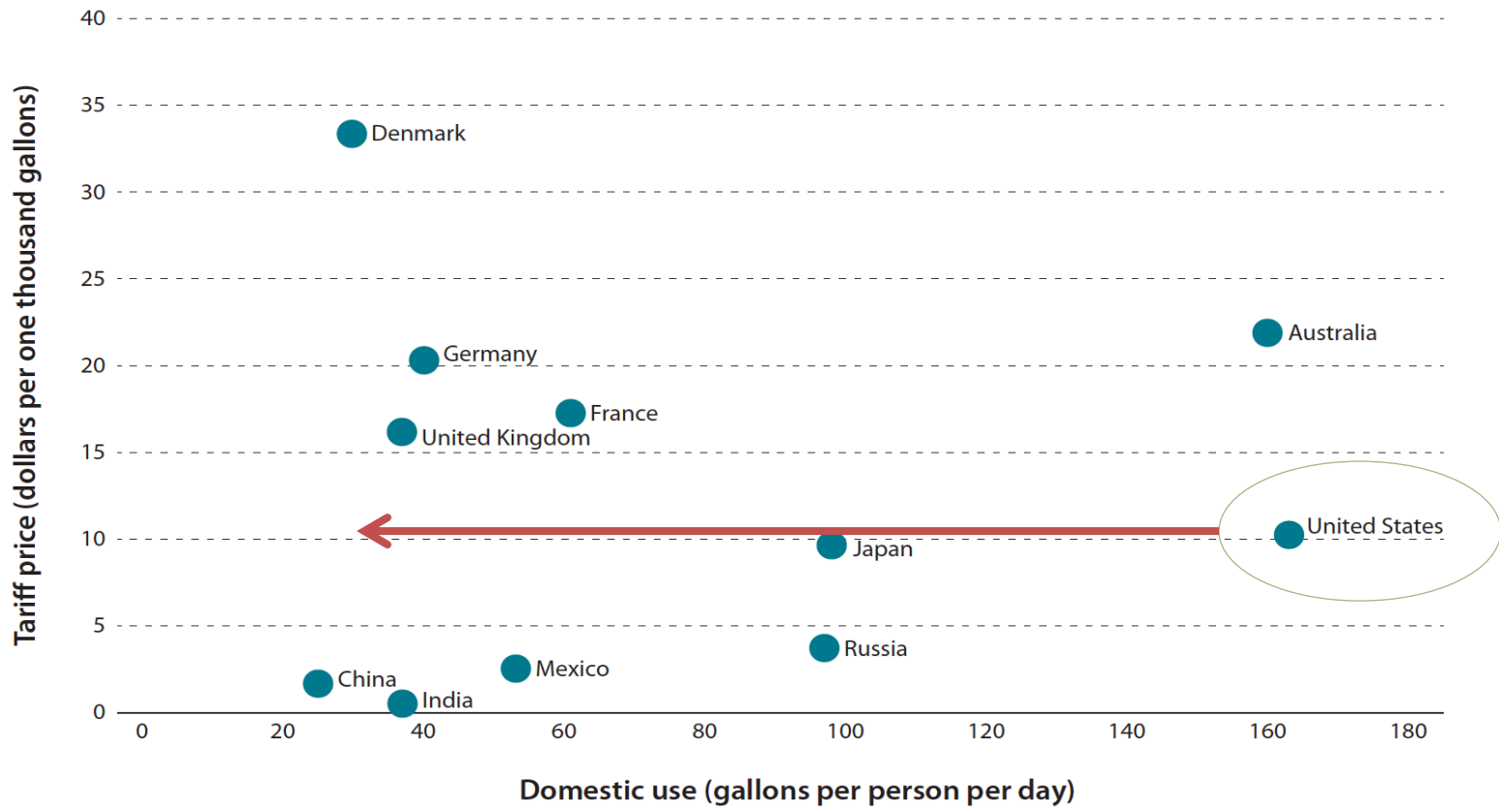


Source: American Water Works Association and Raftelis Financial Consultants 2011.

Note: "Average monthly water bill" refers to the monthly water bill charged by the municipal water systems that operate in the selected cities assuming a monthly water use of 11,200 gallons. For more details, see the technical appendix.

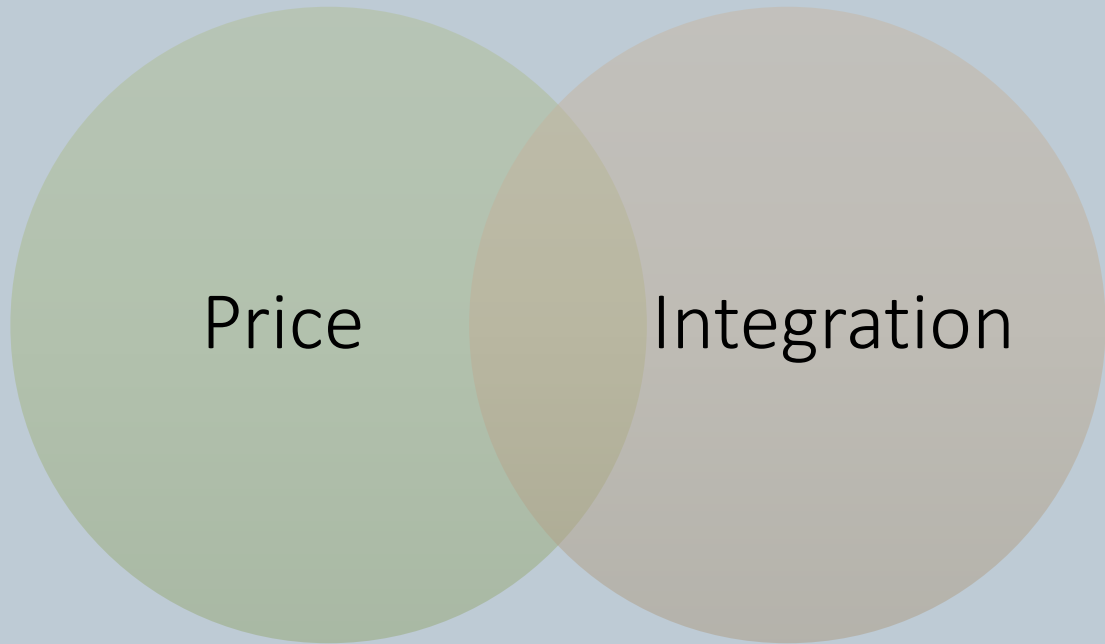
FIGURE 10.

# Tariff Price and Domestic Use per Capita, 2012



Source: Standard & Poor's 2012.

Note: The tariff price includes water and wastewater tariffs and it is the average price among cities in that country.



Price

Integration

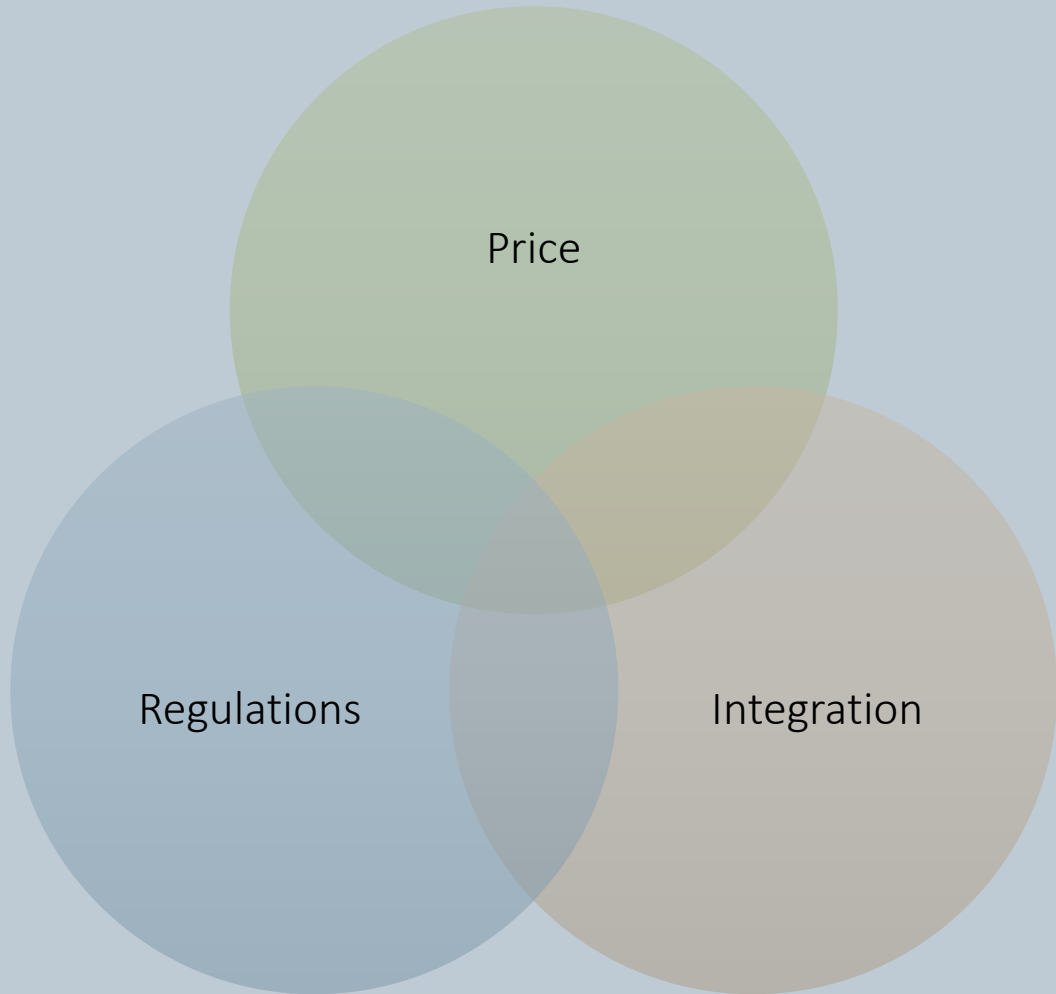
# From Fragmentation to Integration

Agency	Responsibilities		
	Water Supply	Water Quality	Flood Control
Department of Water Resources	X		X
State Water Resources Control Board	X	X	
Delta Stewardship Council	X	X	X
California Public Utilities Commission	X	X	
Colorado River Board	X		
Department of Pesticide Regulation		X	
Department of Public Health		X	
Department of Toxic Substances Control		X	
Office of Environmental Health Hazard Assessment		X	

# From Fragmentation to Integration

Entity	Responsibilities		
	Water Supply	Water Quality	Flood Control
<b>Federal Agencies</b>			
Bureau of Reclamation	X		X
Army Corps of Engineers	X		X
Environmental Protection Agency		X	
Geological Survey	X	X	
<b>Other Entities</b>			
Tribal governments	X	X	X
Cities and counties	X	X	X
Special districts	X	X	X
Private water companies	X		

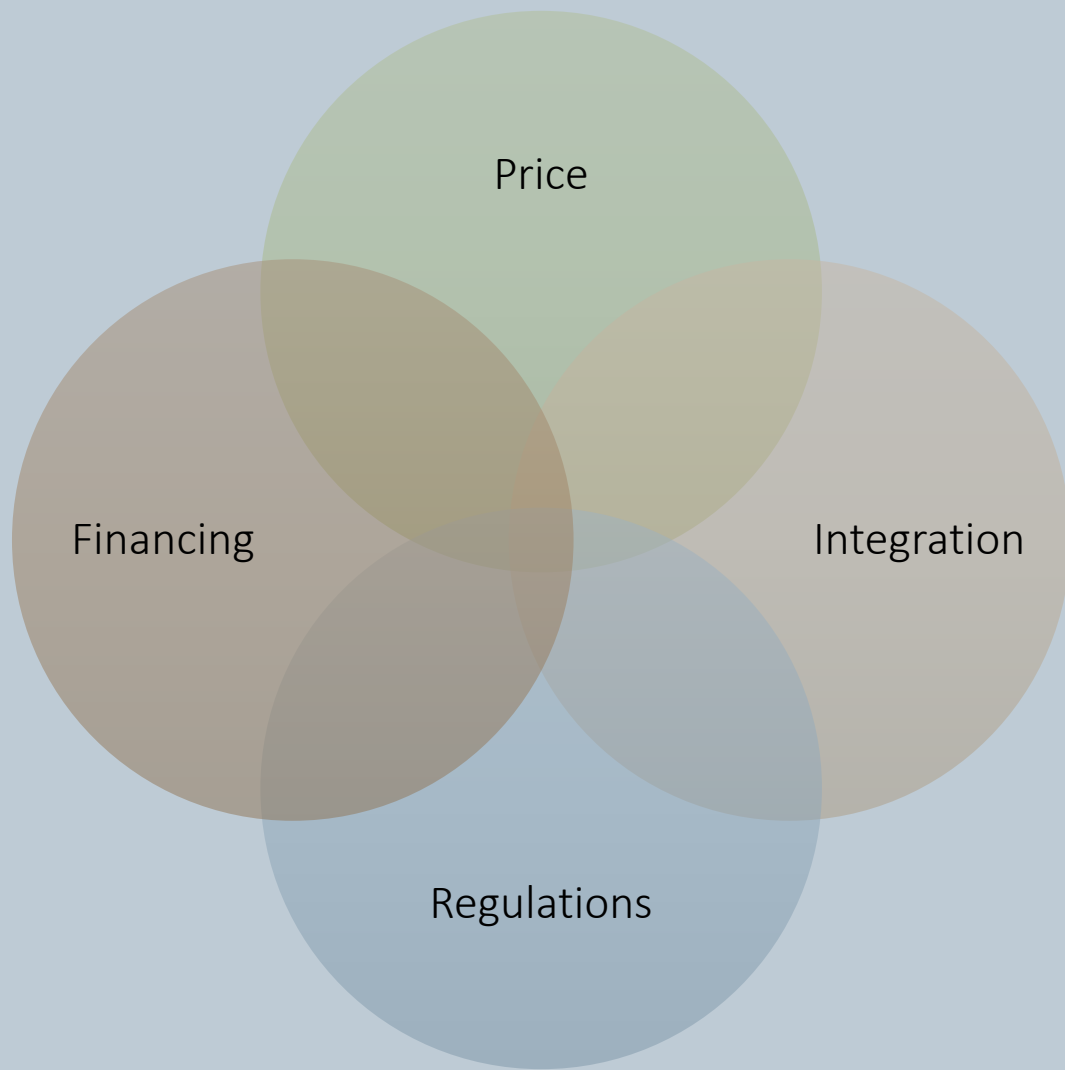





Price

Regulations

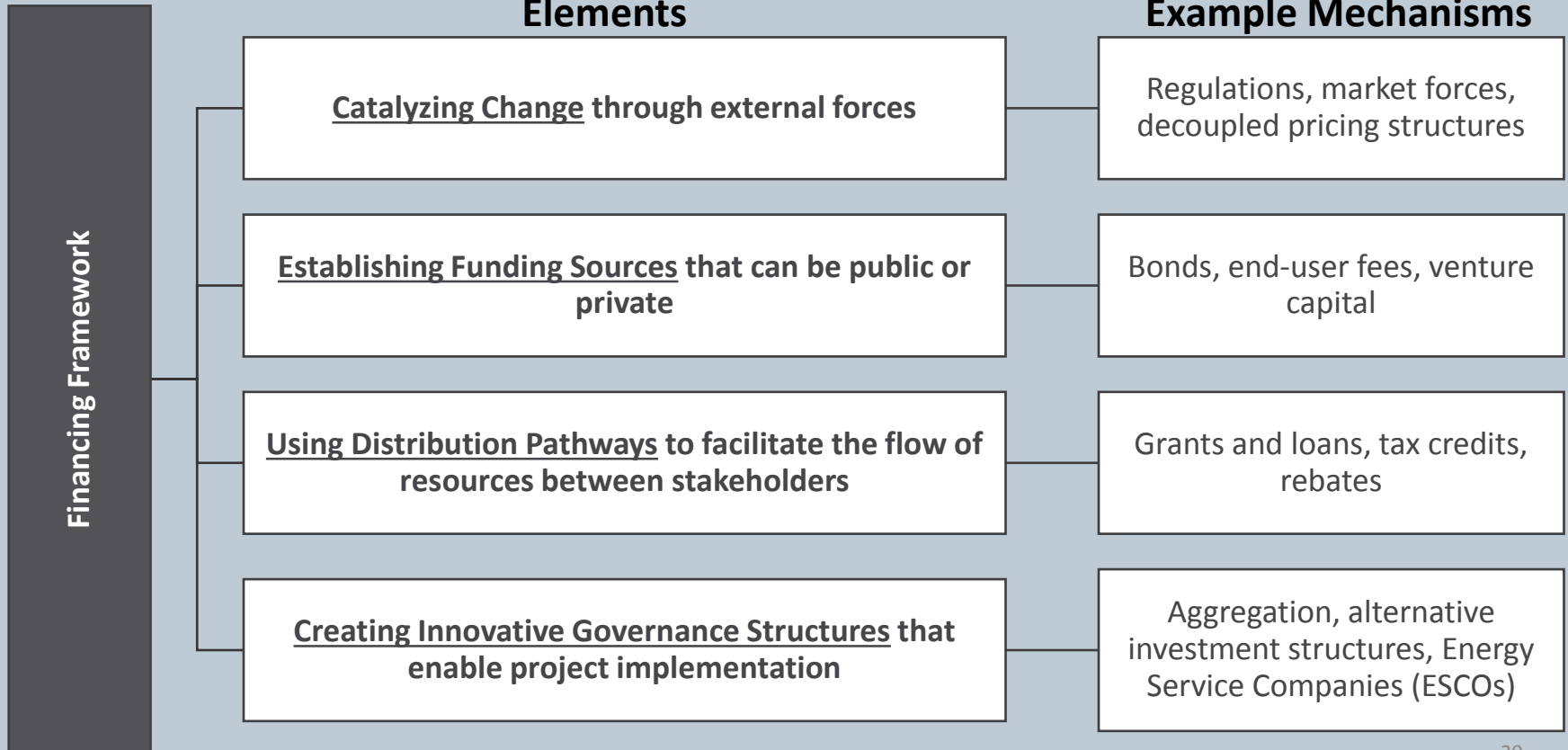
Integration





# Looking to the Electricity Sector: How to Finance Decentralize Systems

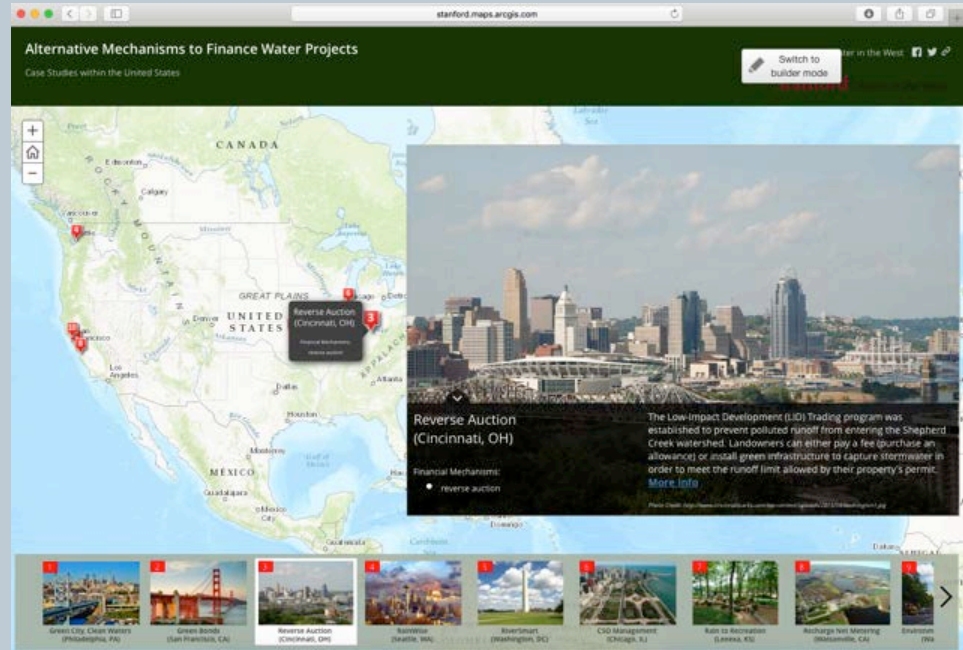
# Innovative Financing Framework



# Financing Water Projects- Living Map

## Mechanisms Highlighted:

- Stormwater Fees
- Reverse Auction
- Performance-Based Rebates
- Stormwater Credit Trading Program
- Grant Programs
- Environmental Impact Bond
- Project Aggregation



# Food for Thought: Governace

- Enact policies and economic forces to drive change
  - Portfolio standards, demand-side management and pricing
- Promote coordination among and within water sectors, as well as across all relevant jurisdictional levels
- Collect and publish relevant water resources data

# Food for Thought: Financing

- Establish more innovative funding solution
  - Green banks, impact investment, CBPPP and on-bill financing
- Utilize a diverse financing strategy to minimize risk and increase economic potential
- Cost Sharing and customer-based financing can be an *enabler* at every scale
  - Developer, end-user, communities and municipalities

# Thank you

Newsha Ajami – [newsha@stanford.edu](mailto:newsha@stanford.edu)

Resources: <https://goo.gl/WIM3jA>

Living Map: <http://arcg.is/2onr2Do>







# D.C. Storm Water Retention Credit Trading

- Direct Regulation
- Credit Trading platform



[Stormwater Retention Credits Trading Program \(Washington, D.C.\)](#)

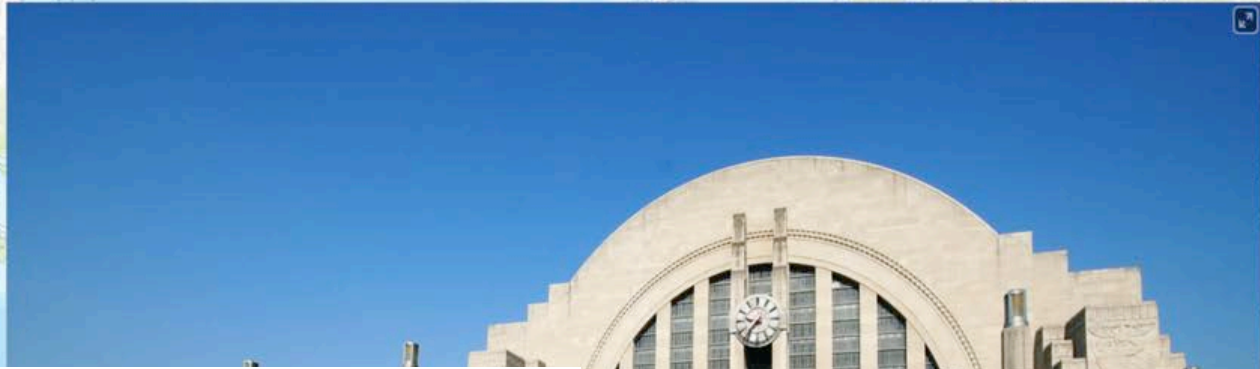
Financing Mechanisms:

- Credit Trading
- Direct Regulations

The District of Columbia Department of Energy & Environment (DOEE) recently implemented a Stormwater Retention Credit (SRC) Trading Program to encourage property owners to capture stormwater runoff and prevent pollutants from spilling into the Chesapeake Bay and the District's local waterways. The SRC Trading Program enables properties that voluntarily install green infrastructure to generate credits that can be used in an open market and be used to meet regulatory requirements for managing stormwater runoff. [More Info](#)

Photo Credit: Wally Gobetz



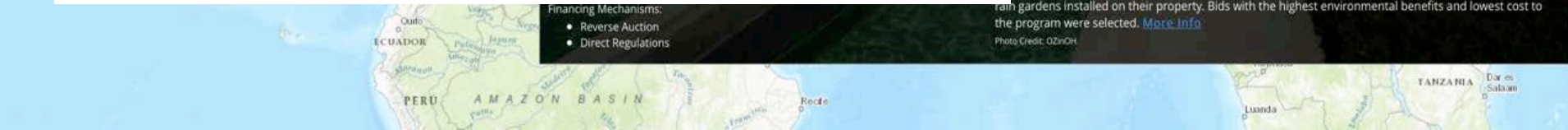


## Reverse Auction in Cincinnati Ohio

- Direct Regulation
- Reverse Auction-to attain the highest environmental benefits for the lowest price

In an effort to develop a cost-effective stormwater management plan, a two-year reverse auction pilot program was implemented in Shepherd Creek using parcel-level runoff mitigation practices. Residents submitted sealed bids stating how much they would be willing to be paid to have free rain barrels and/or rain gardens installed on their property. Bids with the highest environmental benefits and lowest cost to the program were selected. [More Info](#)

Photo Credit: OZINOH



# Emerging models of Public Private Partnerships

# Emergence of Community Based PPPs

## Public Private Partnership (PPP)

- Transactional contract
- Performance based contractual agreement
- Goal is minimizing risk and increasing profits

## Community Based PPP

- “Relational contract” based on long-term trust and confidence between partners
- Alignment of goals between public and private sectors
- Shared risks and responsibility for project management
- Transparency between partners through adaptive management of project goals
- Focused on local economic growth and Improved quality of life in urban and underserved communities

# Prince George County, MD: Clean Water Partnership

- Manage stormwater runoff in a **Design-Build-Operate-Maintain (DBOM) CBP3**
- Design, installation, maintenance, and monitoring of stormwater facilities to treat about 4,000 acres of impervious areas over the next 30 years.

- The CWP's goals:

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  - t
  - a
  - Financial
  - D
  - P
  - C
- In addition to reimbursement for O&M expenses, they will receive
- Base fee equal to 5 percent of the operation and maintenance costs and expenses,
  - Incentive fee based on:
    - delivering projects within the time and budgetary goals,
    - promoting socioeconomic change by incorporating County-based businesses, minority/protected class businesses, and creating jobs for County residents.

- Fee-Credit: property owners that implement stormwater retrofits

## **Impact Driven Bonds:**

Promote positive social and/or environmental  
impacts

Attract sustainability motivated investors

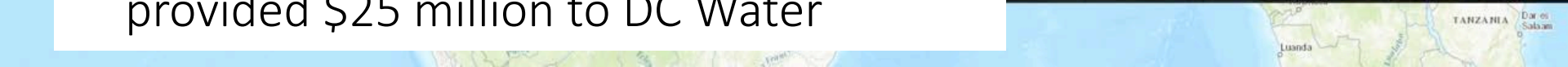


## Environmental Impact Bond:

- Reduce stormwater runoff in **twenty acres** by installing **green infrastructure** such as green roofs, porous pavement, and rain gardens in two District neighborhoods.
- Goldman Sachs and Calvert Foundation, provided \$25 million to DC Water

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Photo Credit: Wally Gobetz



# Performance Related Financial Risk Management

Performance Tier 1

Run off  
Reduction >  
41.3%

DC Water pays  
Investors \$3.3  
million

Performance Tier 2

$18.6\% \leq$  Runoff  
Reduction  $\leq$   
41.3%

No outcome  
payments due

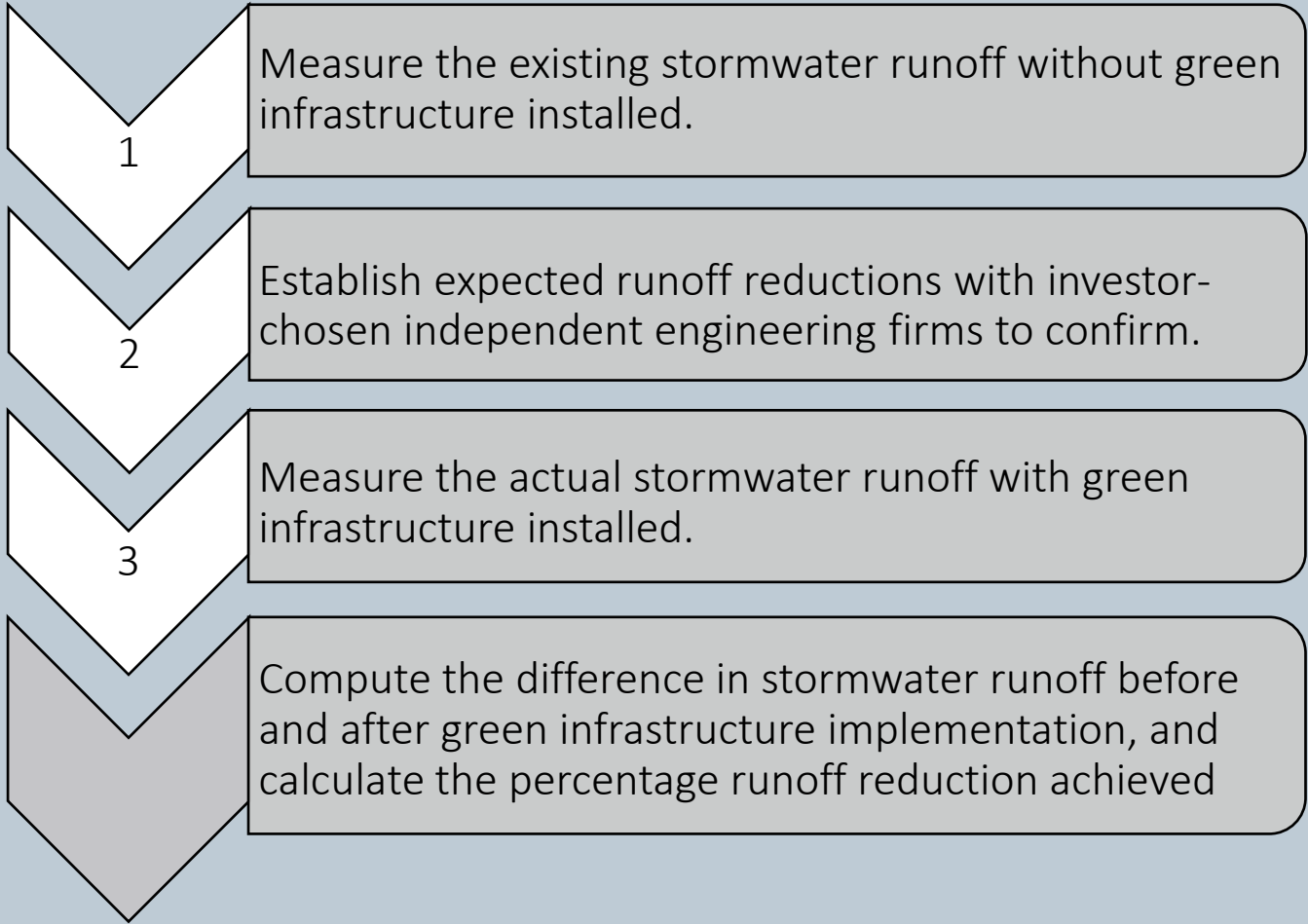
Performance Tier 3

Runoff  
Reduction <  
18.6%

Investors pay  
DC Water \$3.3  
million



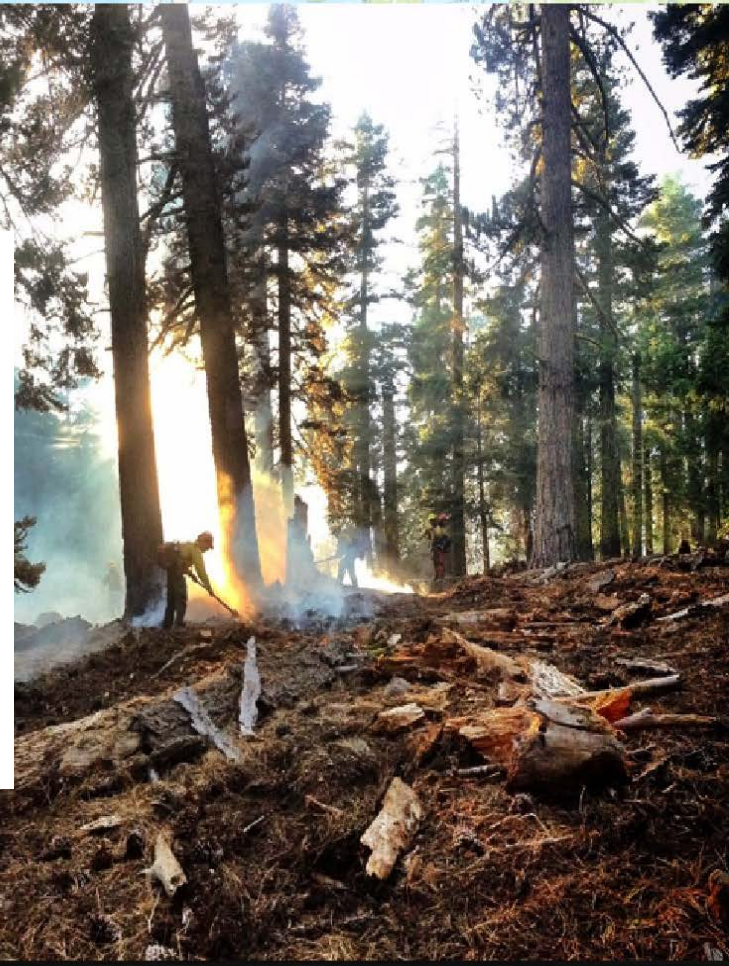
# Assessing Program Performance





## Forest Resilience Bond

- Aggregation of funds to reduce cost and risk to each investor
- Identified beneficiaries



# Primary Beneficiaries and Performance Criteria

US Forest Service

Reduced wildfire severity

Protected wildlife habitat and recreation

Water Utilities & Dependent Companies

Protected water quality

Increased water quantity

Electric Utilities

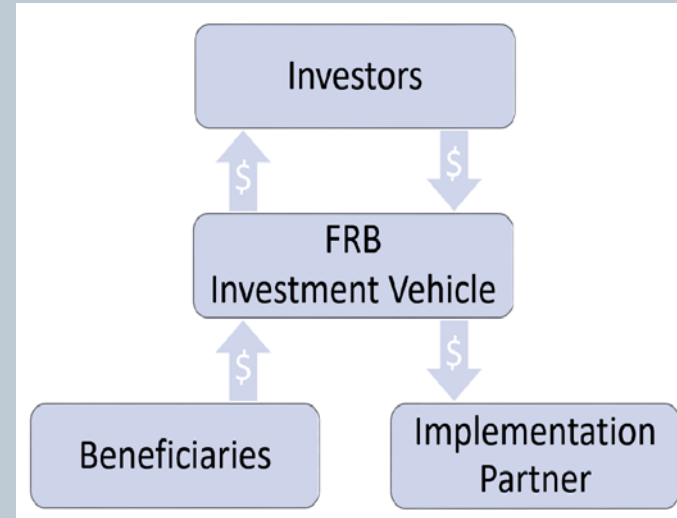
Increased hydropower

Avoided reservoir sedimentation

State Governments

Public safety & health

Job creation





SFPUC Green Bond (under climate bonds standards) to attract sustainability motivated investors.

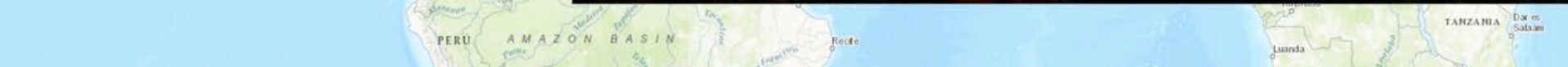


**Green Bond**  
(San Francisco, CA)

Financing Mechanisms:  
• Bonds

On May 2016, San Francisco Public Utilities Commission (SFPUC) issued the world's first green bond certified under the water-specific criteria of the Climate Bonds Standard, an evaluation tool used to assess the environmental integrity of bonds earmarked for water-related projects that include climate change mitigation or adaptation attributes. [More Info](#)

Photo Credit: Julie, Dave & Family



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