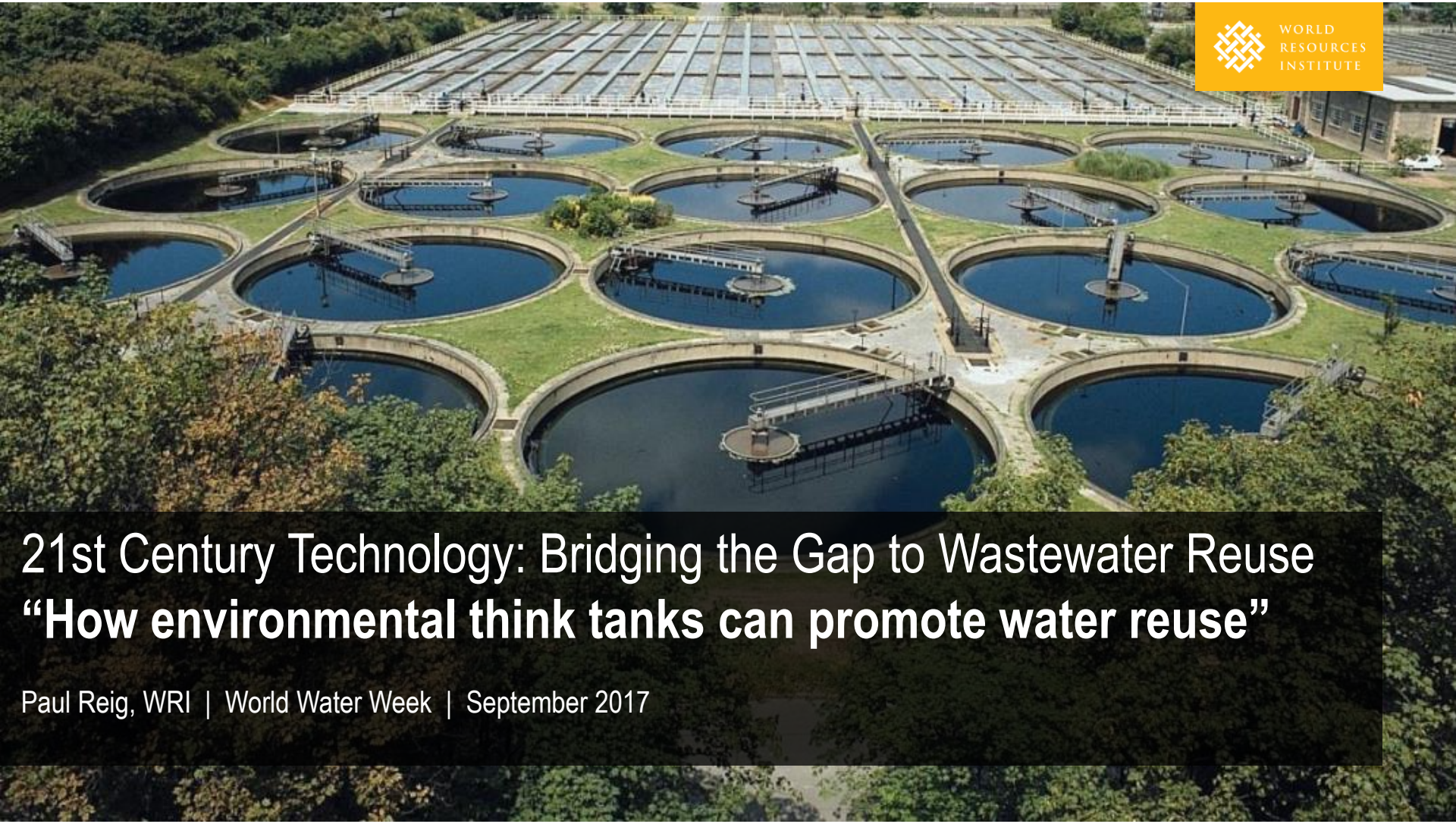
21st Century Technology: Bridging the Gap to Wastewater Reuse

Monday, August 28, 2017
NL Pillar Hall



21st Century Technology: Bridging the Gap to Wastewater Reuse

"How environmental think tanks can promote water reuse"

Paul Reig, WRI | World Water Week | September 2017

AQUEDUCT™
Measuring and Mapping Water Risk

DONATE

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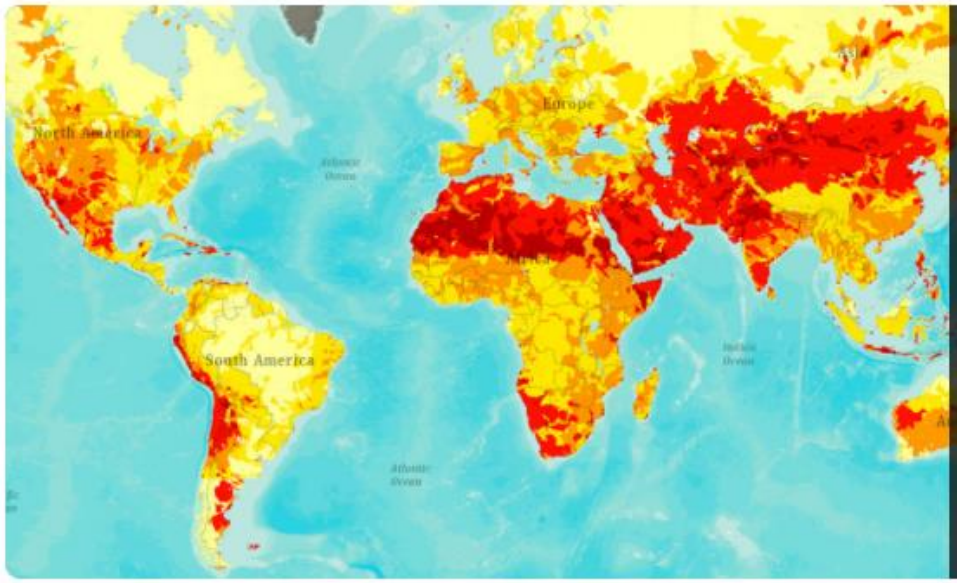
Measuring, mapping and understanding water risks around the globe.

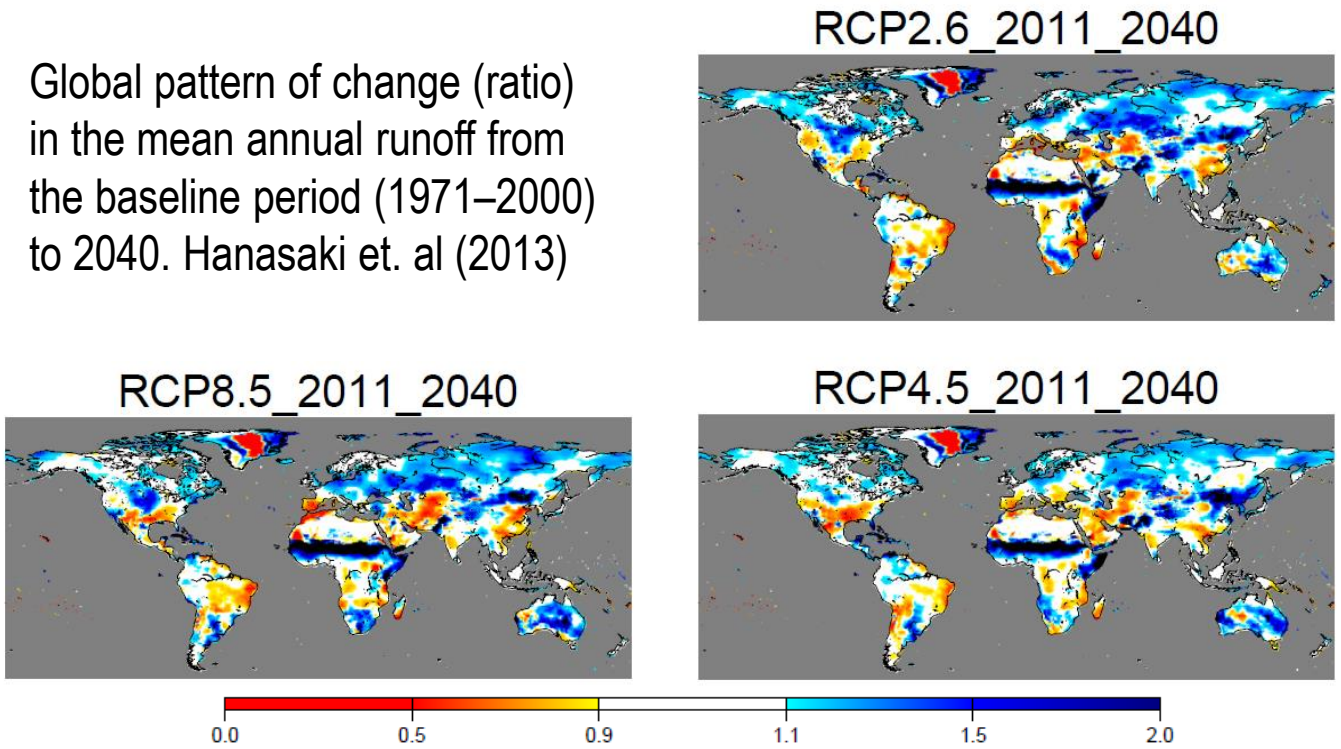


Aqueduct's global water risk mapping tool helps companies, investors, governments, and other users understand where and how water risks and opportunities are emerging worldwide.

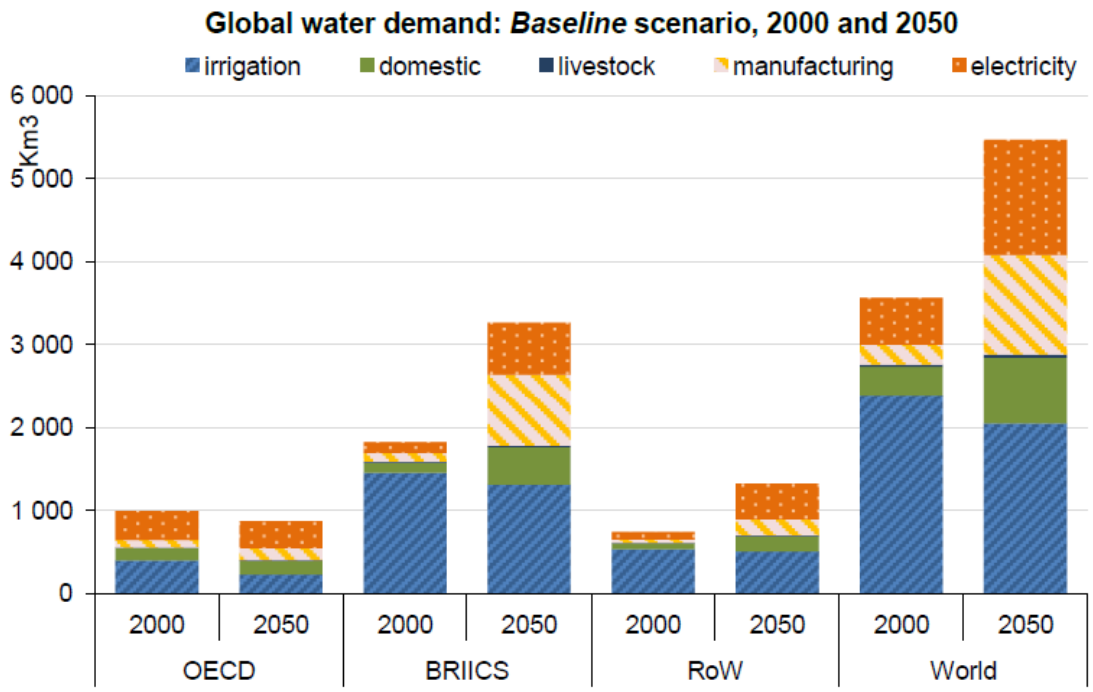
LAUNCH THE MAPS

FUTURE WATER SUPPLIES

Global pattern of change (ratio) in the mean annual runoff from the baseline period (1971–2000) to 2040. Hanasaki et. al (2013)

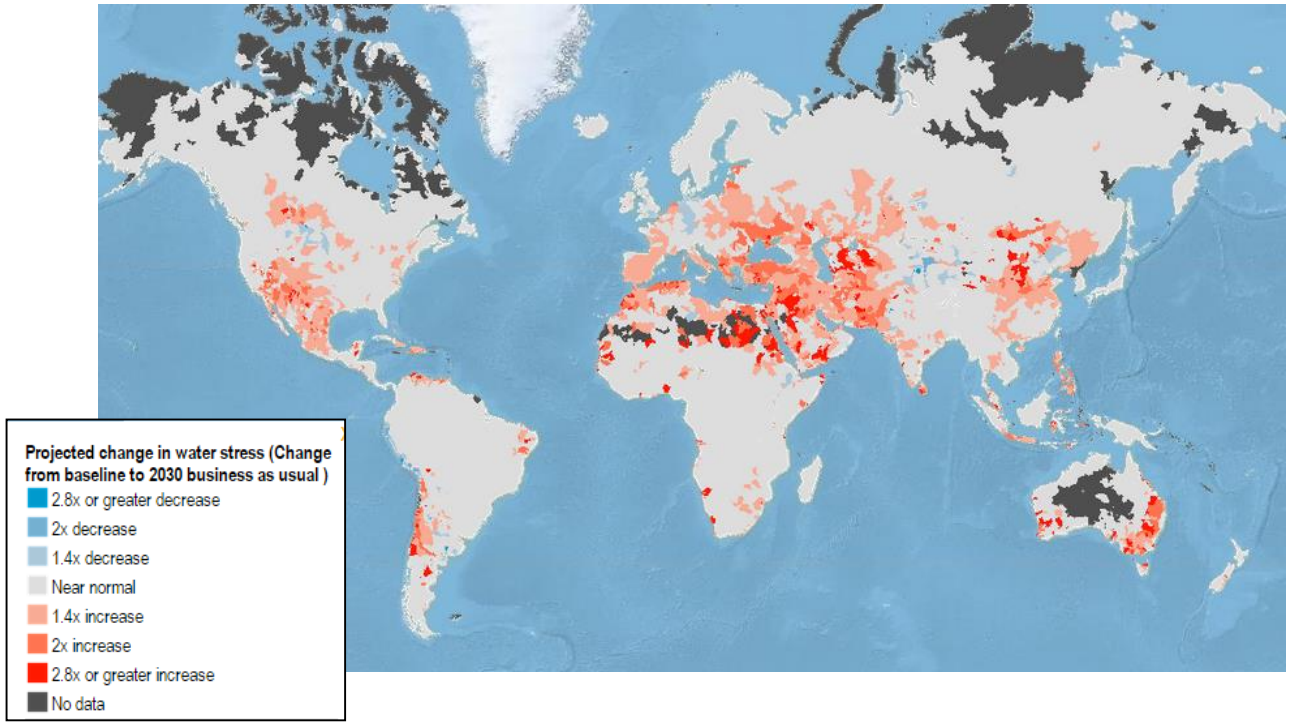


FUTURE WATER DEMAND



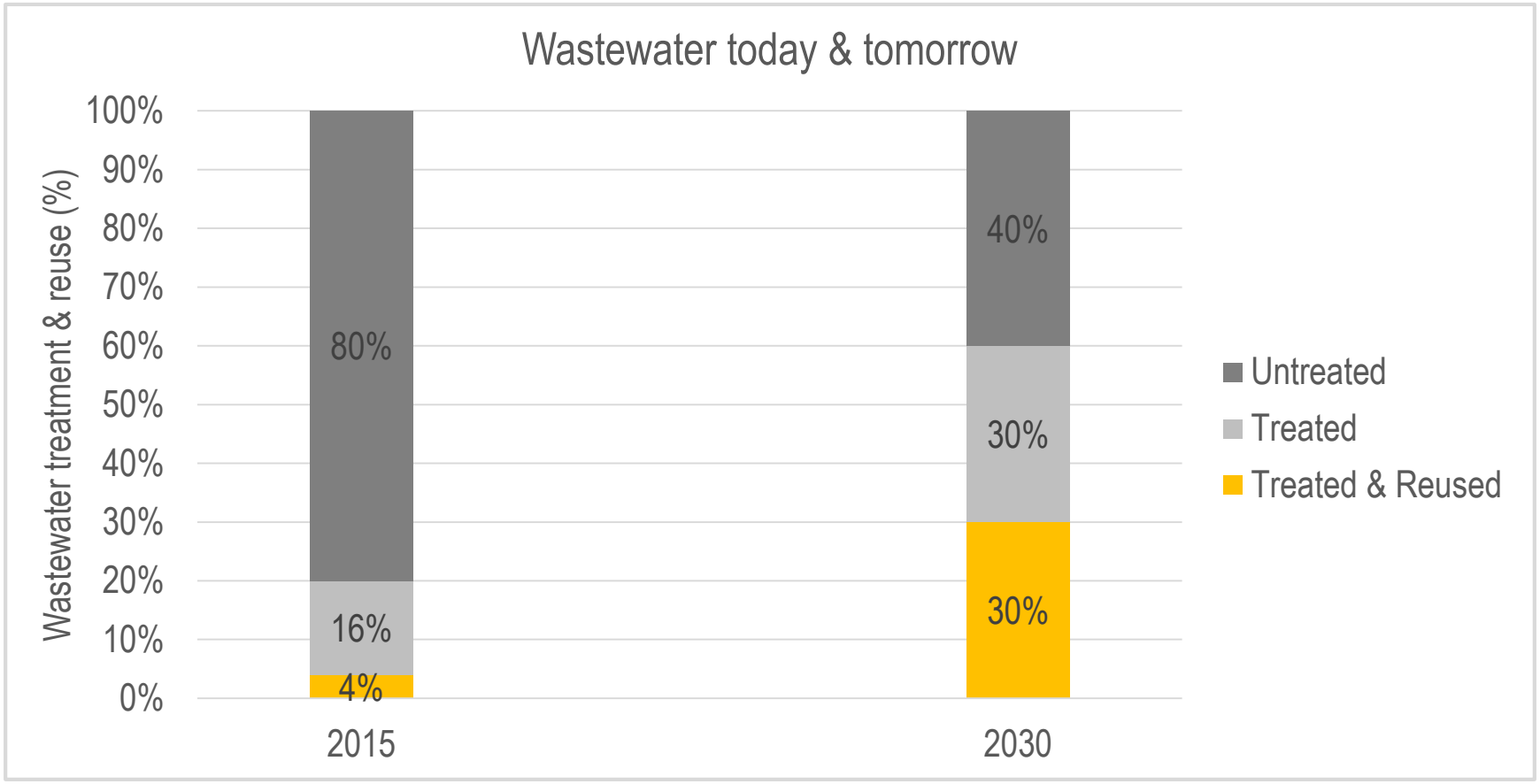
Source: OECD (2012)

FUTURE WATER STRESS



Source: WRI (2015)


Wastewater today & tomorrow
Wastewater treatment & reuse (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
80%
16%
4%
2015
2030
Untreated
Treated
Treated & Reused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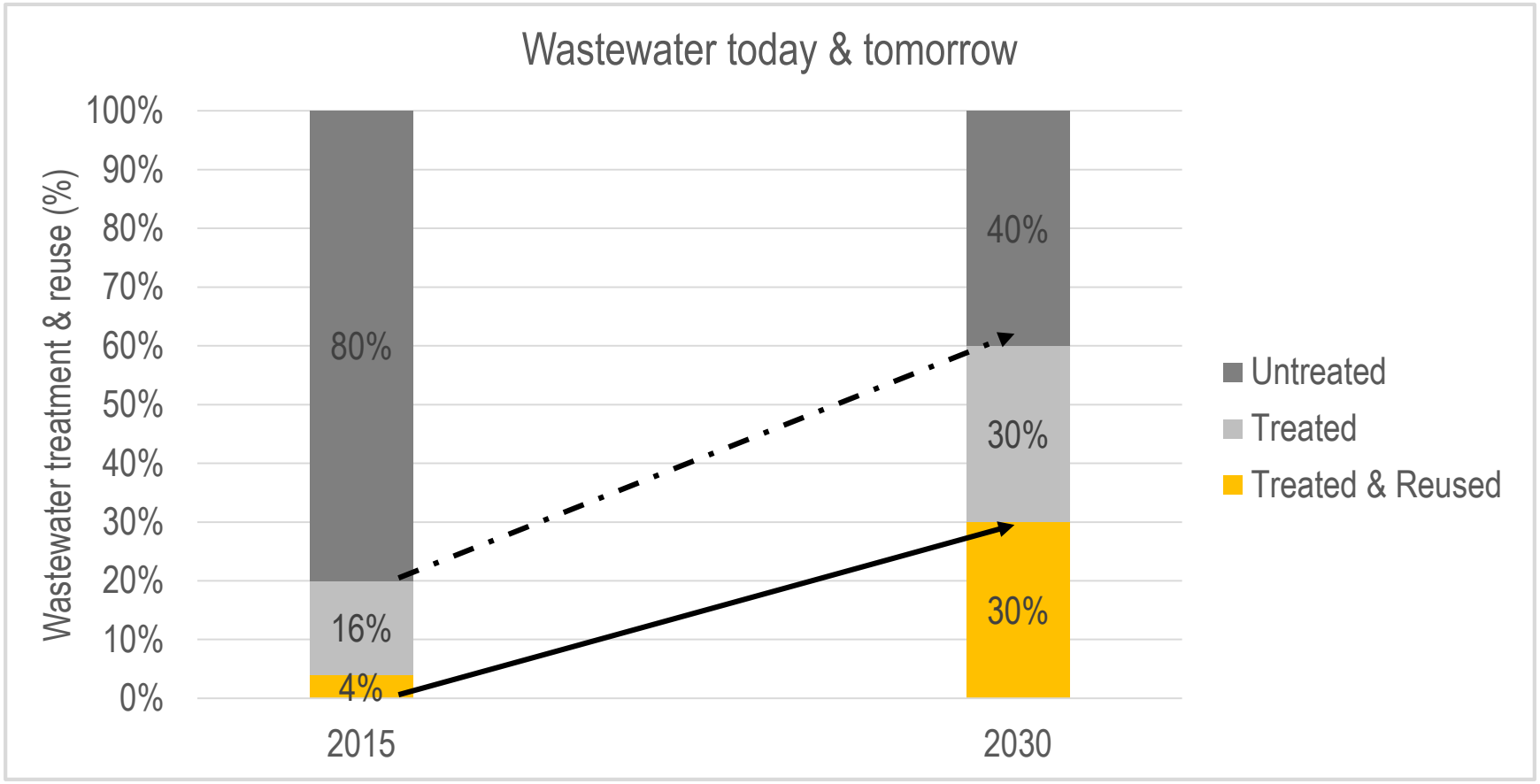
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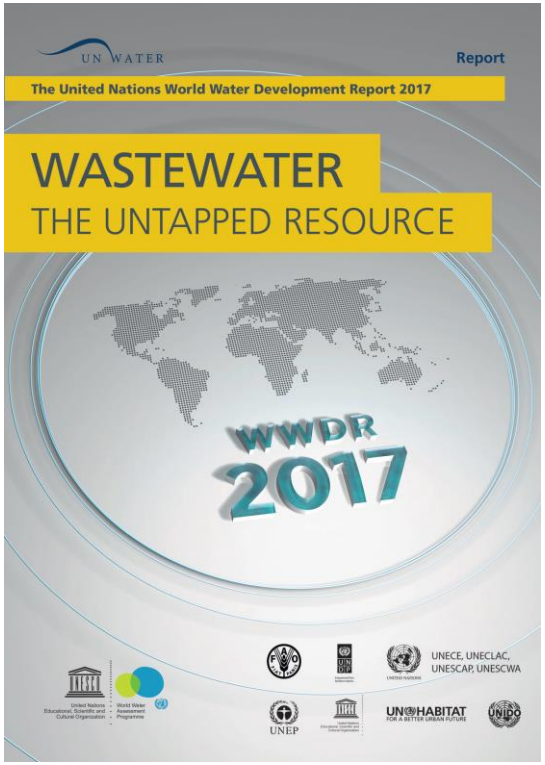
ROSLAN RAHMAN/AFP/GETTY IMAGES



2017 UN World Water Development Report,
Wastewater: The Untapped Resource

ENABLING ENVIRONMENT FOR CHANGE

- Fit-for-purpose technical solutions
- Suitable legal and regulatory frameworks
- Cost recovery and appropriate financing mechanisms
- Enhancing knowledge and building capacity
- Minimizing risks to people and the environment
- Public awareness and social acceptance

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COST RECOVERY AND APPROPRIATE FINANCING MECHANISMS

Challenges

- *Potable water is underpriced*
- *Treated wastewater must be priced lower than potable water*
- *Revenues from selling treated wastewater lower than operational and maintenance costs*

Opportunities

- *Pricing water to reflect its cost and help drive investments in reuse.*
- *New business models for wastewater treatment and reuse*
  - *Water Swaps*
  - *Replenishment of Natural Capital*
  - *On-site value creation*
  - *Marketing reclaimed water*
  - *Hedging future water markets*

COST OF WATER STEWARDSHIP

WORLD RESOURCES INSTITUTE

For additional information, please contact:

Paul Reig | Senior Associate, WRI | preig@wri.org

WATER FOR GROWTH

Incorporating water reuse into water stewardship strategies

21st Century Technology: Bridging the Gap to Wastewater Reuse
August 28, 2017

Will Sarni
Water Foundry
will@willsarni.com

WATER FOUNDRY

WHAT IS THE NEW NORMAL?

CHALLENGES

PUBLIC POLICY
- Over allocation
- Poor data
- 19th/20th century policies

ENERGY WATER FOOD NEXUS
- Increased demand
- Siloed solutions

INFRASTRUCTURE
- Underfunded
- Price of water

TRENDS

DIGITAL WATER
- Inexpensive sensors
- Internet of things
- Big data
- Artificial intelligence

ONE WATER/CIRCULAR ECONOMY
- Efficiency
- Reuse/Recycling
- Energy/Nutrients

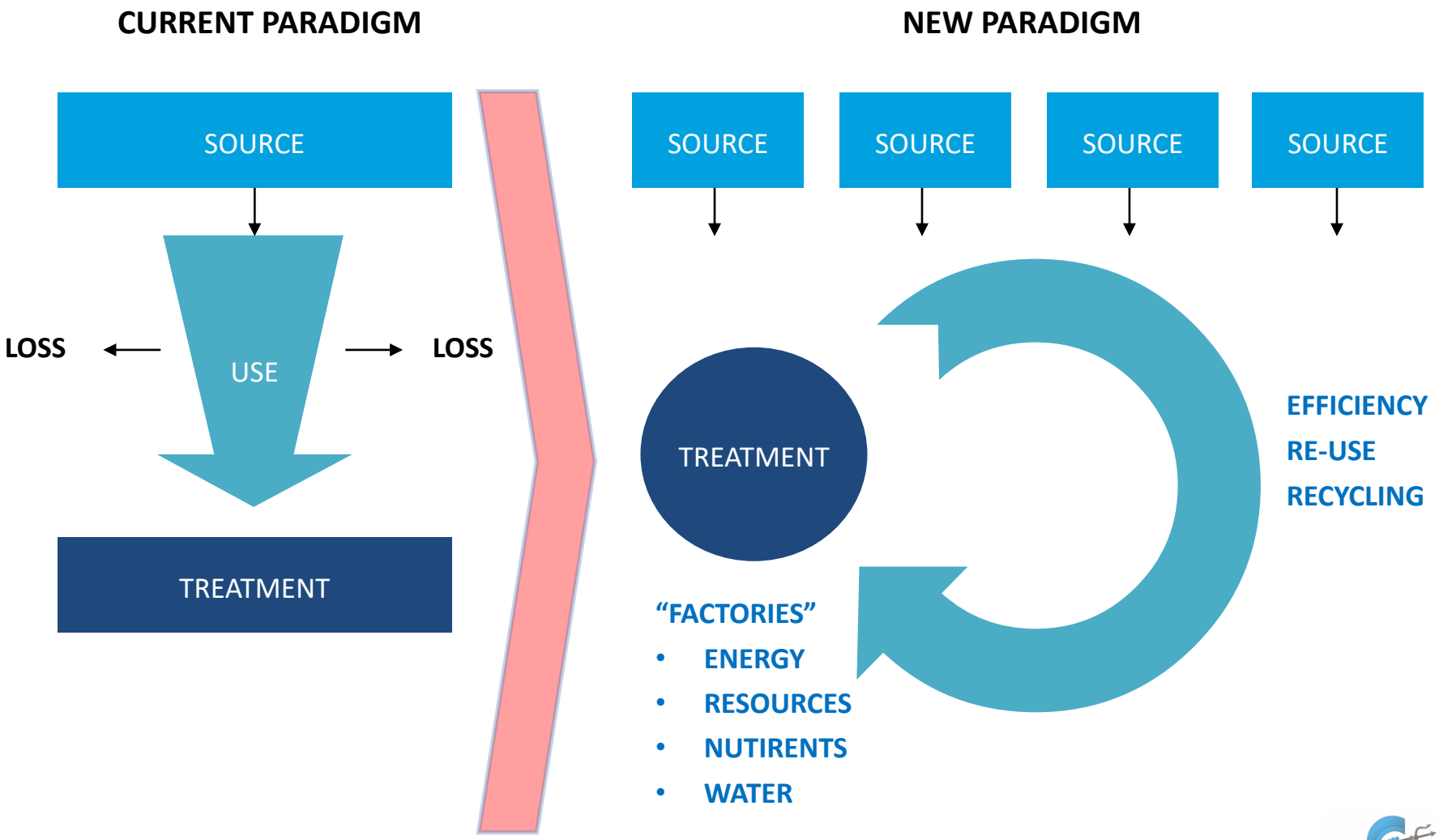
DECENTRALIZED/OFF GRID
- Air moisture capture
- POU/POE treatment

NEXUS SOLUTIONS
- Water funds
- Incentives
- Green bonds
- Prize competitions

INNOVATION
- Exponential tech
- Partnerships
- Funding/financing
- Business models
- Water trading

WATER FOUNDRY

THE CIRCULAR ECONOMY DRIVES INNOVATION AND VALUE



Adapted from Lux Research Water Intelligence 2008

WATER FOUNDRY

WATER RISK AS A BUSINESS RISK

	Supply Chain	Operations	Product Use
Physical	Water scarcity drives up input prices (~2%-20%)	Increased capital expenditure on water treatment, extraction or alternative technologies raises costs	Non-availability or scarcity of water required for using product or service limits growth
Regulatory	Suspension or withdrawal of supplier's water license or discharge permits disrupts supply chain	Reallocation to more urgent needs during drought disrupts operations	Restrictions on use of particular products or services due to water intensity raises costs or checks growth
Reputational	Responsibility "by association" for suppliers' water pollution damages brand or reputation, hinders growth	Competition with household demands, or pollution incidents, damages brand or reputation, hinders growth	Public outcry regarding water intensity of product damages brand, reputation, hinders growth

Financial Impact

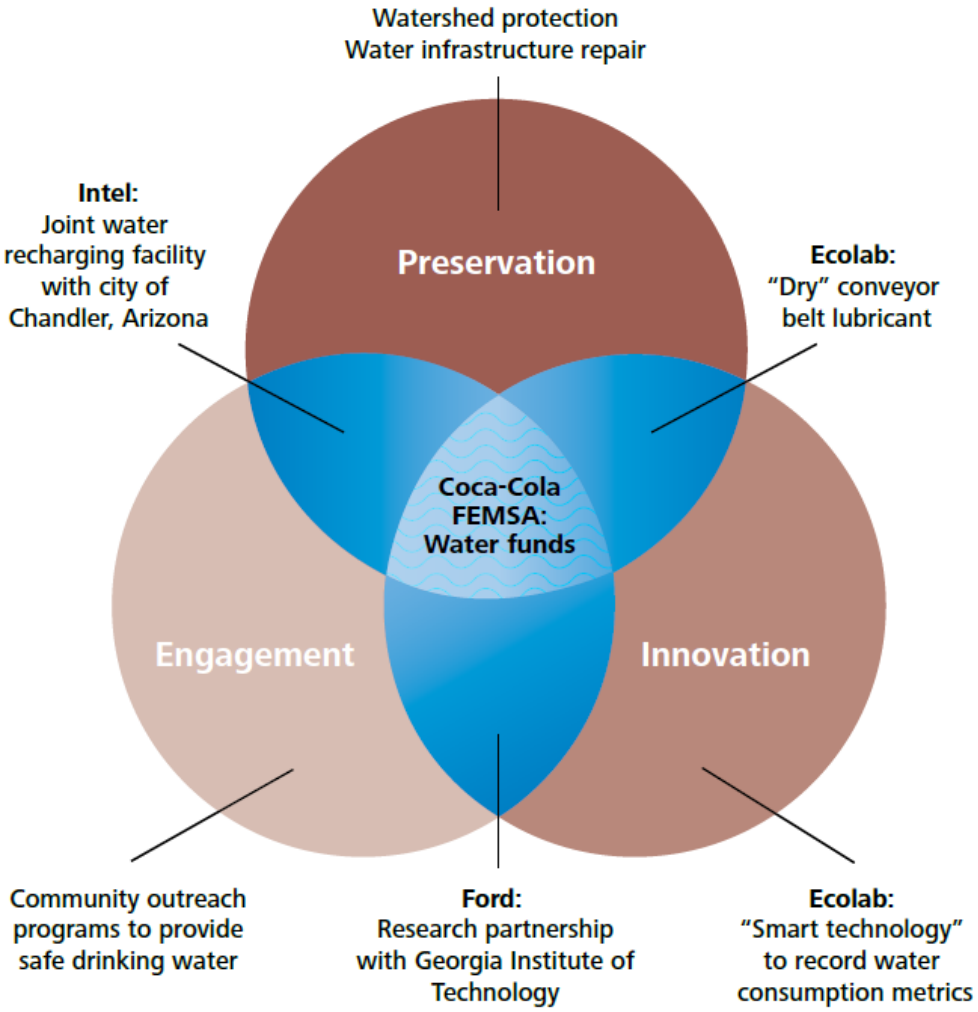
- **Lost revenue**
- **Higher costs from:**
  - Supply chain
  - Changes in production
  - Capital expenditure
  - Regulatory compliance
  - Increasing price of consuming or discharging water
- **Delayed or suppressed growth**
- **Potential higher cost of capital**

1 – "Watching Water," JP Morgan Chase Global Equity Research, April 2008.

WATER FOUNDRY

WATER STEWARDSHIP - HOW TO MITIGATE THESE RISKS?

- **Incorporate water risk** into 'traditional' corporate risk management processes
- **Quantify the "real" value** of water to the business
- **Understand the energy-water nexus** and its potential business implications, set targets across the value chain
- **Increase** focus on **engagement and innovation**
- **Look for opportunities** in the overlaps
- **Make a public commitment** to water stewardship
- **Practice "radical transparency"** about water and seek opportunities to collaborate – or clear the (internal) path for collaboration



Getting Ahead of the "Ripple Effect" A Framework for a Water Stewardship Strategy. W. Sarni, Deloitte University Press. 2013

WATER FOUNDRY

A LICENSE TO GROW STRATEGY

No strategy

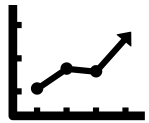
- Water scarcity not acknowledged as an issue
- All resources treated equally
- Cash flows heavily weighted
- Market price of water governs decisions

Efficiency strategy

- Water scarcity as a driver of cost
- Consider cost of acquisition and use of water
- Heavily weight profitability risk
- Focus on water conservation
- Set internal water efficiency goals

Risk Strategy

- Manage water scarcity risk at the facility or business-unit level
- Pursue stakeholder engagement to improve water access
- May calculate full cost of water
- May participate in public policy formulation
- Ad hoc investment in technology innovation
- "Social license-to-operate" risks heavily weighted



LICENSE-TO-GROW STRATEGY

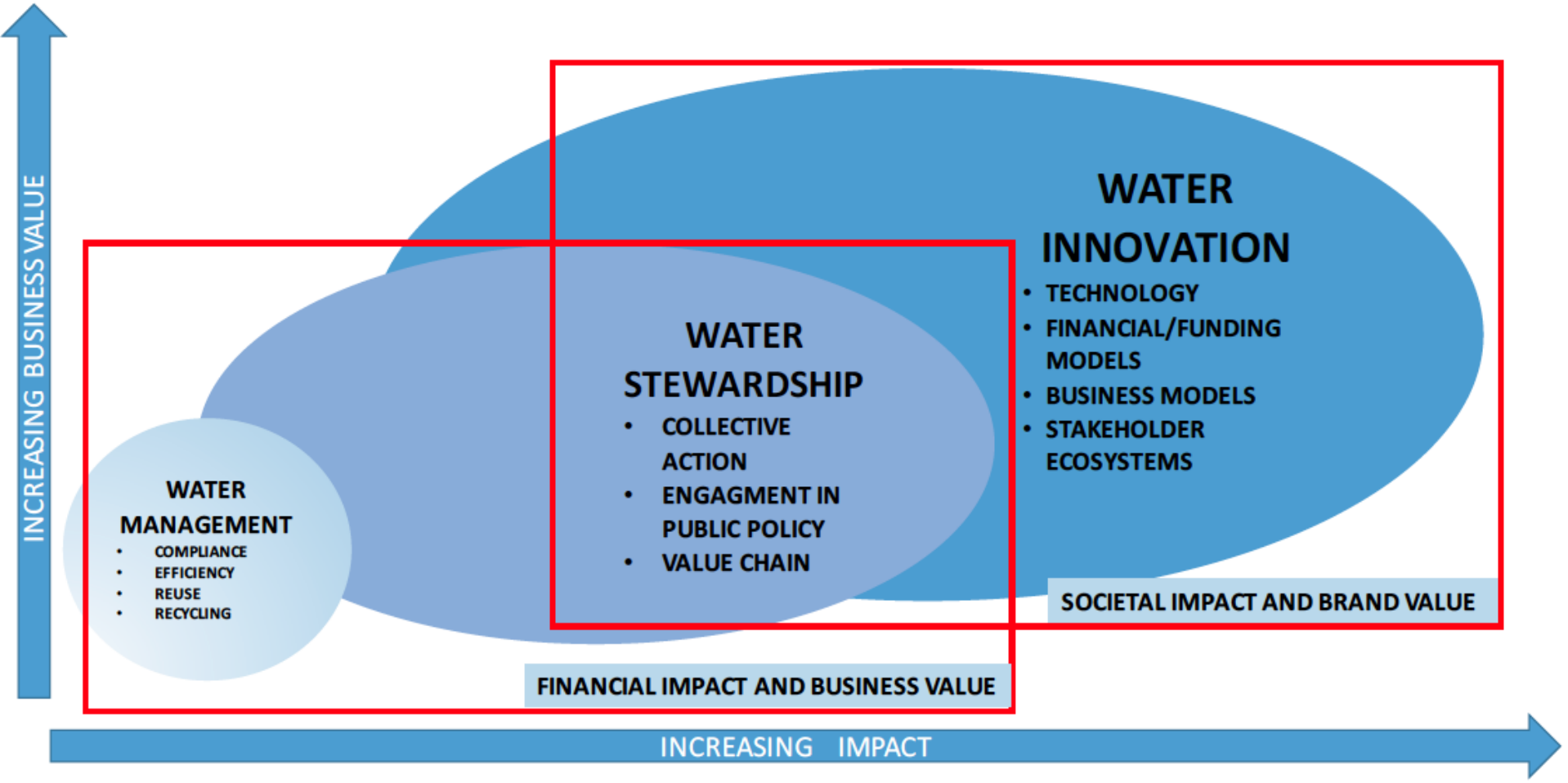
- **Quantify *value* of water**
- **Proactively drive business "ecosystems and "aligned action"**
- **Innovation - develop product/service offerings that address water scarcity**
- **Manage water scarcity as a platform for growth**
- **Participate in water-related policy development**

INCREASING VALUE AND COLLECTIVE ACTION

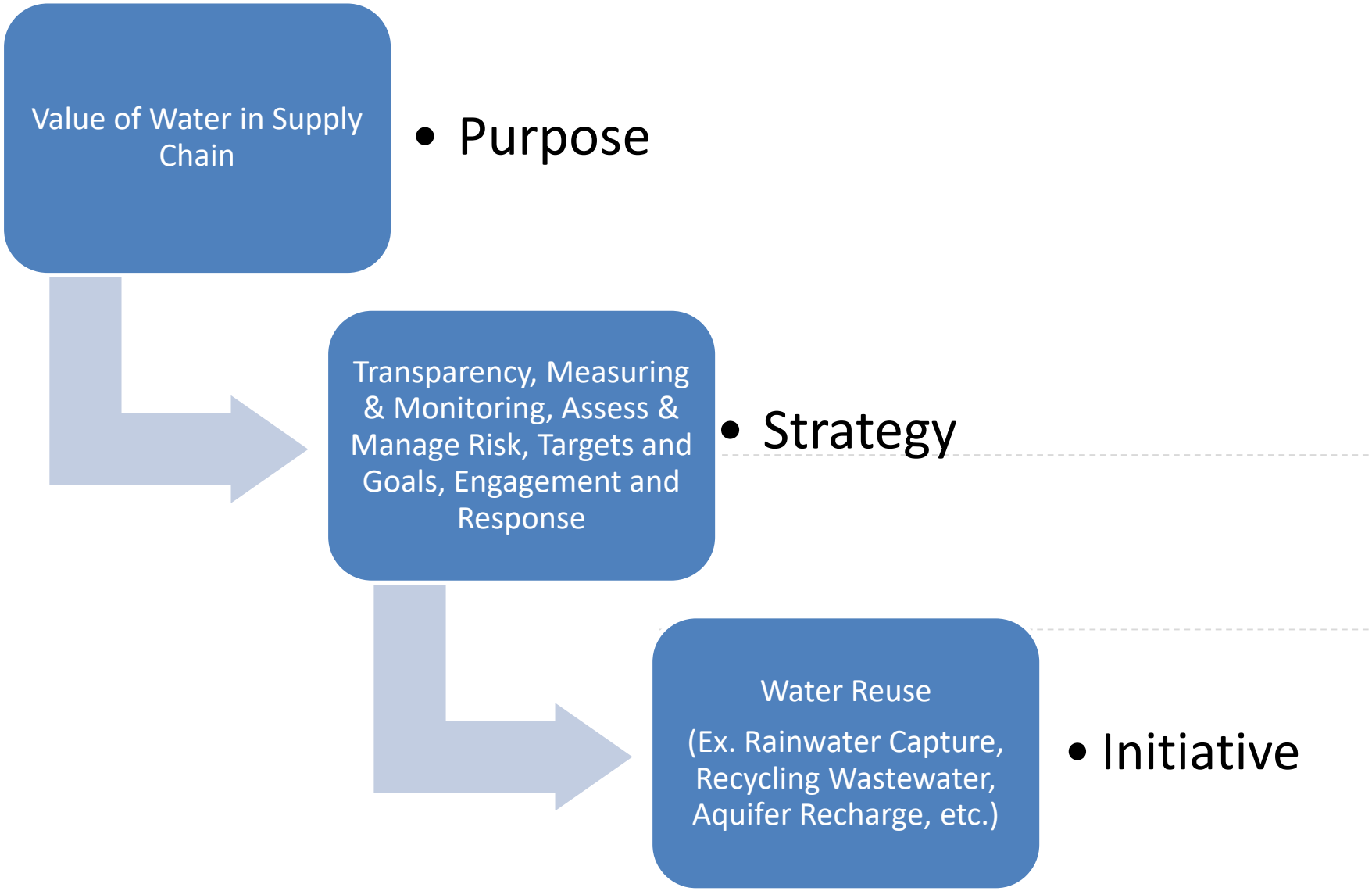
Fueling Growth: You Can't Always Buy What You Need. W. Sarni. Deloitte University Press. 2014.

WATER FOUNDRY

CREATING ABUNDANCE THROUGH INNOVATION



OVERVIEW OF WATER REUSE AS A COMPONENT OF WATER STEWARDSHIP



Respect for the Human Right to Water as a Company Value

- Tenants of Water Policy- Safety, Sufficiency, Transparency, Physical Availability, and Responsibility.

Reduce	Reuse	Innovate
• 57 Billion Gallons of Water Conserved Since 1998 • Ultra Pure Water Conservation • Water Efficient Facilities	• Treat and Return 80% of Water Withdrawal to Local Communities • Reuse of Greywater and Rainwater	• Solar Hot Water System in India, Costa Rica, and Israel • IoT Sensor Technology

Commitment to Advancing the Circular Economy

- Chemical Industry is Uniquely Positioned to Contribute to Water Stewardship
  1. "Reduce Water Scarcity With New Treatments
  2. Develop New Technologies to Improve Water Availability, Water Quality, Cost and Energy Efficiency
  3. Turn Wastewater Into A Valuable Resource Through Advanced Reclamation Process"

Ternuezen, Netherlands	Tarragona, Spain	Freeport, Texas
• Recycles 3.6 million m3/year of treated municipal wastewater • Reduced Energy Associated with Treatment by 95% • Reduced Carbon Dioxide Emissions by 60,000 Tonnes Annually	• Recycles 6.9 million m3/year of treated municipal wastewater • 40% of Water Needs From One Facility • 2016 Environmental Leader's Project of the Year	• Recycled Water Expected to Save 20 Million m3/Year • 10% Water Reduction • Production of Ethylene and Polyethylene at Lower Cost

CASE STUDY – Toyota Corporation

CDP Water Report A List Company

- Leader in Water Management, Water Risk Reduction and Information Disclosure
- Target: Effective Wastewater Management and Reduced Consumption Specific to Local Needs.

Actions	Results	Examples
• Reduce Consumption in Existing Practice • Introduce Technology that Reduces Industrial Water Consumption Through Rainwater Use and Improving Recycling Methods	• 5.1% Reduction in Total Water Consumption • 4.2% Reduction in Consumption per Unit • In North America Facilities, Reduction in 99.8 Million Gallons	• Motomachi Plant, Japan-Utilizing Wastewater to Create a Variety of Waterfront Environments • Mississippi Plant, USA-Harvesting Rainwater • Kentucky Plant, USA-Capturing Condensation

Thank You

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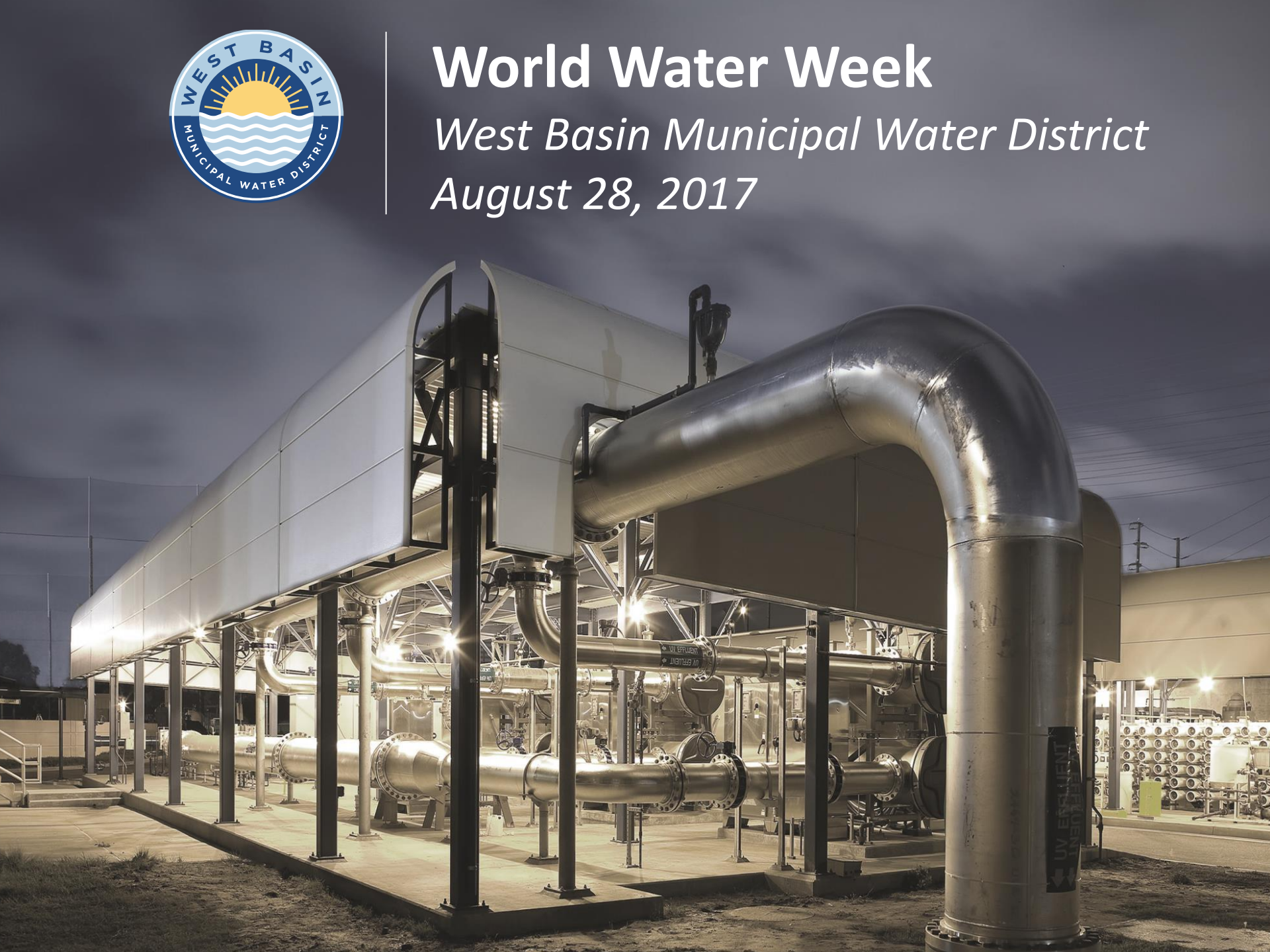
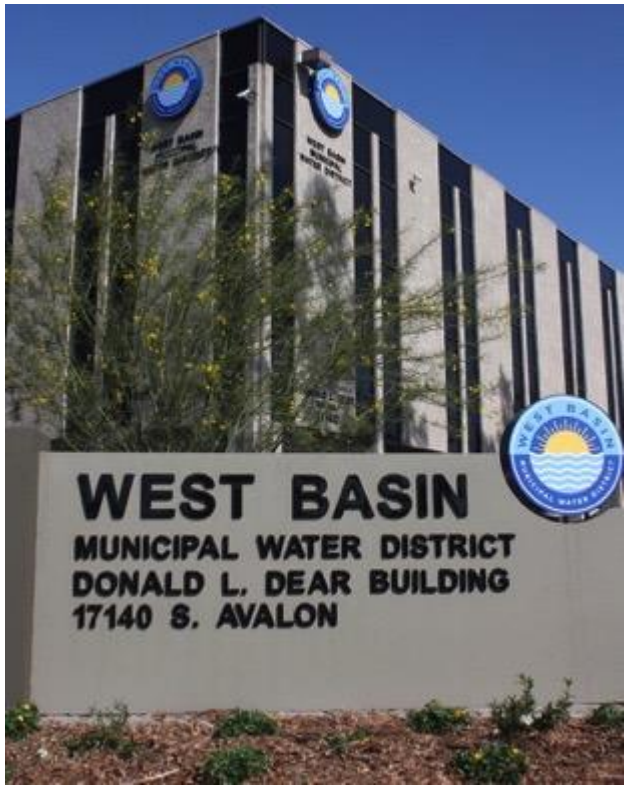
World Water Week

West Basin Municipal Water District

August 28, 2017



WEST BASIN MUNICIPAL WATER DISTRICT

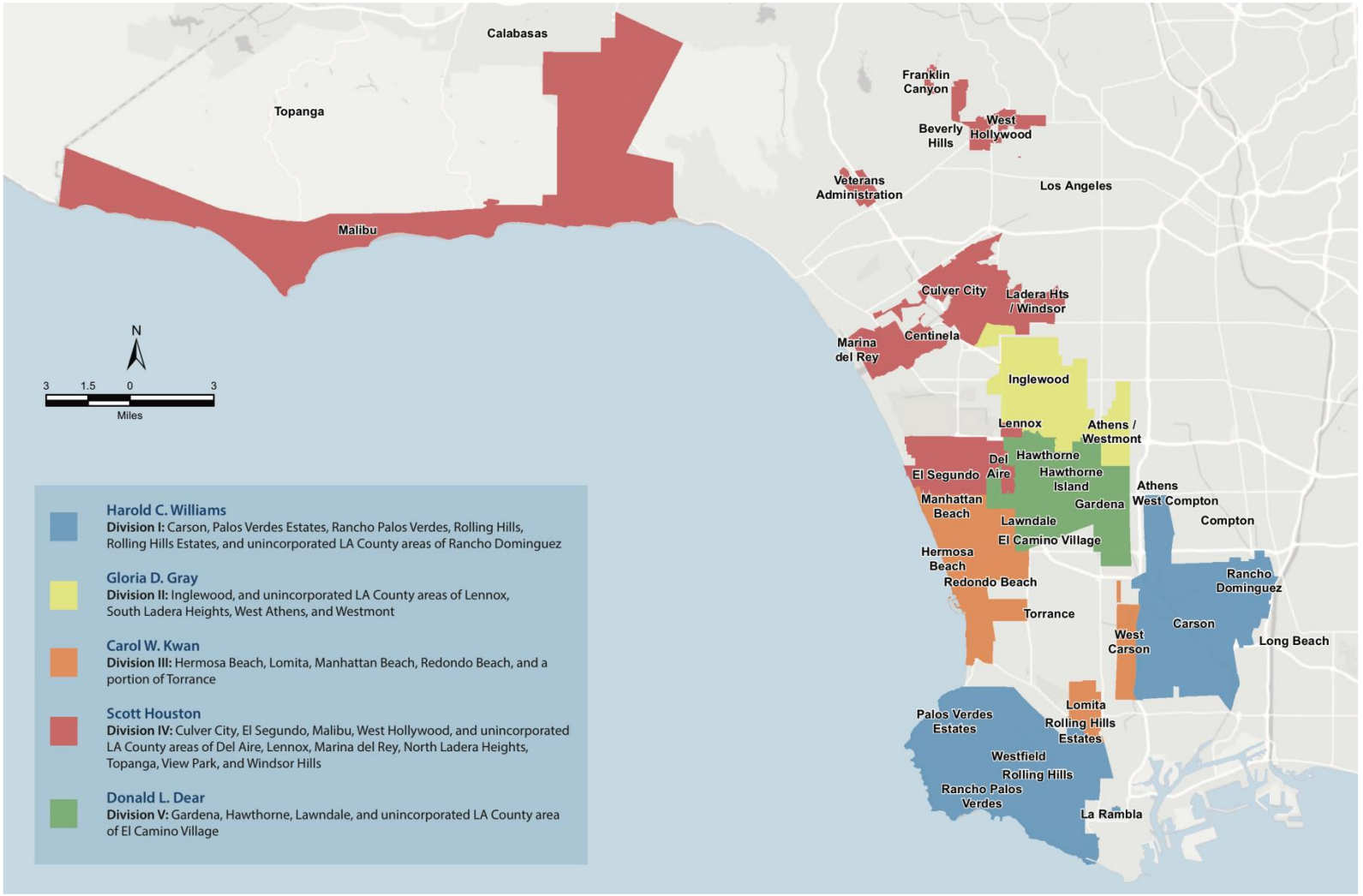


Celebrating 70 Years!

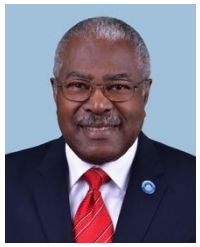
1947-2017

- Public wholesale water agency
- Member of Metropolitan Water District of Southern California
- Provides imported drinking water to nearly 1 million people in 17 cities
- Industry leader in implementing effective water conservation programs, producing recycled water, exploring desalination and providing community education

West Basin Service Area



West Basin Board of Directors



Division I
Harold C. Williams
President

Division II
Gloria D. Gray
Secretary

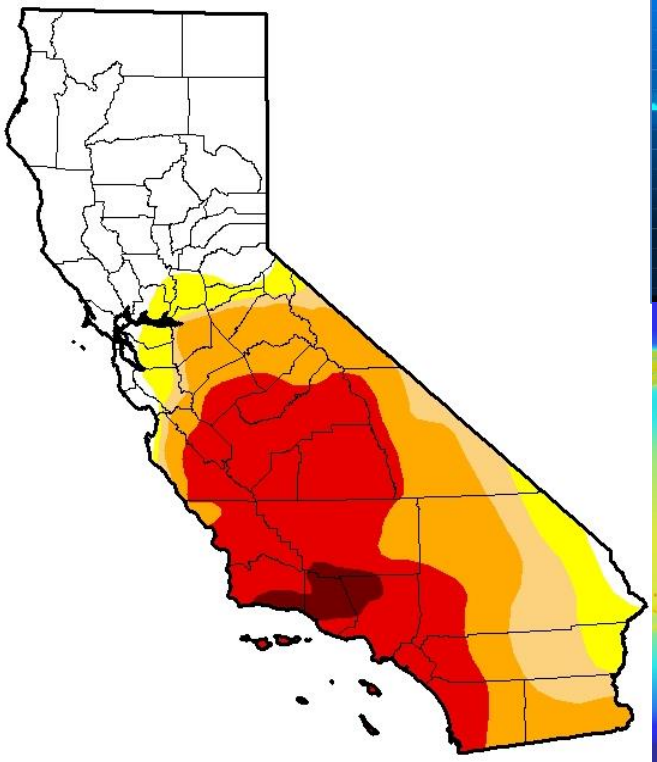
Division III
Carol W. Kwan
Member

Division IV
Scott Houston
Vice President

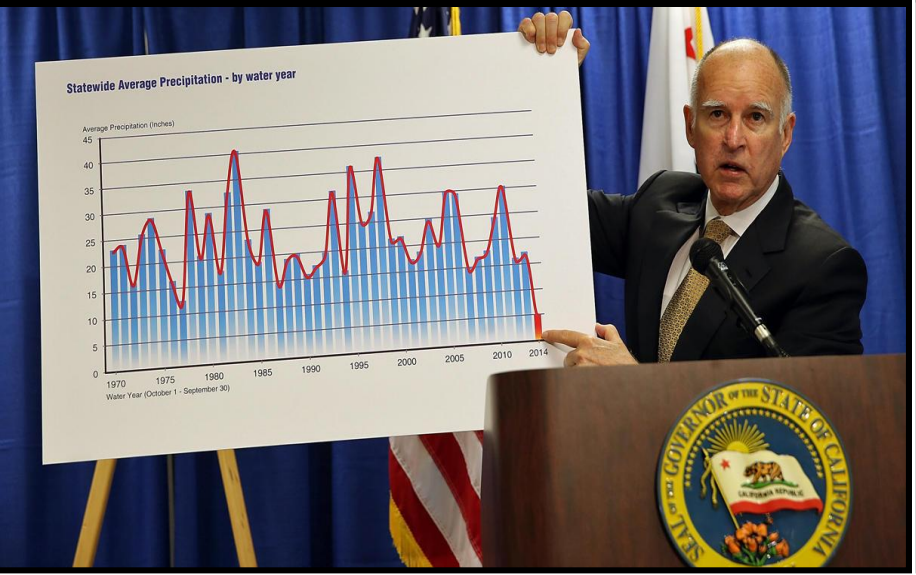
Division V
Donald L. Dear
Treasurer

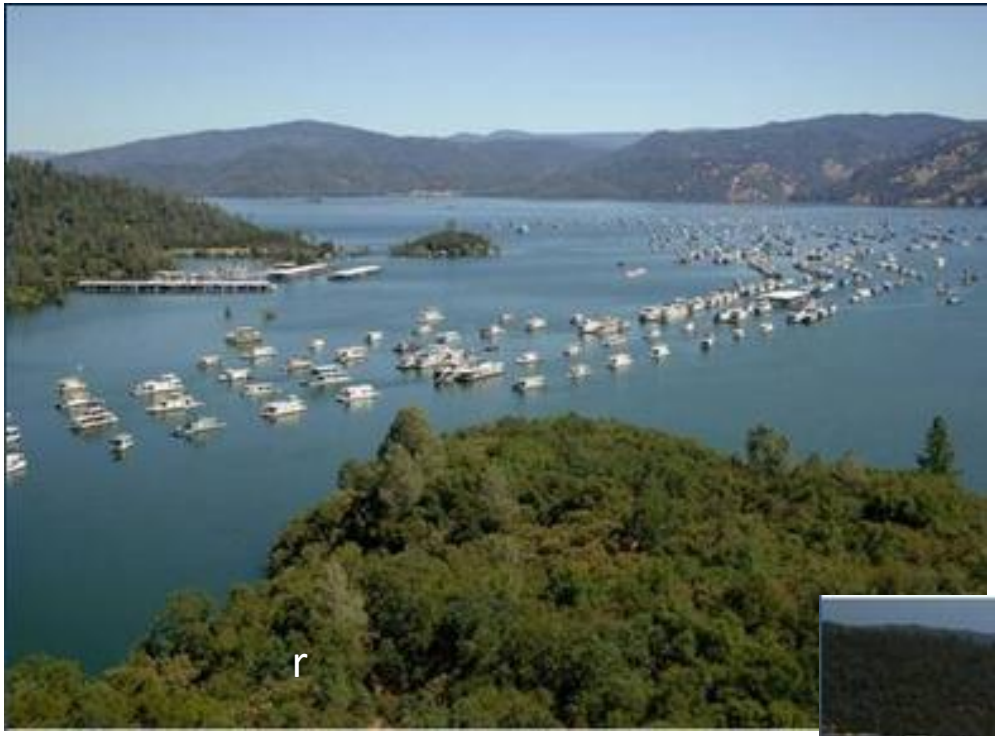
Celebrating 70 Years!
1947-2017

Challenges to a Reliable Water Future



California's Historic Drought





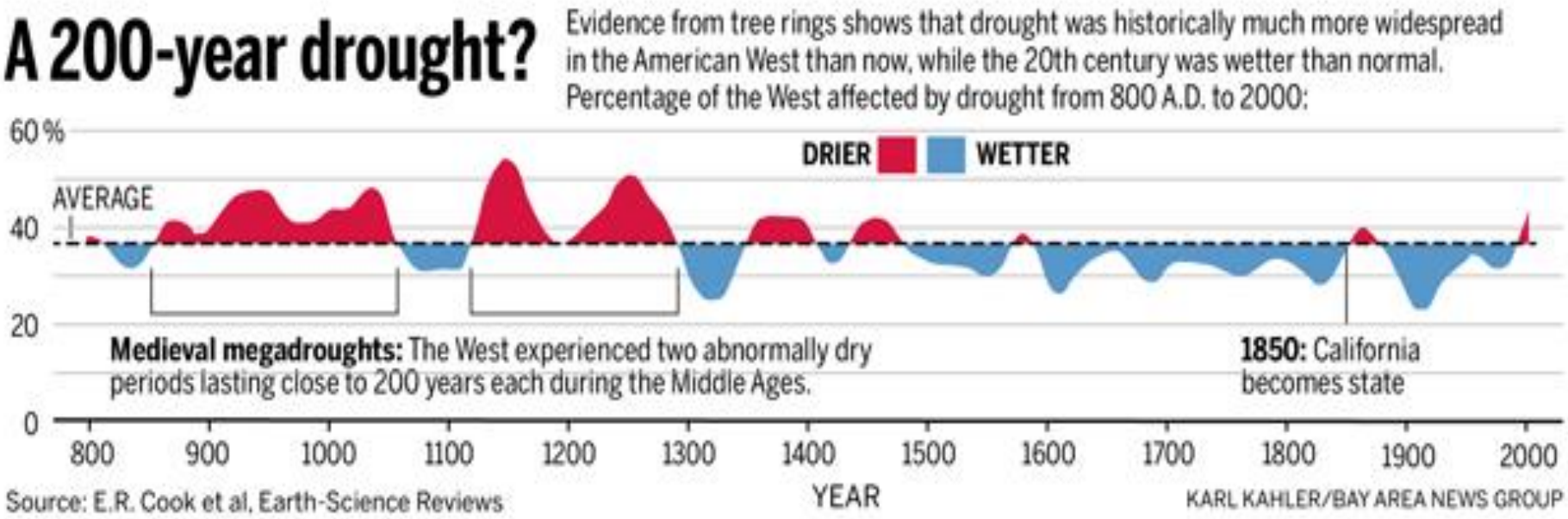
Lake Oroville - 2010

Lake Oroville - 2014

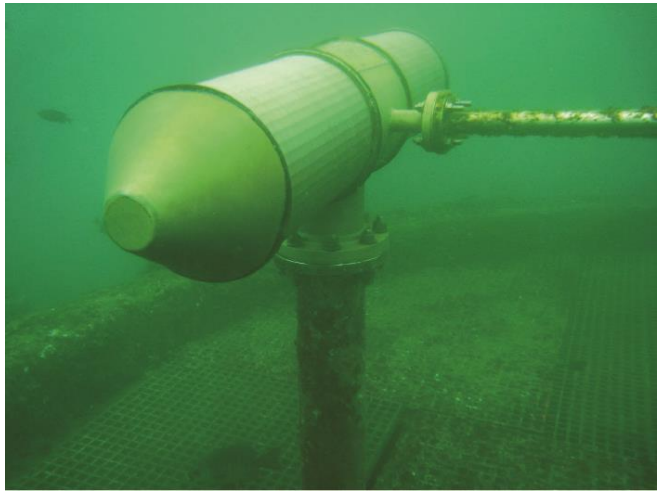
Where Does Our Water Come From?

60%
Water Supply
For 19 Million

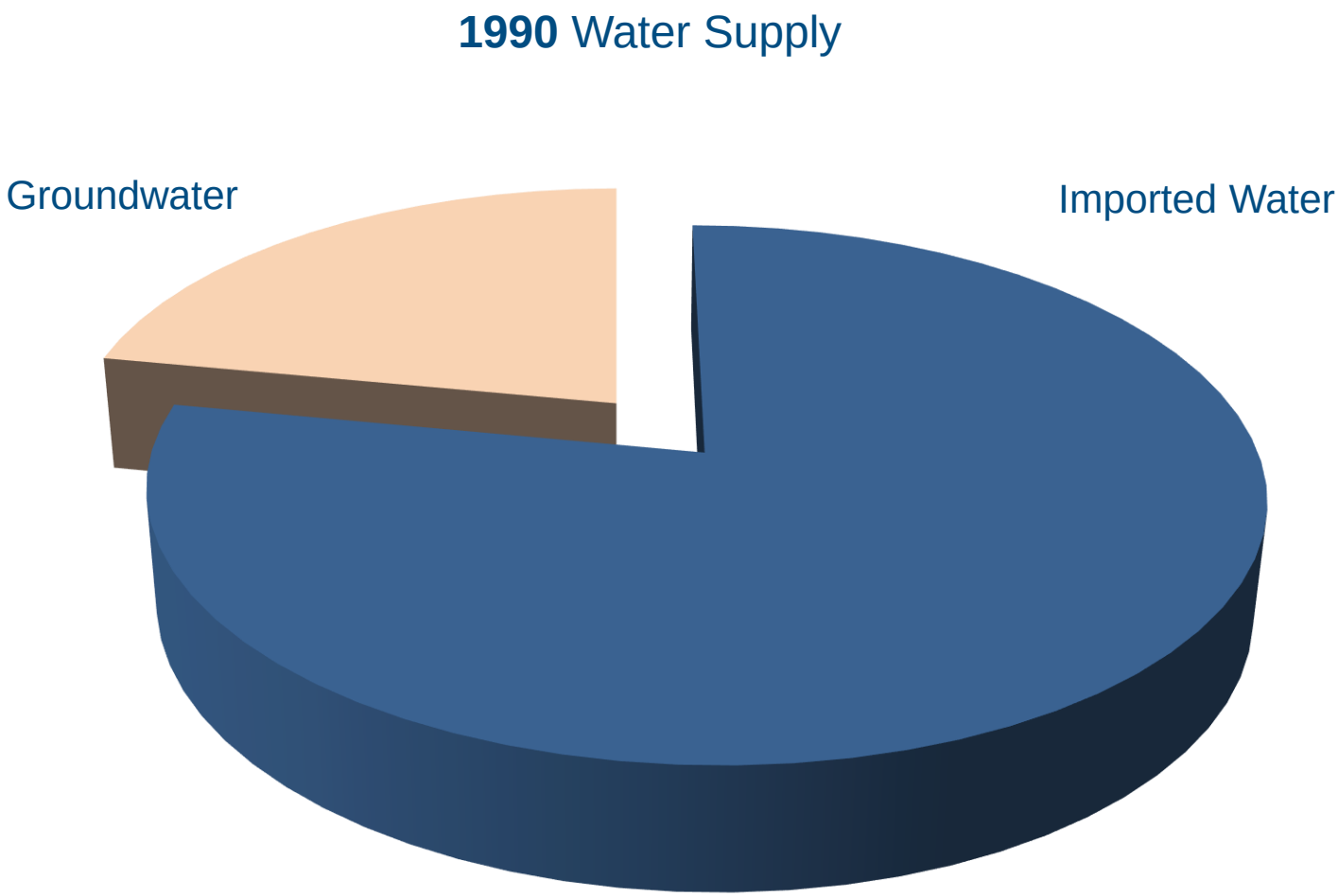
Food for Thought: Are these the first 4 years of a mega-drought?



Balanced Approach to Reliability



Water Reliability Through Supply Diversification



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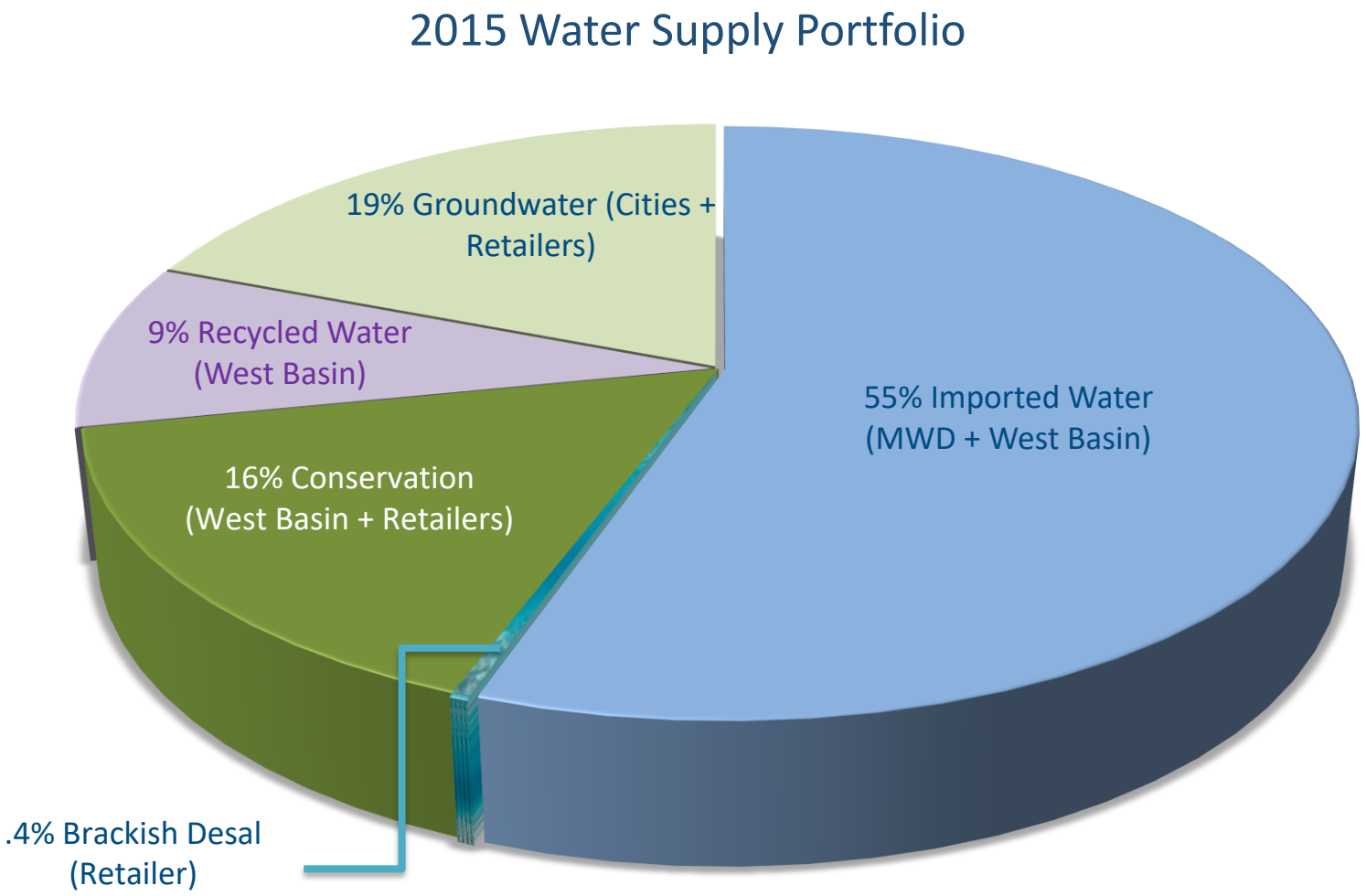


Percentages rounded and based on 2015 Urban Water Management Plan data

Water Recycling

Edward C. Little Water Recycling Facility
El Segundo, Calif.

- More than **175 billion gallons** of water produced
- Over **13,000** visitors annually
- **Five** “designer” waters

“Fit for Purpose” Recycled Water

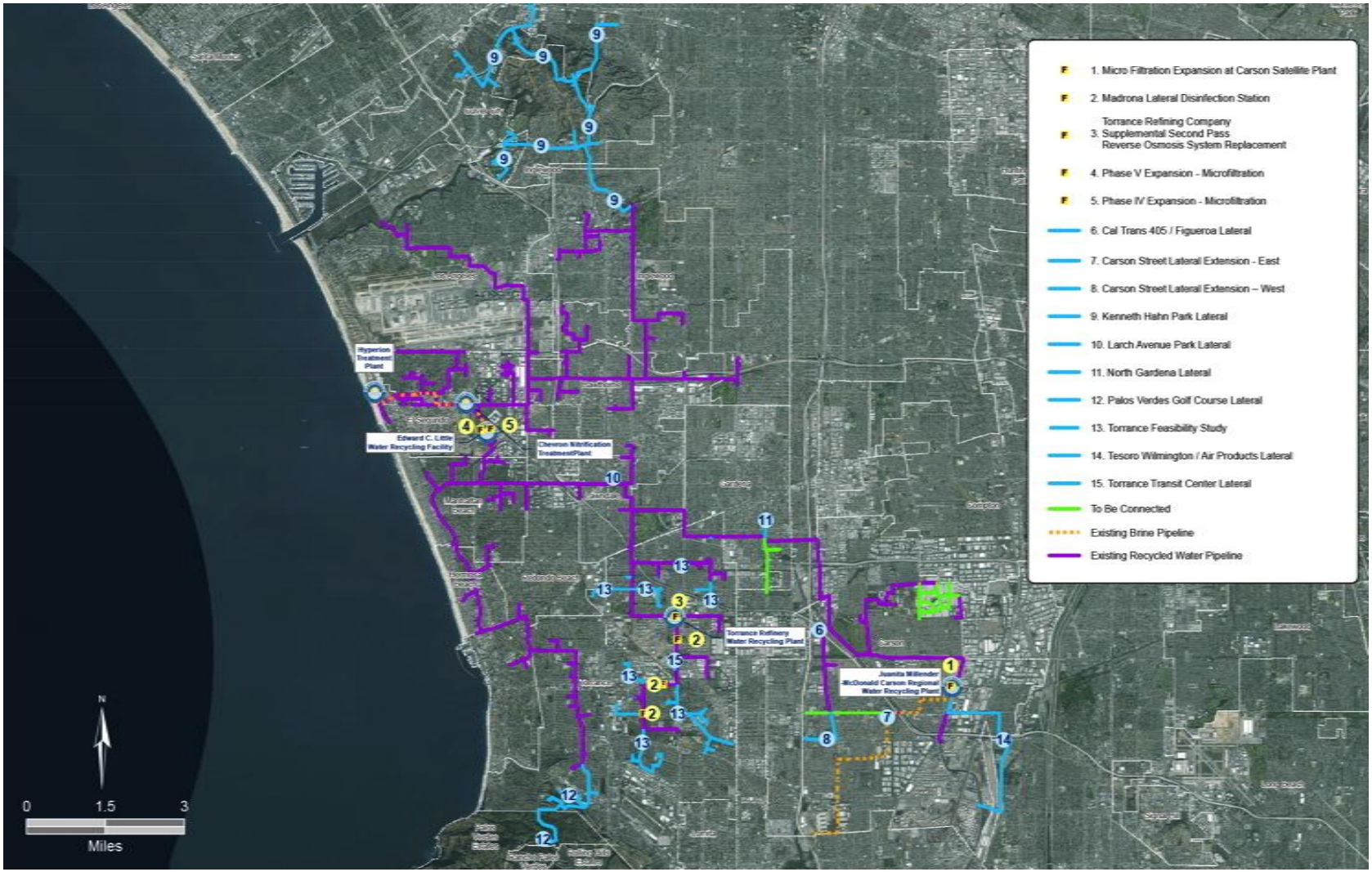
Disinfected Tertiary for Irrigation

Nitrified for Cooling Towers

RO for Industrial Boilers (1x and 2x)

RO/UV for GW Replenishment

Recycled Water Distribution System

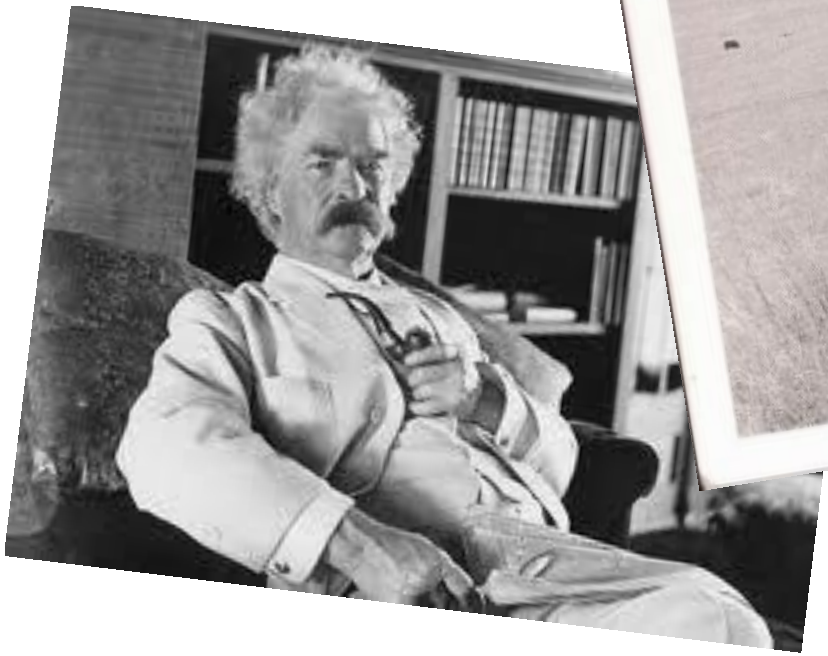


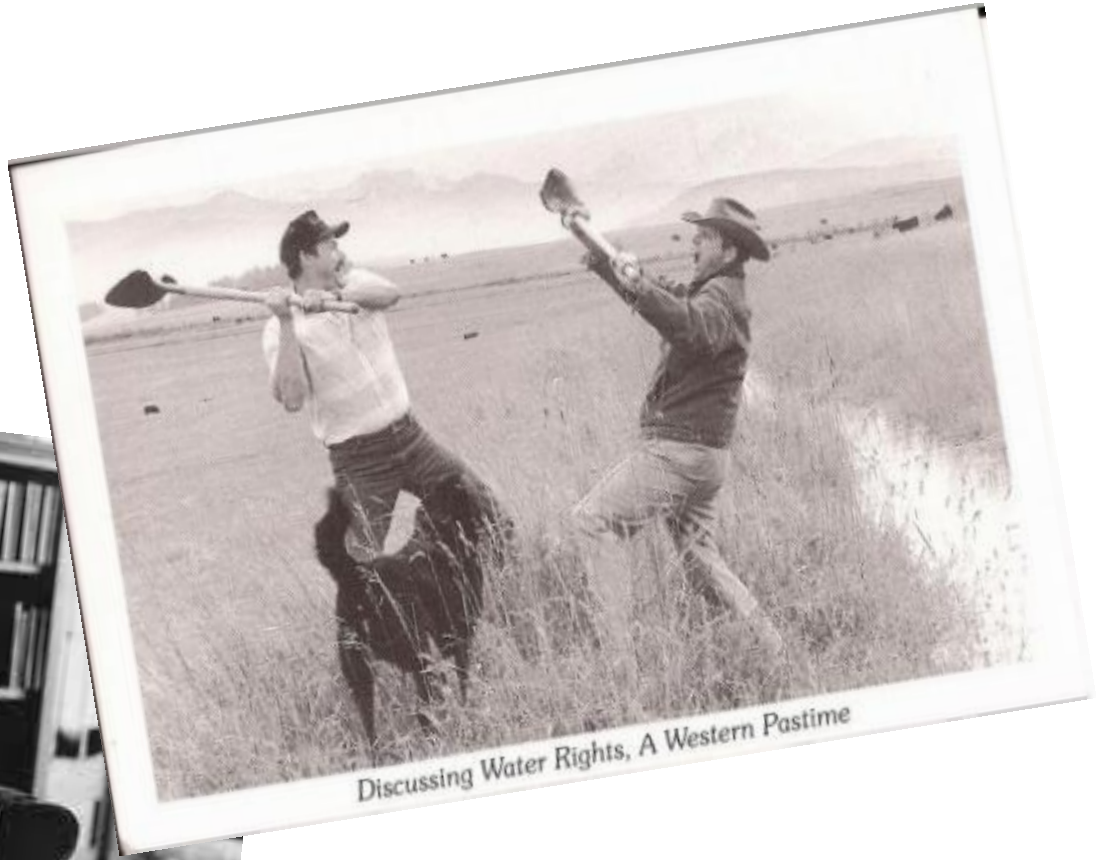
5 Designer Recycled Waters

Piloting New Technologies

$13 million Pilot Membrane Bioreactor (MBR) Treatment at Hyperion WRP

Exploring New Drought-Proof Sources





Discussing Water Rights, A Western Pastime

"Whiskey is for Drinking, Water is for Fighting!"

Scott Houston
Vice President, Board of Directors
West Basin MWD
info@scotthouston.org

www.westbasin.org
www.scotthouston.org

Facebook.com/Scott.Houston.Calif
Twitter: @ScottHoustonCA

Thank you!

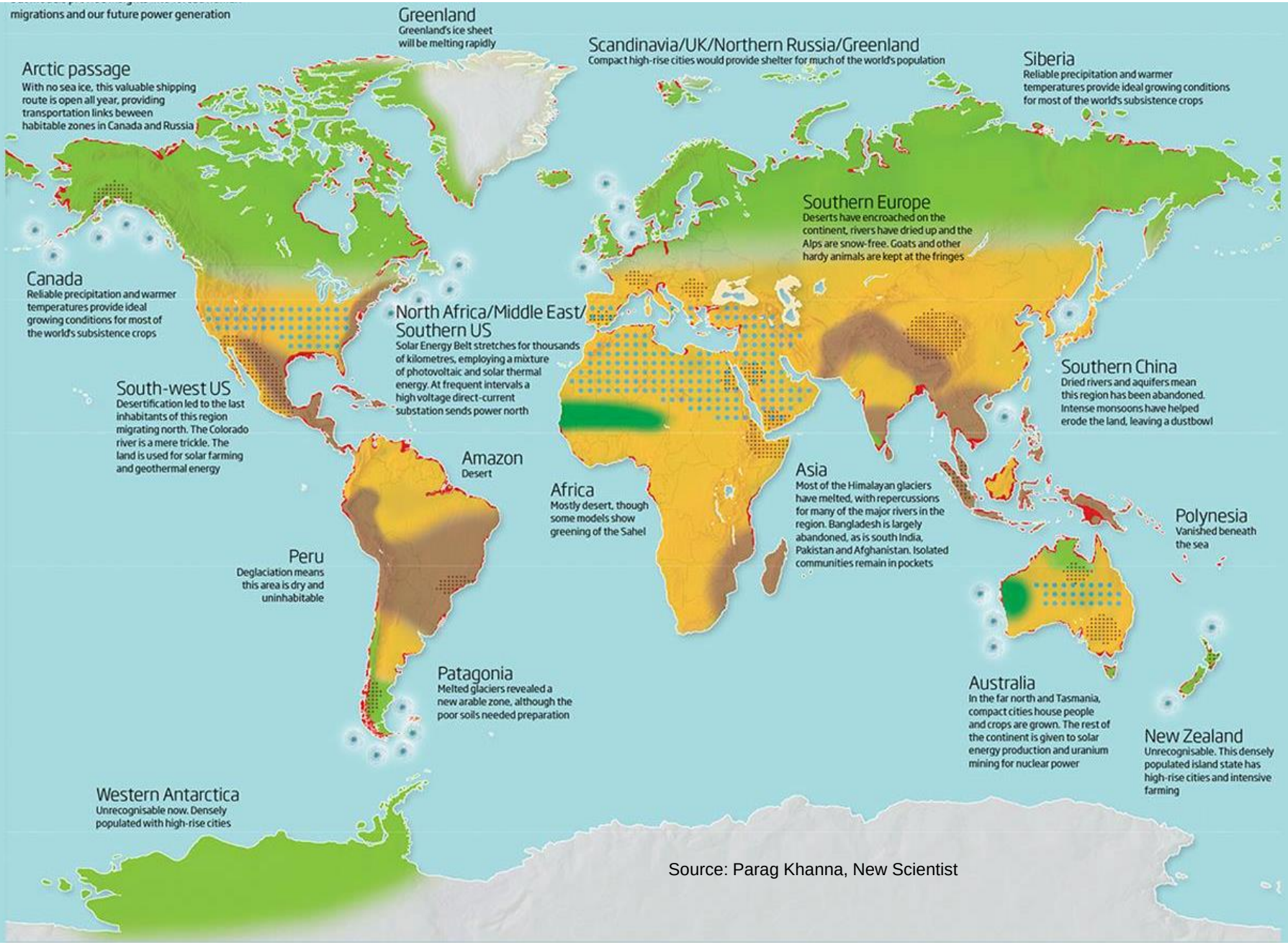
Accelerating adoption of water reuse

Presentation at Stockholm World Water Week

Albert Cho, Vice President, Strategy and Business Development

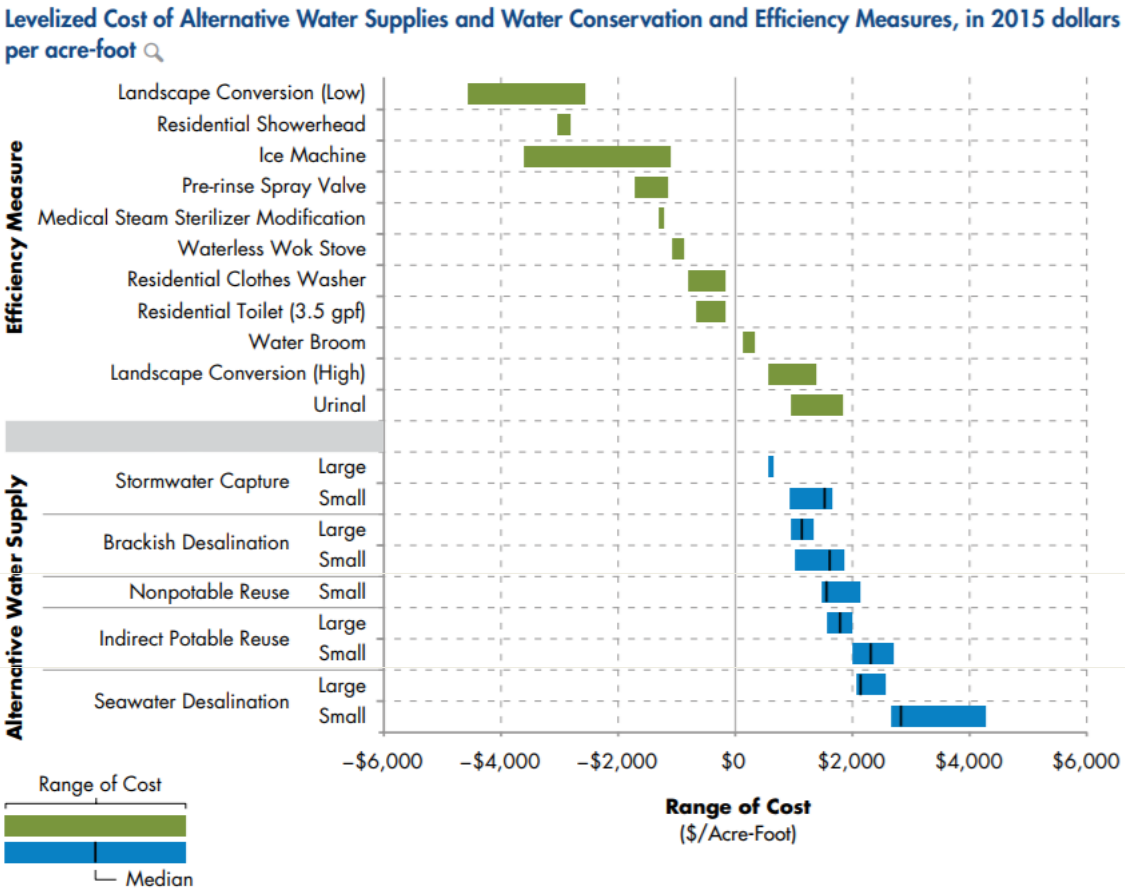
August 28, 2017

v1



Source: Parag Khanna, New Scientist

Comparative economics of water supply

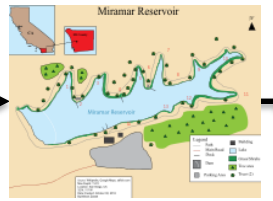


Source: Pacific Institute

Common Processes for Wastewater Reuse

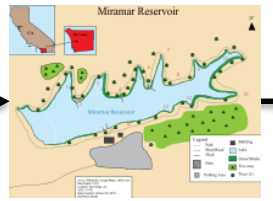






	Secondary/Tertiary Treatment	Membrane Filtration	Reverse Osmosis	AOP	Environmental Buffer
Influent Quality	"Dirty" – lots of solids, organic matter	"Lake Water" – clean, but lots of floaty stuff	"Clear water" – minimal foulants	"Tap Water" – looks like drinking water	"Distilled Water" –pure water
Why Step is Required	• Remove pollutants • Reduce organics levels in water • Settle out solids	• Physical barrier • Removes small particles/organics still in water • Removes some pathogens	• Second physical barrier • Removes more ions, pathogens	• Destruction of some Constituents of Emerging Concern (CECs) • Disinfects pathogens/viruses	• Allows integration into existing water supply • Increases public confidence
Key Technologies	• Clarifiers • Activated Sludge • SBR	• Microfiltration • Ultrafiltration • Ceramic Membranes	• Reverse Osmosis Membranes	• UV + H2O2 • UV + HOCl • Ozone + H2O2	• Aquifers • Lakes • Reservoirs

What Alternatives Exist to Make this more Efficient?



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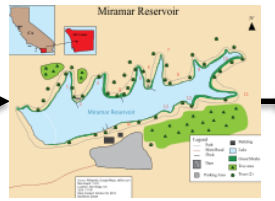
Emerging alternatives

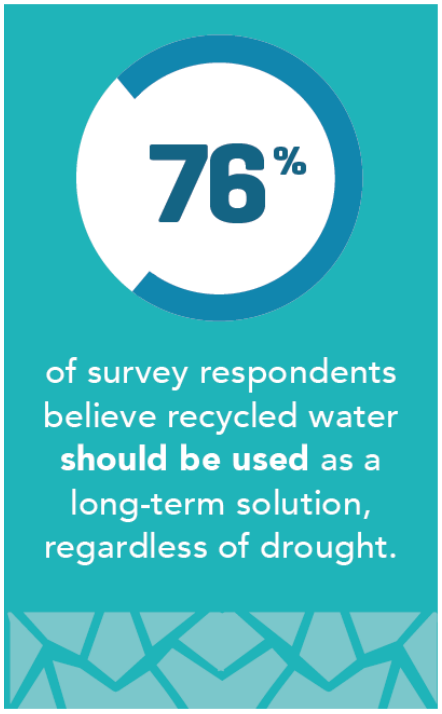


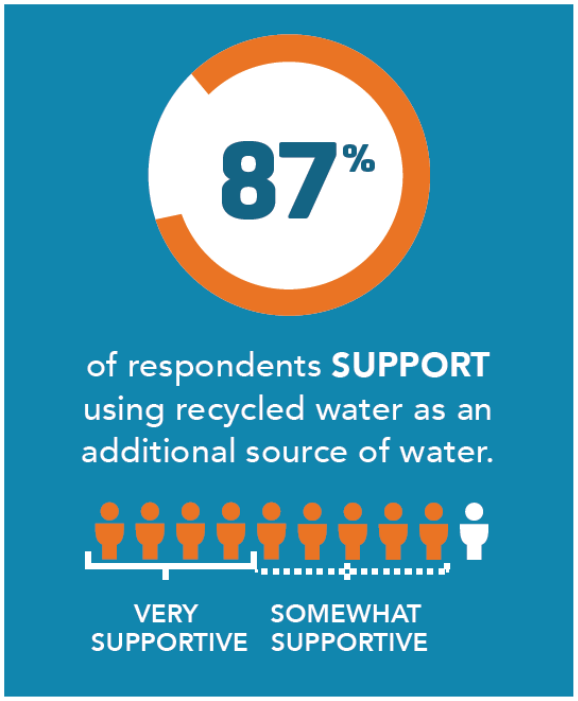


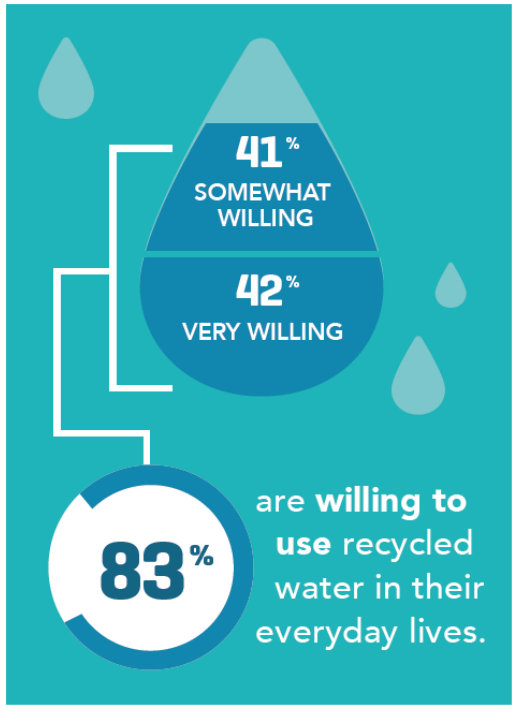


	Secondary/Tertiary Treatment	Ozone	Biologically Active Filtration	AOP	Environmental Buffer
Influent Quality		"Lake Water" – clean, but lots of floaty stuff	"Clean seawater" –low organic matter		
Why Step is Required		• Disinfection • Breakdown of organics • Make TOC biologically available	• CEC Reduction • TOC Removal • Filtration • Removes ions and pathogens		
Key Technologies		• Ozone Generator • Contactor for ozone reaction to take place	• Underdrain • Pressure Filter • Tanks		

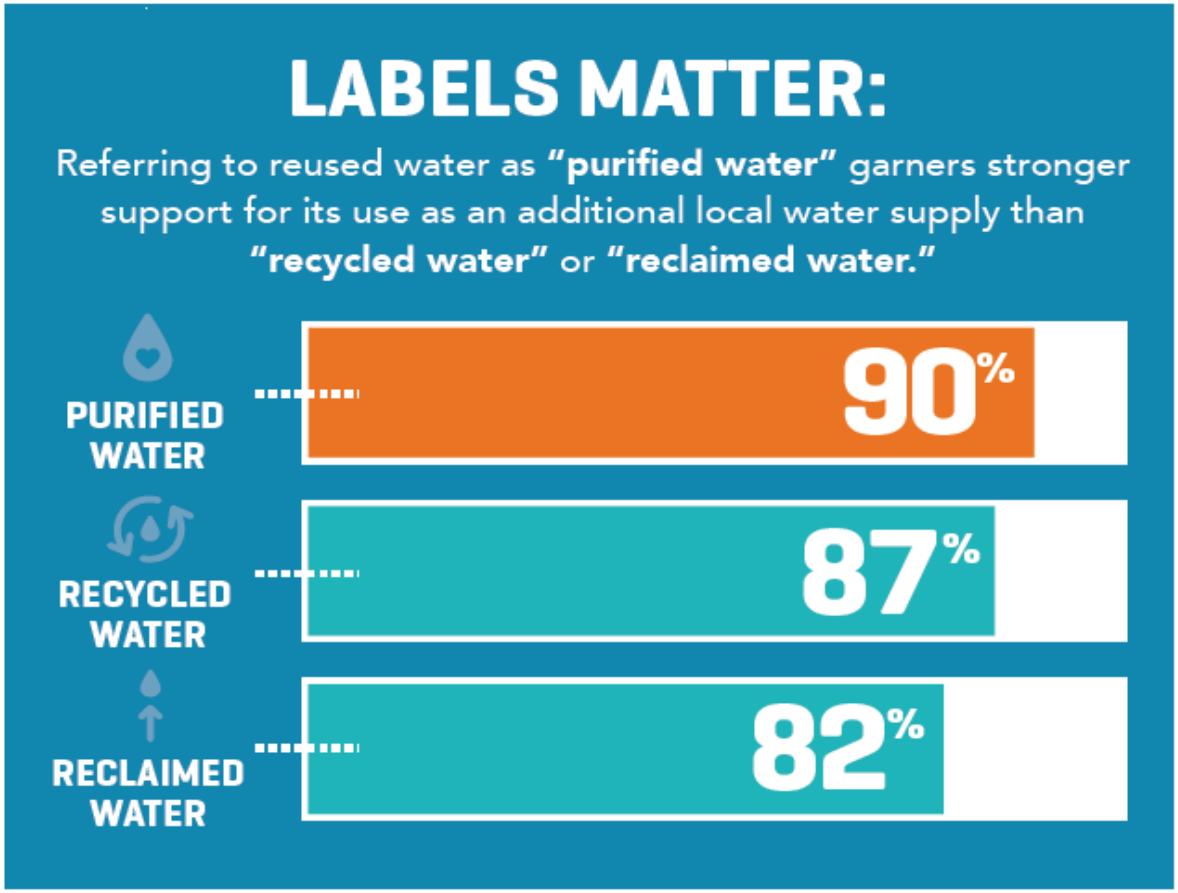
The public is open to new sources of water supply







But education and language are key



New technologies will build public confidence – you can help!


Thank you

We Must Overcome the Stigma of *Reused Water*

Nelson Switzer, Chief Sustainability Office, Nestle Waters North America
@nelsonswitzer
World Water Week
28 August 2017

Pressure


“Fresh” Water

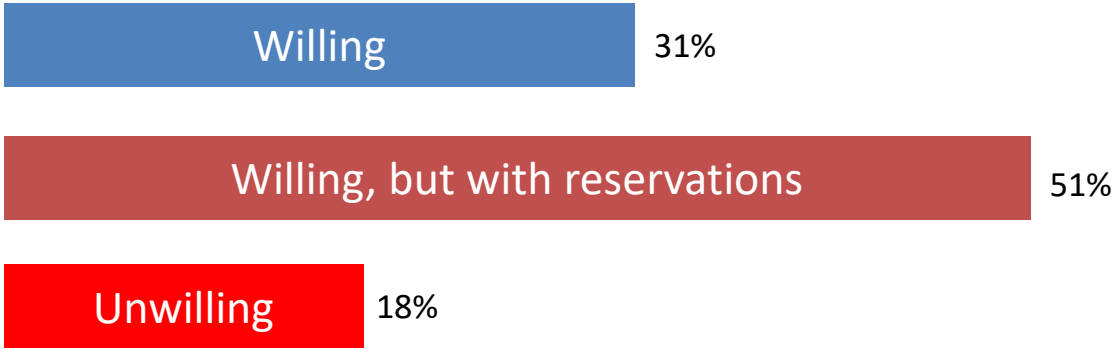

“Used” Water

There is a stigma associated with reused water.

But what is this stigma, and how can we overcome it to ensure the world's growing population can access the abundant supply of clean, safe water needed to survive and prosper?


Dirty
Unsafe
Harmful

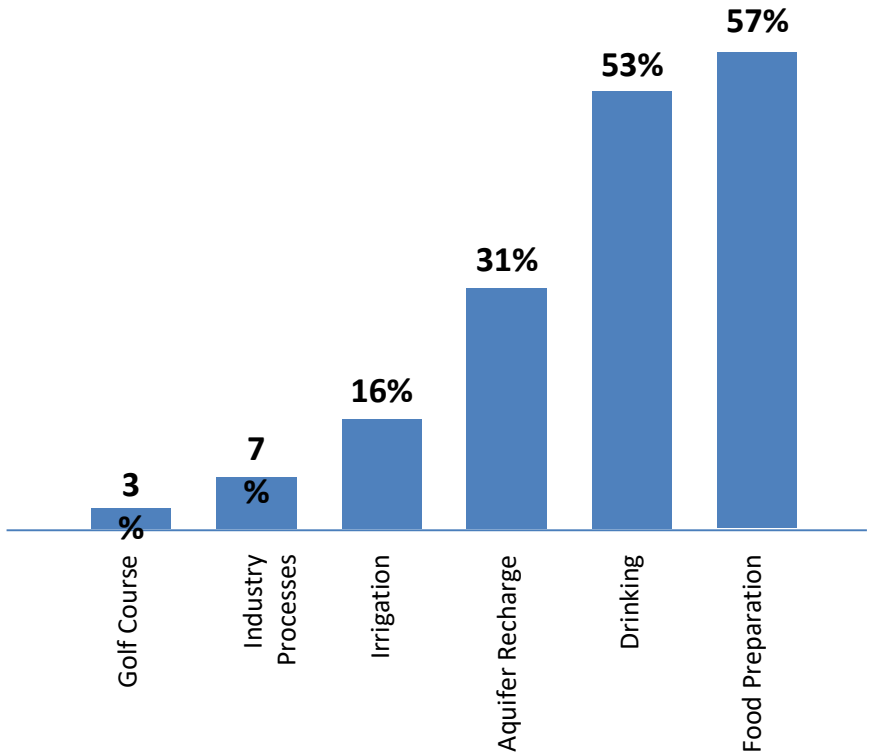
Perception: *reused water is dirty*



Source: *Acceptance of Water Recycling in Australia, National Baseline Data*. J S Marks, B Martin, M Zadorozny (2006)

Perception: *reused water is dirty*

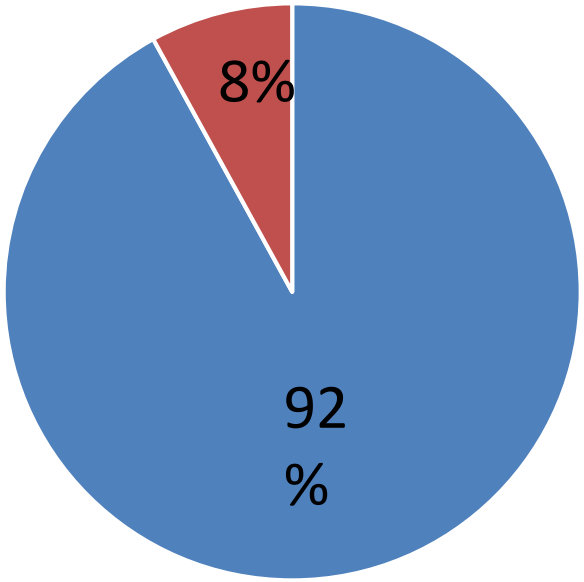
The closer reclaimed water is to **immediate consumption**, the deeper the ***reservation to use it***



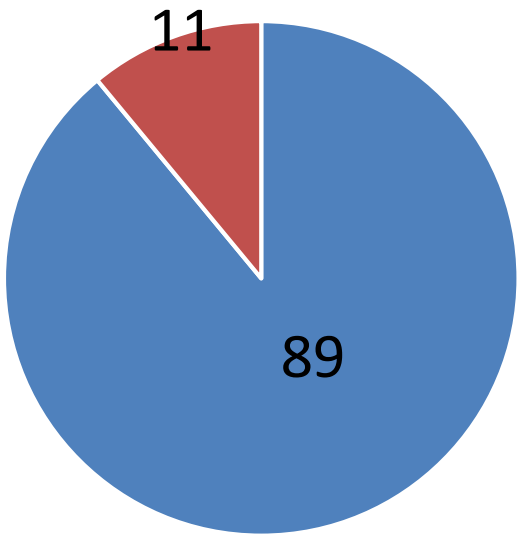
Source: *Recycled water for consumer markets — a marketing research review and agenda*. S. Dolničar and C. Saunders. (2006)

Perception: *reused water is unsafe*

"People will worry about the safety of recycled water for their children."



"I have no objection to water recycling as long as safety is guaranteed."



Source: *Sydney Water Study* (1999)

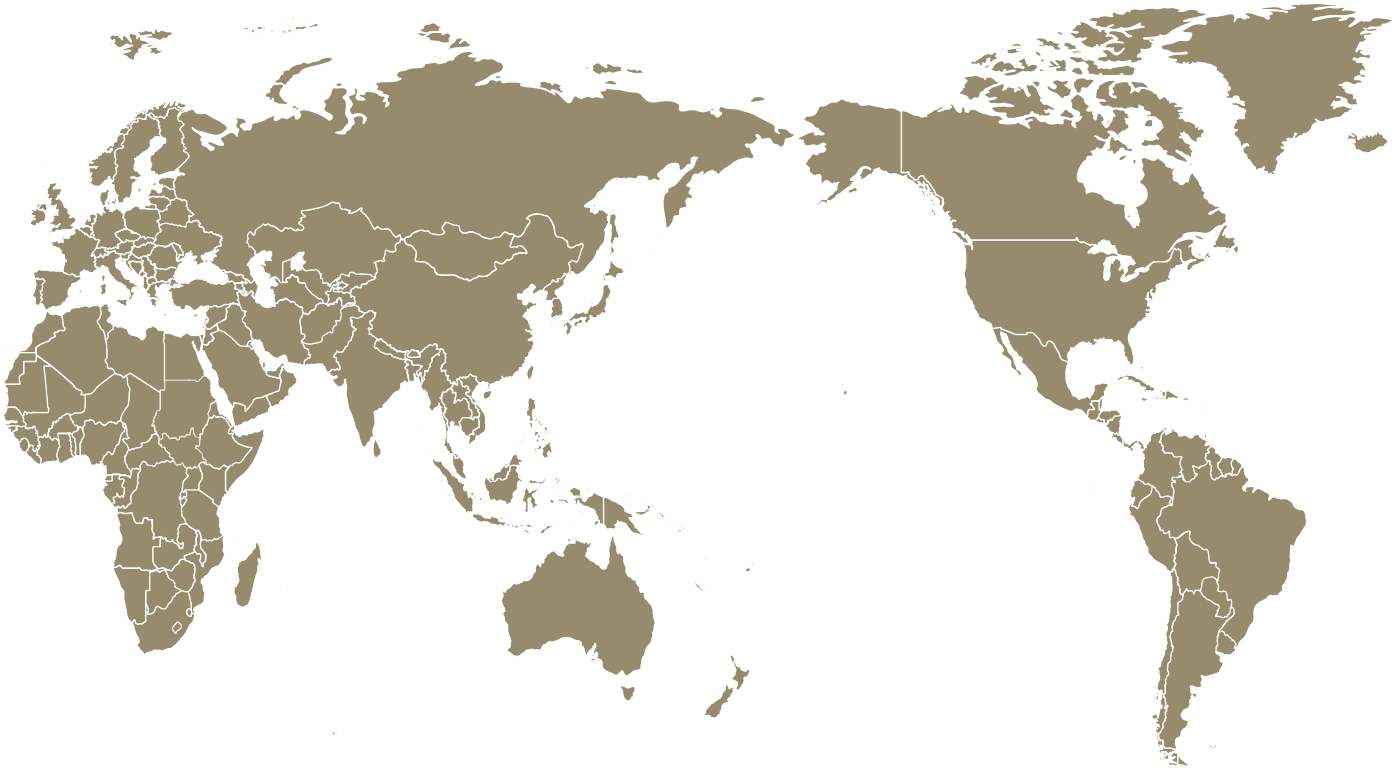
Perception: *reused water is harmful*

	City Water	Reclaim Water
pH	9.3	7.3
Conductivity (µmhos)	330	900
Alkalinity (as $CaCO_{3)}$, ppm	56	60-90
Total Hardness (as CaCO3)*,ppm	98	100-250
Calcium (as CaCO3), ppm	29	100-135
Magnesium (as CaCO3), ppm	69	100-140
Ortho phosphate (as PO4)*, ppm	1.5	5-15
Silica (as SiO2), ppm	6	9.5
Chloride (as Cl)*, ppm	48	110-150
Sulfate (as SO4)*, ppm	31	120-170
TOC (ppm as C)*, ppm	2.5	5-50

Figure 3: City Water vs. Reclaim Water Quality

Source: http://www.uswaterservices.com/resource-library/case-studies/details?ltemplate=details&lcommtypeid=17&item_id=32

Reused: *what is being reused?*



Millions of m^3 of reused water per day

China	14.82
Mexico	14.40
United States	7.60
Chile	0.84
Spain	0.62
Singapore	0.53
Japan	0.50
Australia	0.46
Israel	0.40
Saudi Arabia	0.20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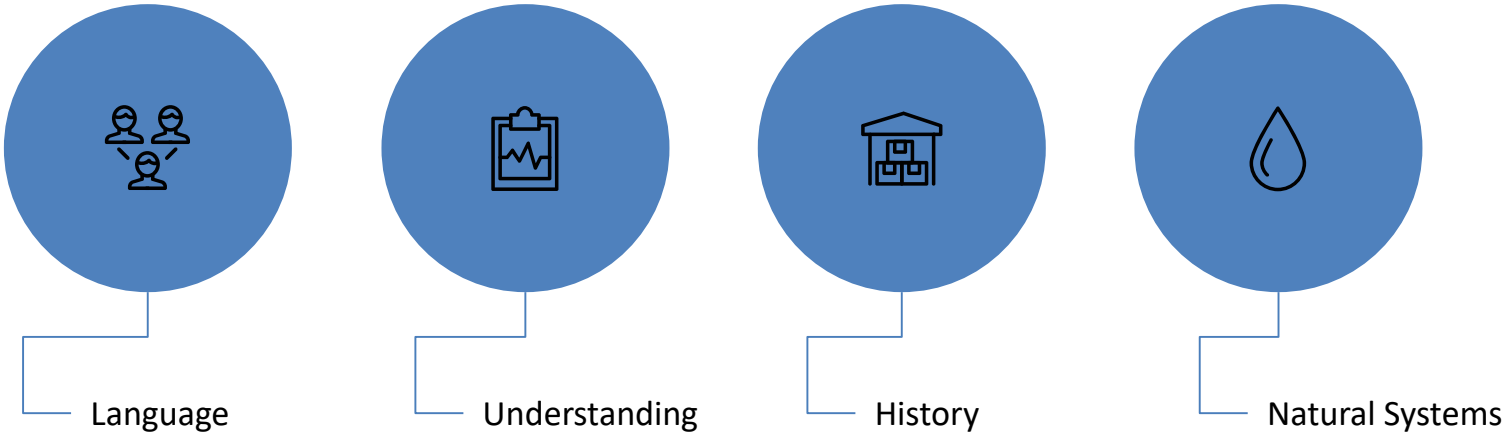
Innovation: *California*

Stigma killing: *keys to success*



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