



EMBRACING REGULATORY CHANGES TO MEET WATER-RELATED CHALLENGES

RECLAMATION AND REUSE STRATEGIES

Bob Salvatelli

Director of Sales, Sustainable Water



THE WATER APOCALYPSE

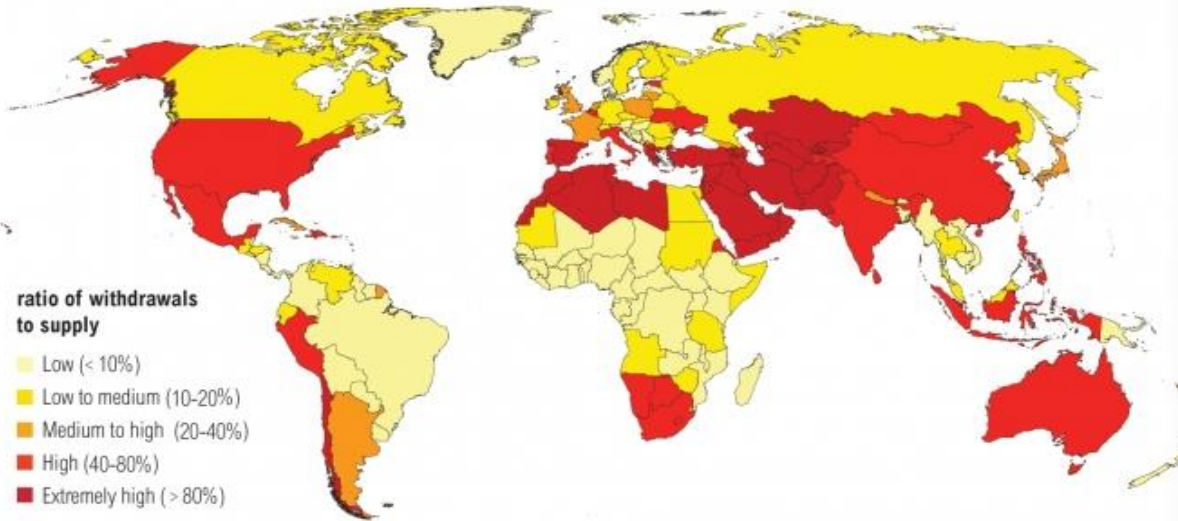


Together These Factors Will Completely Change Water Management



WATER SCARCITY THREATENS OUR NATION

Water Stress by Country: 2040



NOTE: Projections are based on a business-as-usual scenario using SSP2 and RCP8.5.

For more: ow.ly/RiWop

 WORLD RESOURCES INSTITUTE

“The United States is on the verge of a national crisis...the situation has grown so dire the US Office of the Director of National Intelligence now ranks water scarcity as a major threat to national security alongside *terrorism*.”





- The Hill, April 2016

SUSTAINABLE BUSINESS OREGON

Drought should be an ever-present concern, even in wet years

The state needs a comprehensive plan for drought periods to prevent issues during drought years, say guest columnists from the University of Arizona and the Oregon Environmental Council.

Apr 28, 2016, 9:56am PDT
INDUSTRIES & TRADE Insurance, Weather

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Robert Glennon and Samantha Murray

As ancient Roman adage cautions, "In times of peace, prepare for war." The idea is that peacetime provides the breathing room to conceive, plan and execute a military strategy.

Because once war has arrived, it's too late.

BUSINESS PHASE

Are you more likely to buy products from B Corporations?

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3 questions with the Columbia Riverkeeper Brett Vanderveer

Oregon could be head to water shortages, despite record rain (Video)

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Clean water crisis threatens US

French Chateau Estate

By Sarah Ferris and Peter Sullivan - 04/26/16 08:00 AM EDT

The United States is on the verge of a national crisis that could mean the end of clean, cheap water.

Hundreds of cities and towns are at risk of sudden and severe shortages, either because available water is not safe to drink or because there simply isn't enough of it.

The situation has grown so dire the U.S. Office of the Director of National Intelligence now ranks water scarcity as a major threat to national security alongside terrorism.

The problem is being felt most acutely in the West, where drought conditions and increased water use have helped turn lush agricultural areas to dust.

But dangers also lurk underground, in antiquated water systems that are increasingly likely to break down or spread contaminants like lead.

The crisis gripping Flint, Mich., where the water supply has been rendered undrinkable, is just a preview of what's to come in towns and cities nationwide, some warn.

"We are billions of dollars behind where we could and should be," said Rep. Jared Huffman (D-Calif.), who spent 12 years on a municipal water board before running for state office. "People in the clean-water world would tell you they've been shouting about this for a long time."

70,000 co-op employees working hard every day to keep the lights on for 42 million consumers.

AMERICA'S ELECTRIC COOPERATIVE

THE POWER OF RELIABILITY

NRECA *nreca.org* *renewal*

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Water Scarcity is Not Just a Concern Outside of the U.S.



A FAILED INFRASTRUCTURE SYSTEM

“Households and *businesses that do not self-supply are assumed to absorb the higher costs* that are a consequence of disruptions in water delivery and wastewater treatment *due to worsening infrastructure.*”

- American Society of Civil Engineers, Failure to Act

“

The underlying assumption for this cost is that *the prices of water and wastewater treatment will increase as services need to be rationed* to stretch the effectiveness of the infrastructure in overcoming the capital gap. ”

FAILURE TO ACT
THE ECONOMIC IMPACT
OF CURRENT INVESTMENT TRENDS IN
WATER AND WASTEWATER TREATMENT
INFRASTRUCTURE ★★ ★★

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

TABLE 2 ★ Estimated Costs for U.S. Households and Businesses due to Unreliable Water and Wastewater Infrastructure (billions of 2010 dollars)

SECTOR	COSTS, 2011–20		COSTS, 2021–40		COSTS, 2011–40	
	CUMULATIVE	ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE	ANNUAL
Households	\$59	\$6	\$557	\$28	\$616	\$21
Businesses	\$147	\$15	\$1,487	\$74	\$1,634	\$54
TOTALS	\$206	\$21	\$2,044	\$102	\$2,250	\$75

NOTE Numbers may not add due to rounding.

SOURCES EDR Group based on interviews, establishment counts, and sizes by sector from *County Business Patterns*, population forecasts of the U.S. Census, and forecasts of establishments and households provided by the INFORUM Group of the University of Maryland.

By 2040, the total costs to businesses due to unreliable infrastructure will be *\$1.634 trillion*

Capital Spending Has Not Kept Pace with Needs for Water Infrastructure



TIGHTENING GOVERNMENTAL REGULATIONS

The federal & state regulatory environment is constricting to eliminate ground and surface water pollution as well as provide greater control over critical water resource management. A few regulatory issues driving water reuse:

- A move toward water withdrawal limitations
- Federal mandates to resolve CSO & SSO issues
- Stricter nitrogen & phosphorus discharge standards
- Stricter drinking water testing parameters



Water Withdrawal Limits



Combined Sewer Overflows



Point Source Pollution Control



U.S. DEPARTMENT OF
ENERGY

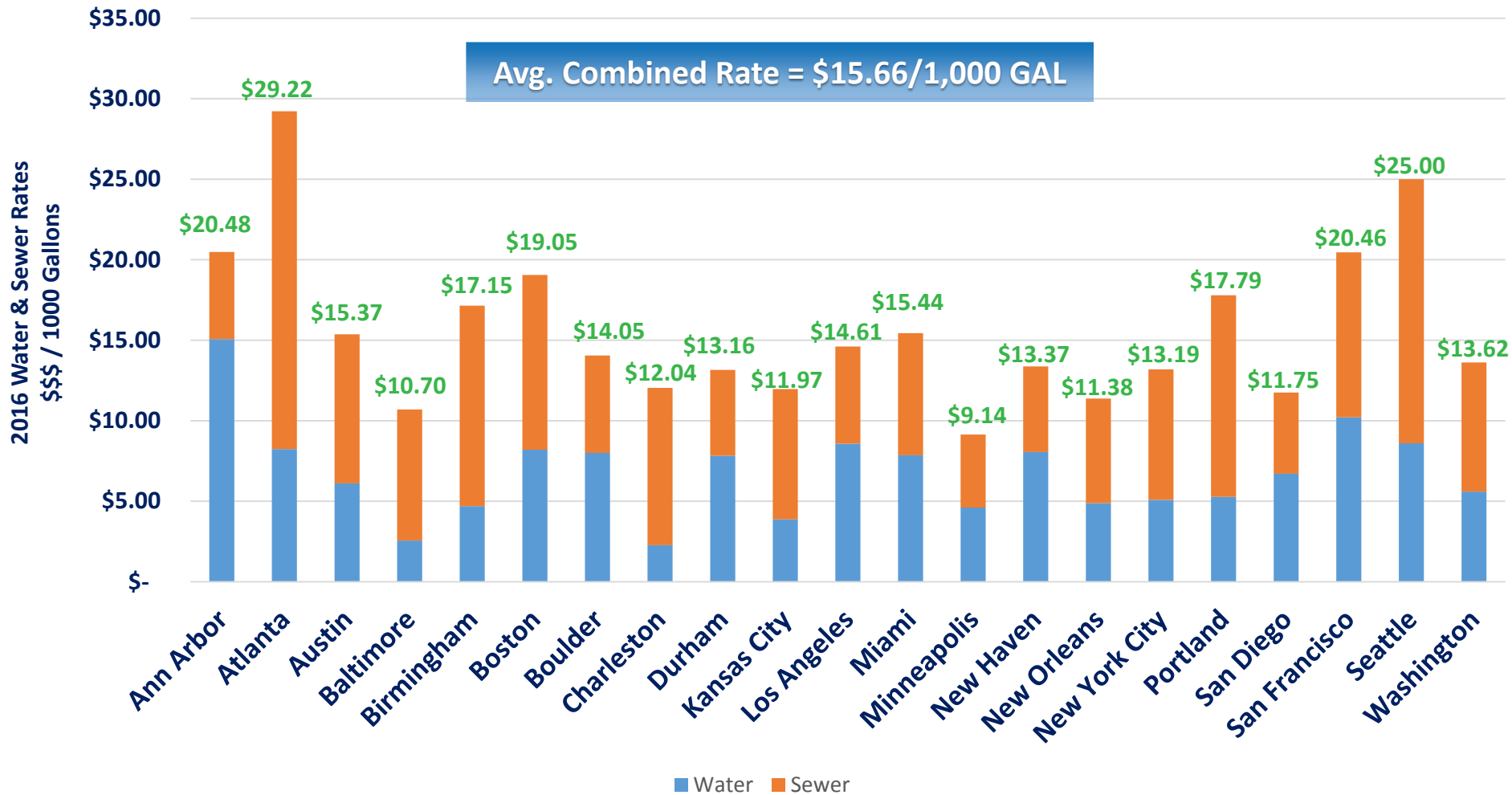


Unfunded Mandates Drive Rate Increases



HOW RATES COMPARE NATIONALLY

2016 Water and Sewer Rates for 20 Major U.S. Cities



Consistent Rate Increases for all Major Cities Driving Operational Costs



A SUSTAINABLE WATER CYCLE...DECENTRALIZED WATER RECLAMATION & REUSE



Risk Management | Cost Savings | Environmental Responsibility



FLEXIBILITY: INDEPENDENCE & RESILIENCE

**Reduces
freshwater
withdrawal**

**Expands Muni.
Infrastructure Capacity**

**Additional On-
Site Storage**

**Reliable & local
water supply**

**Zero Discharge:
reduced contribution
to CSOs and
wastewater discharge
to environment**

**Lower Life
Cycle Costs**

**Protects valuable
research experiments**

Minimum recovery time

Multiple Benefits Allow for Cross Facility Collaboration



ECOLOGICAL WATER TREATMENT TECHNOLOGIES



**ReCip®
Tidal Wetlands**



**Hydroponic
& Fixed Media**



**Moving Bed
Bioreactor (MBBR)**



**Membrane
Bioreactor (MBR)**



**Conventional
Activated Sludge**



CAPITAL EXPENSE



OPERATING EXPENSE



ENERGY EFFICIENCY



EFFLUENT QUALITY



FOOTPRINT



AESTHETICS



Innovative Technology Increases Biodiversity & Reduces Energy Requirements



THE EVOLUTION OF WATER CONSERVATION

LEVEL OF SOPHISTICATION & IMPACT →



STICKERS



LOW FLOW
FIXTURES



RAIN BARRELS



STORMWATER REUSE



RECLAMATION & REUSE

SIMPLE SOLUTIONS

BUILDING-BASED SOLUTIONS

CAMPUS-WIDE SOLUTIONS

The Most Impactful Solution That Does Not Require Behavioral Change



A THRIVING MARKET

“Global water reclamation and reuse markets to grow at a CAR of 22.39% in terms of volume of water recycled, and at a CAGR of 19.2% in terms of revenue between 2015 and 2019.”

Global Water Recycle and Reuse Market 2015 - 2019

July 10, 2015

Water Recycling Required in San Francisco Large Buildings

RELATED STORIES

Despite Drought San Francisco Uses Drinking Water to Heat Hundreds of Buildings

San Francisco Publishes Energy Consumption Data for 305 City Buildings

LA, DC, San Francisco Top Cities for Energy Star Buildings

Developers in San Francisco must install water recycling systems on large, new buildings in the city per an ordinance unanimously approved by the San Francisco Board of Supervisors.

The vote happens as California enters its fourth year of record drought.

Other cities are trying similar water reuse strategies to conserve water, reports KQED. Palo Alto requires new homes and commercial buildings to have laundry-to-landscape systems and San Jose plans to pass a similar law this year.

Late last month the California Water Resources Board approved revisions to Los Angeles County's stormwater discharge permit, which includes a plan to capture and reuse stormwater runoff that could serve a model for the rest of the state.



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Market Acceptance Presents Opportunity for Risk Mitigation and Revenue Insulation



SUPPORT FOR WATER RECLAMATION & REUSE

“ Decentralized wastewater systems help communities reach the *triple bottom line of sustainability*: good for the environment, good for the economy, and good for the people. ”

– US EPA, Decentralized Wastewater Treatment: A Sensible Solution

DROUGHT-WEARY CALIFORNIANS ARE READY FOR RECYCLED WATER

Residents eager for long-term solutions to water scarcity

76%

of survey respondents believe recycled water should be used as a long-term solution, regardless of drought.

87%

of respondents **SUPPORT** using recycled water as an additional source of water.



41%

SOMEWHAT WILLING

42%

VERY WILLING

83%

are willing to use recycled water in their everyday lives.

Californians believe that recycled water should be used as a **LONG-TERM SOLUTION** for a water-secure future – regardless of potential rainfall from El Niño.



By Patrick Crow

The Obama Administration is stirring its water policies to be sustainable and secure water future.

It will host a White House Water Summit on March 22, which has invited agencies and private-sector organizations to discuss availability or quality, efficient usage, water security, ecology

The precursor to the meeting was a Dec. 15, 2015, White House by the Department of Interior (DOI) and the White House Office of innovations in water technology and markets, plus current

At the roundtable the administration announced a public-private partnership particularly those related to drought.



The strategy calls for additional investments to promote the Specifically mentioned were desalination, conservation and The administration's policy calls for federal agencies to secure resources while the private sector would improve water efficiency. The White House said increasing the use of water-efficient consumption by 33 percent, bringing the U.S. more in line with emissions 1.5 percent a year.



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Home \ Bureau of Reclamation Announces Plans to Invest \$23 Million in Water Reuse and Efficiency

Bureau of Reclamation Announces Plans to Invest \$23 Million in Water Reuse and Efficiency

Date: February 09, 2016

Bureau of Reclamation Commissioner Estevan López released plans February 8 to spend an additional \$23 million this year to support water reuse and efficiency, including \$9 million for the Title XVI Water Reclamation and Reuse Program, \$9 million for WaterSMART Grants, and \$5 million to support water recycling as part of California's Central Valley Project. Reclamation also plans to invest \$2 million in research and development.

Under the fiscal year 2016 omnibus appropriations legislation, Reclamation received an additional \$100 million to address the ongoing Western drought. The WaterReuse Association joined seven other water sector groups last month in urging the Bureau of Reclamation to use a portion of newly received drought response funds to invest in water reuse activities.

"We are so pleased that the Bureau of Reclamation continues to see water reuse, conservation, and efficiency as priorities," said WaterReuse Association Executive Director Melissa L. Meeker. "We applaud their ongoing support of sustainable systems."

Last month's letter to the Bureau of Reclamation urging that a portion of the drought response funds be invested in water reuse was signed by the WaterReuse Association, National Association Clean Water Agencies (NACWA), American Public Works Association (APWA), National Association of Water Companies (NAWC), Water Environment Federation (WEF), Association of Metropolitan Water Agencies (AMWA), American Water Works Association (AWWA), and Association of California Water Agencies (ACWA).

The \$100 million provided for western drought response will address a number of projects affected by drought:

- Central Valley Project, which includes funding for the American River Division, Delta Division, Friant Division, Shasta Division and other programs. California (\$37.9 million);
- WaterSMART Grants, Title XVI Water Reclamation and Reuse Program, Drought Response and Comprehensive Drought Planning.

Water Resiliency has become a National Priority Requiring



- The White House, Moonshot for Water

Promoting Innovative Solutions for Effective Water Management Planning



SUSTAINABLE WATER'S COMMITMENT



COMMITMENT TO THE WHITE HOUSE WATER SUMMIT INITIATIVE

Sustainable Water is committing to deploy \$500 million in capital to develop 50 eco-engineered decentralized water reclamation and reuse systems across governmental, institutional, and commercial market sectors. This commitment is anticipated to save 7.5 billion gallons of potable water annually in the next 10 years.



RISK
MITIGATION



FINANCIAL
SAVINGS



ENVIRONMENTAL
RESPONSIBILITY



SOCIAL
RESPONSIBILITY



**\$500
MILLION**
— TO DEVELOP —
**50 ECO-ENGINEERED
WATER RECLAMATION SYSTEMS**

Sustainable Water's Innovative Approach to Increasing Water Security

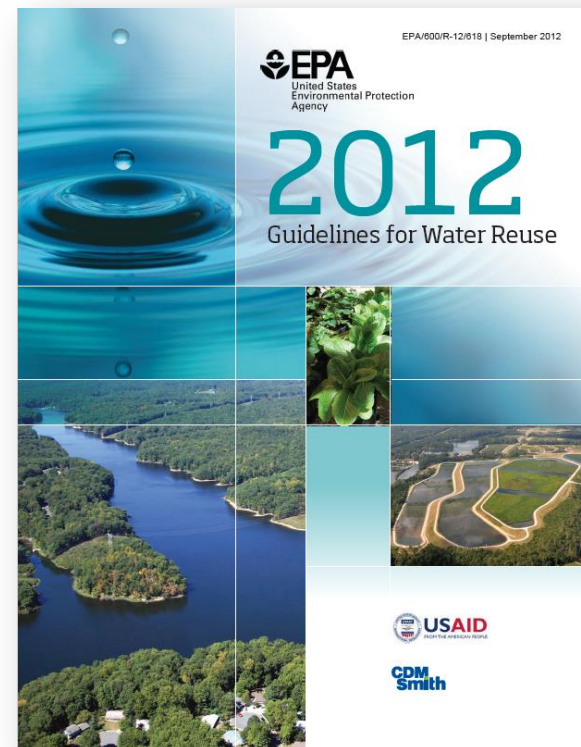
WATER REUSE SUCCESS STORIES





NATIONAL IMPLICATIONS FOR REUSE

Category of reuse		Description	Number of States or Territories with Rules, Regulations, or Guidelines Addressing Reuse Category
Urban Reuse	Unrestricted	The use of reclaimed water for nonpotable applications in municipal settings where public access is not restricted	32
	Restricted	The use of reclaimed water for nonpotable applications in municipal settings where public access is controlled or restricted by physical or institutional barriers, such as fencing, advisory signage, or temporal access restriction	40
Agricultural Reuse	Food Crops	The use of reclaimed water to irrigate food crops that are intended for human consumption	27
	Processed Food Crops and Non-food Crops	The use of reclaimed water to irrigate crops that are either processed before human consumption or not consumed by humans	43
Impoundments	Unrestricted	The use of reclaimed water in an impoundment in which no limitations are imposed on body-contact water recreation activities (some states categorize snowmaking in this category)	13
	Restricted	The use of reclaimed water in an impoundment where body contact is restricted (some states include fishing and boating in this category)	17
Environmental Reuse		The use of reclaimed water to create, enhance, sustain, or augment water bodies, including wetlands, aquatic habitats, or stream flow	17
Industrial Reuse		The use of reclaimed water in industrial applications and facilities, power production, and extraction of fossil fuels	31
Groundwater Recharge – Nonpotable Reuse		The use of reclaimed water to recharge aquifers that are not used as a potable water source	16
Potable Reuse	Indirect Potable Reuse (IPR)	Augmentation of a drinking water source (surface or groundwater) with reclaimed water followed by an environmental buffer that precedes normal drinking water treatment	9
	Direct Potable Reuse (DPR)	The introduction of reclaimed water (with or without retention in an engineered storage buffer) directly into a water treatment plant, either collocated or remote from the advanced wastewater treatment system	0



As of August 2012, **22 States have adopted regulations and 11 states have guidelines or design standards** with water reuse as the primary intent.

- 2012 Guidelines for Water Reuse, EPA

Validated Technology to Minimize Risk for District-Scale Management



CALIFORNIA SUPPORTS WATER INVESTMENT

74%

Of voters supported a tax on water investment

Voters in the area have twice supported taxes for water investment. The funds support projects from a massive seismic retrofit of the water district's largest reservoir to the installation of hydration stations in schools.



In November 2014, California voters approved Proposition 1, the Water Quality, Supply, and Infrastructure Improvement Act, a \$7.5 billion water bond for investments in the state's water management systems.

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It's Time for States to Invest in Infrastructure

FEBRUARY 23, 2016 | BY ELIZABETH MCNICHOL

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(20 pp.)

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REPORT

Reversing the decline in state investment in transportation, public buildings, water treatment systems, and other forms of vital infrastructure is key to creating good jobs and promoting full economic recovery – and this is an especially good time for states to do it.

The condition of roads, bridges, schools, water treatment plants, and other physical assets greatly influences the economy's ability to function and grow. Commerce requires well-maintained roads, railroads, airports, and ports so that manufacturers can obtain raw materials and parts and deliver

EVERY STATE NEEDS
INFRASTRUCTURE
IMPROVEMENTS THAT

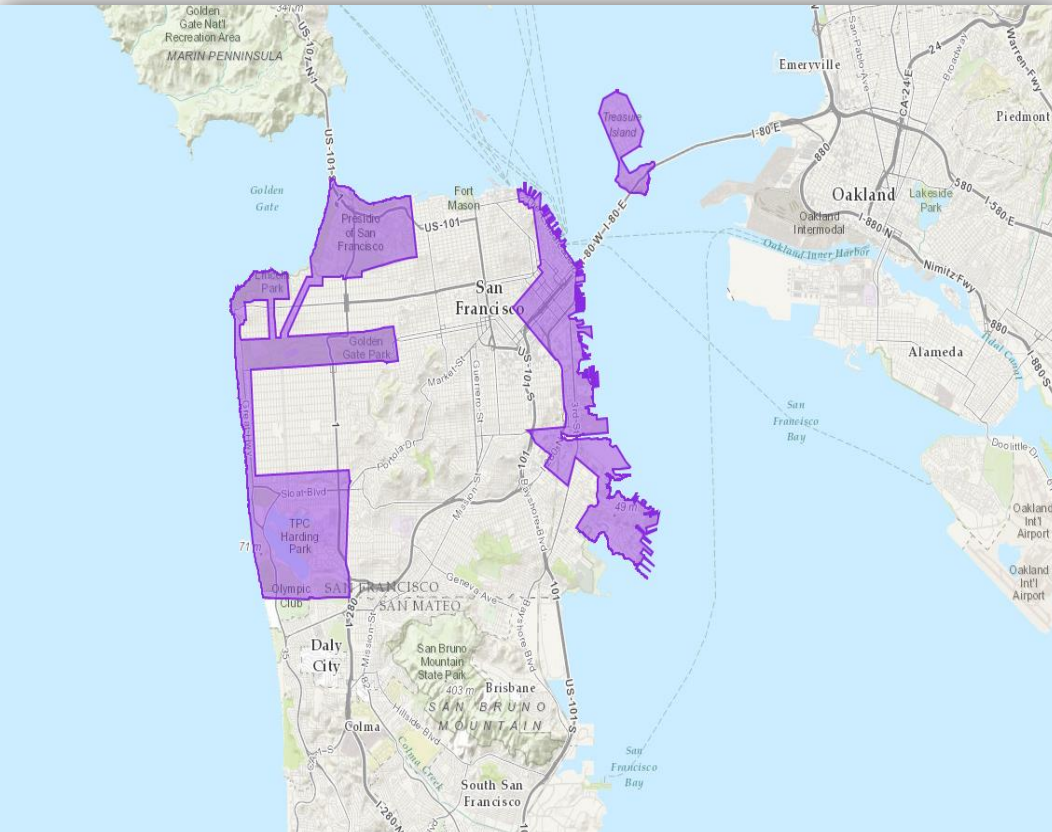
Statewide Approval for Resilient Water Planning and Effective Treatment Solutions



SAN FRANCISCO PUBLIC UTILITIES

In the early 1900's, *the Golden Gate Park area was transformed from “great sand and waste” to a garden spot through the use of partially treated wastewater and groundwater.* In the 1930s, the McQueen Treatment Plant was constructed in the Park to provide secondary-treated recycled water to irrigate Golden Gate Park.

- San Francisco Water Power Sewer

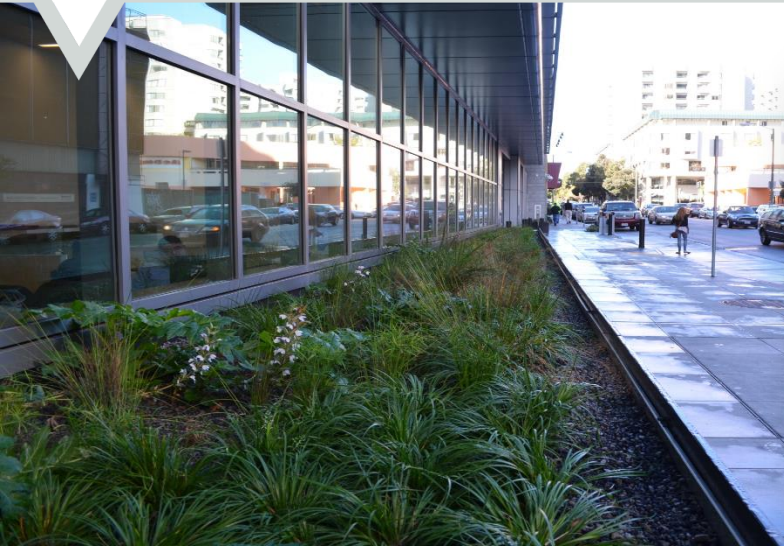


The City and County of San Francisco's Recycled Water Ordinance Requirements (highlighted purple area):

- New construction or major alterations to a building totaling 40,000 square feet or more
- All subdivisions
- New and existing irrigated areas of 10,000 square feet or more



SFPUC HEADQUARTERS BUILDING



Building Features

- One of the first buildings in the nation with on-site treatment of gray and black water
- Treats 5,000 gallons of wastewater daily – Satisfying 100% of the water demand for the low-flow toilets and urinals
- 25,000 gallon rainwater harvesting system provides water for irrigation uses



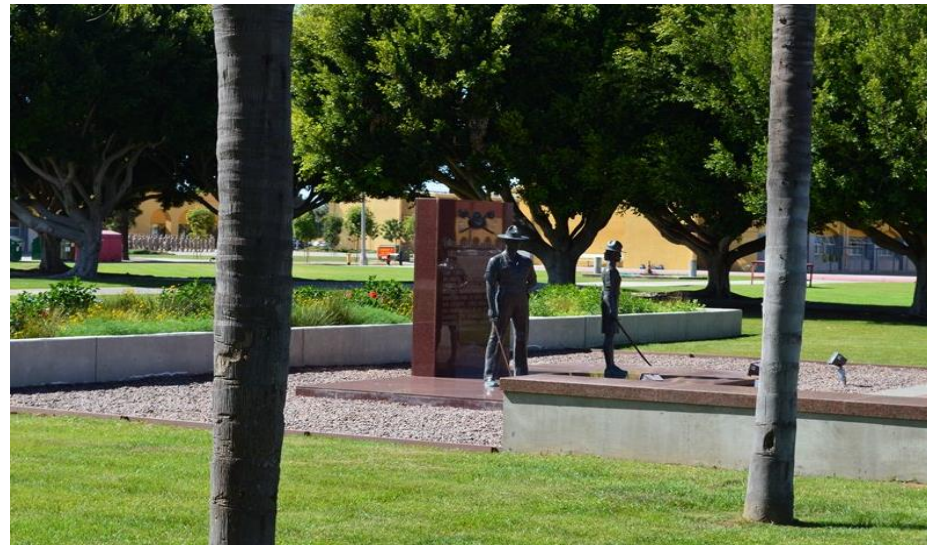
Impactful Solution that Decreased Potable Water Consumption by 70%



SAN DIEGO MARINE CORP RECRUITING DEPOT

Treatment Features

- 10,000 GPD wastewater treatment facility.
- Satisfies 100% of irrigation demands.
- Efficient solution for high traffic area.



Wastewater Management Tool Serves as the Centerpiece of the Depot



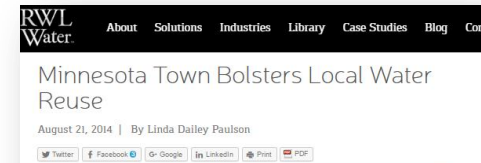
MANKATO, MINNESOTA

Mankato Power Plant



First Large-Scale Project in MN to Use Recycled Water for Cooling

- Natural gas-fired, combined-cycle facility
- Meets power needs in MN and Upper Midwest
- Cooling water for the plant is supplied by municipal WWTF
 - Provides up to 6.2 mgd of reclaimed water
 - Power plant returns cooling water discharge to the WWTF



MPRnews Sections Members More

Minnesota starts to think about re-using wastewater

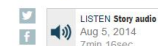
Elizabeth Dunbar Mankato, Minn. Aug 4, 2014

Environment



At Grand, Lead Control Room Operator at the Calpine energy plant in Mankato, Minn., said that when the plant is in operation, it will use 700 to 1,200 gallons of reclaimed water per minute and will supply on average 3,200 Megawatts per day to the Northern States Power energy grid. Jackson Forderer / For MPR News

Reclaimed Water



Currently, MN has **40 water reuse projects** across the state for:

- Toilet Flushing
- Energy Plant Cooling Water
- Golf Course Irrigation
- Agricultural Irrigation
- Wetland Enhancement

Water Scarcity Driving Minnesota's Largest Reuse Project



CITY OF AUSTIN RECLAIMED WATER



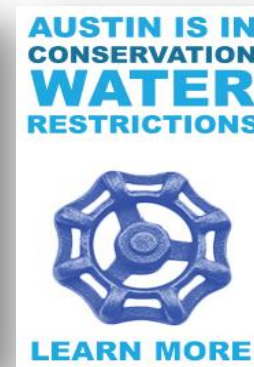
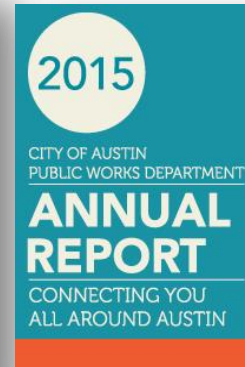
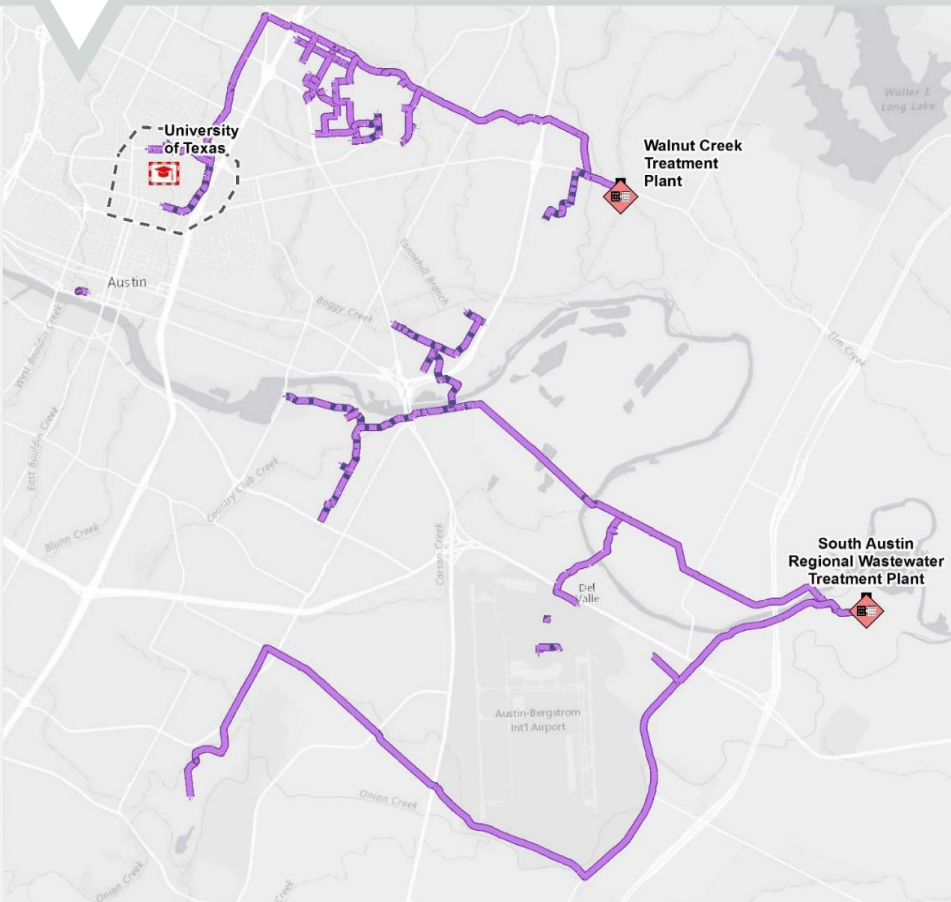
“As of May 2015 , *City Code requires new commercial developments or redevelopments within 250 feet of a reclaimed water main to connect* for irrigation, cooling, and other significant non-potable water uses.”

- City of Austin

New Construction and Redevelopments Require Reclaimed Water



CITY OF AUSTIN RECLAIMED WATER



Why Do Austin Customers Decline Reclaimed Water Connections?

74 Total Customers
1.5 Billions Gallons Reclaimed in 2013
Over 50 Miles of Distribution Lines

Customer	Vol. (MG/yr)	Reason
3502/3504 Red River	0.2	Cost of abandoning sprinkler system and adding new
ABIA Chiller	10.0	Unfamiliar with water chemistry, cost of treatment change
ABIA Garage Irrigation	10.0	Cost of sleeving piping in highly landscaped area
ACC Riverside		Cost of adding purple pipe
AE's Dell Chiller	30.0	Microbial drift from cooling tower
CTECC	0.3	Inability to shut down to perform annual test
Data Foundry	15.7	System capacity / low pressure
Hancock Shopping	5.0	Cost of abandoning sprinkler system and adding new
Hornsby Bend	?	Expensive to address preexisting x-connection issues
Long Horn Hotels	0.3	Cost of abandoning sprinkler system and adding new

Centralized Reuse has Challenges in Dense Urban Environments

THE WATERHUB®



EMORY UNIVERSITY



THE WATERHUB® AT EMORY UNIVERSITY



400K GPD and up to 140M GPY Displaced
Up to 40% of Total Campus Demand
90% of Utility Water Demand
3 Chiller Plants/1 Power Plant (phase 1)



Performance to Date

- 95% of City Water Displaced at Cooling Towers
- Averaging 7 Million Gallons/Month Campus Wide
- Over 50 Million Gallons of Water Delivered since May
- 99% Up-time Reliability

Permitted for Use in Utilities, Irrigation, and Toilet Flushing



CAMPUS WATER FOOTPRINT, FY13-14



We looked at where we currently use the most potable water in our facilities — *applications where we don't really need drinking-water quality water* — and it came down to our toilets, our steam plants and our chiller plants.

- Brent Zern, Assistant Director of Operational Compliance and Maintenance Programs, Emory University

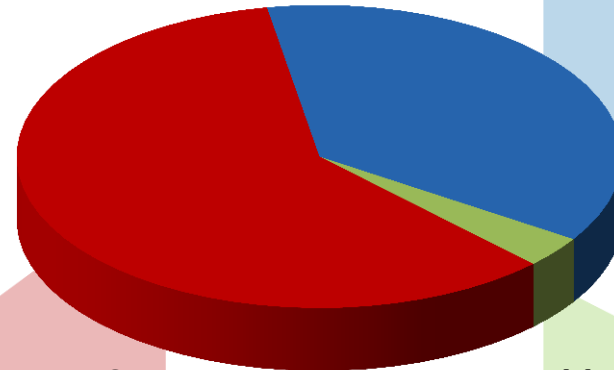


HVAC

122,973,384
37%

333 Million
Gallons Per Year

EMORY



198,711,516
60%

Domestic/Sanitary



11,141,100
3%

Irrigation



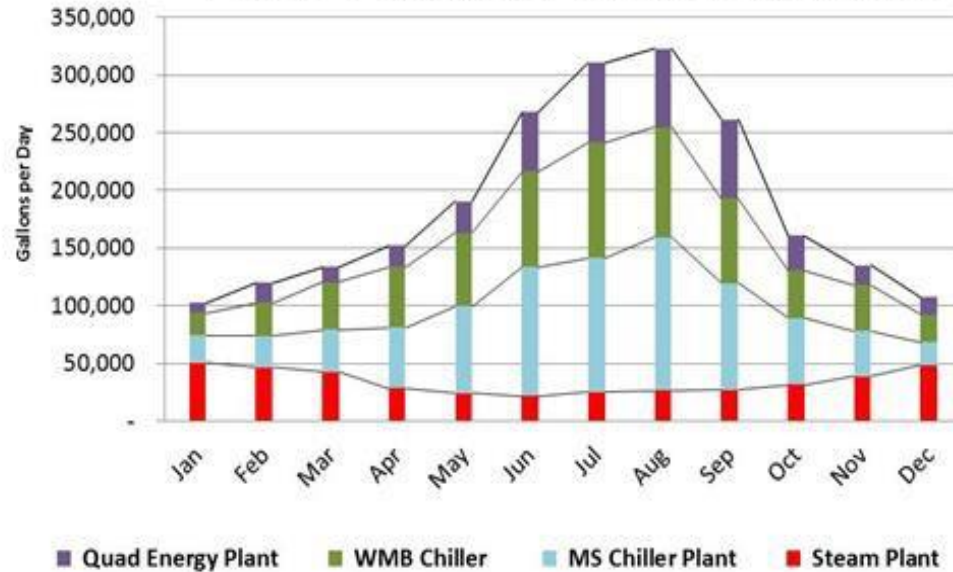
- Utilities
- Irrigation
- Domestic
-

40% Non Potable Demand Identified and Strategy Formulated

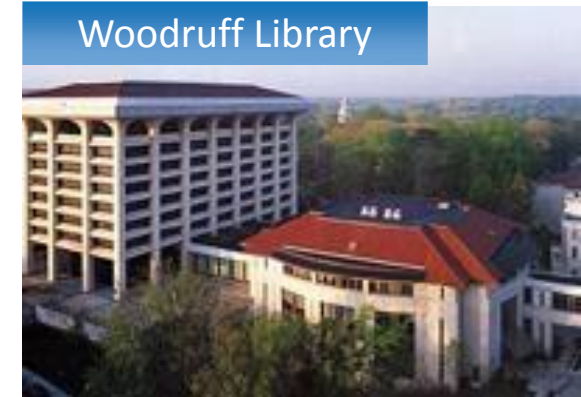
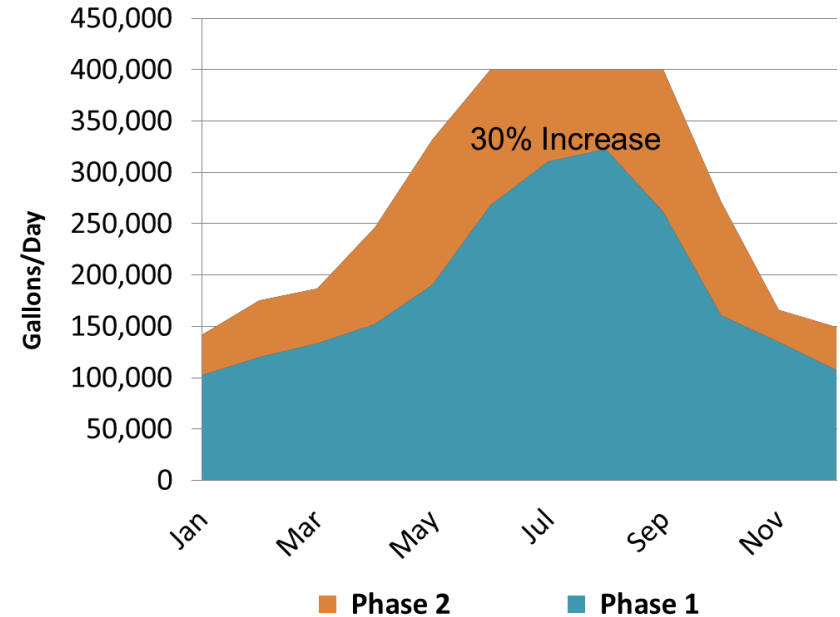


RECLAIMED WATER DISTRIBUTION

Phase 1 Reclaimed Water Distribution



Phase II Reclaimed Water Distribution Expansion



Additional Reclaimed Water Supply Will Address Future Demands



WATERHUB PROCESS DESIGN

How the WaterHub Works

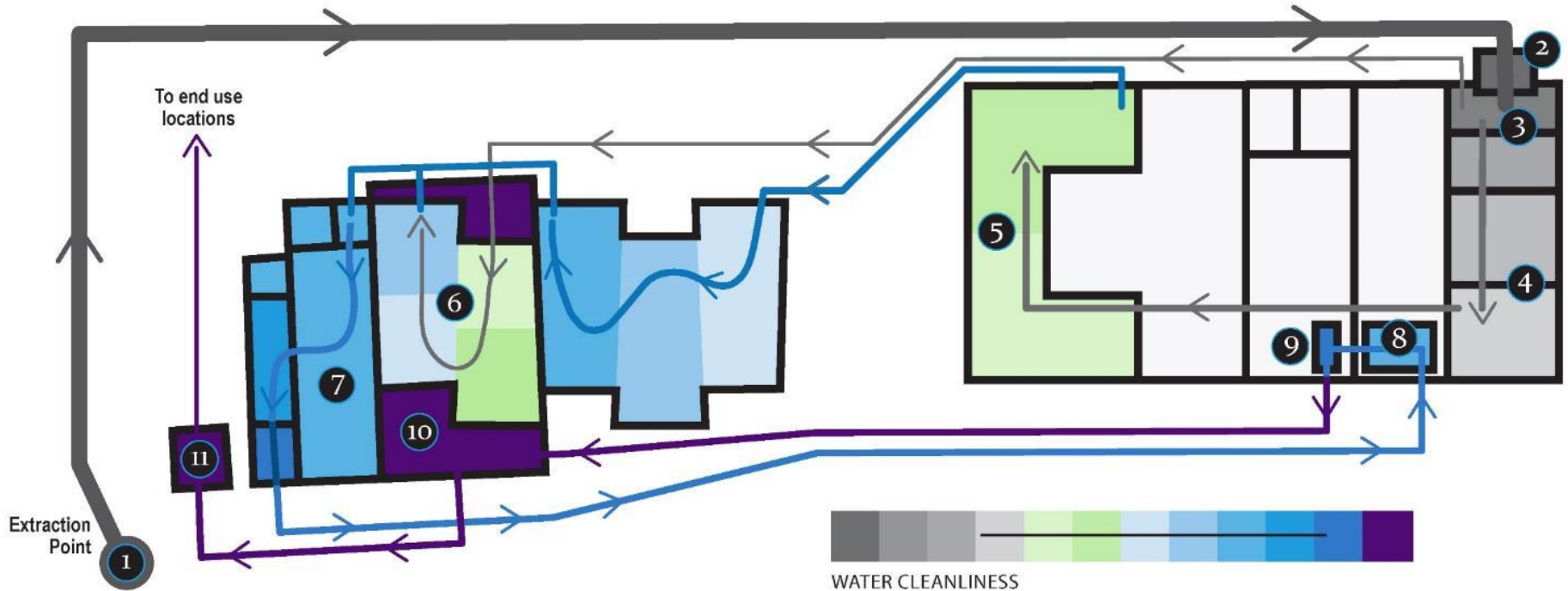
- 1 2 Extraction Point & Rotary Screen**
Wastewater is diverted from the sewer system and sent through a screen to remove debris.

- 3 Anoxic Moving Bed Bioreactors**
Wastewater enters a low-oxygen environment where microorganisms living on honeycombed plastic pellets (high-density housing for microbes) begin to metabolize carbon and nitrogen.

- 4 Aerobic Moving Bed Bioreactors**
Wastewater enters an oxygen containing environment with a different community of microbes that continue the treatment process. Diffusers add air bubbles to assist treatment. Odorous gasses are removed with charcoal filters.

- 5 Hydroponic Reactors**
Water clarity increases as water is treated in tanks with suspended plant roots. Water is cleaned by microbes living on the plant roots and on the specially engineered bio fabric (high-density housing for microbes) located below the plant roots.

- 6 Demonstration Reciprocating Wetlands**
An alternate treatment system, this area demonstrates a highly energy efficient treatment process applicable for rural areas and developing countries. Screened wastewater is pumped to four 8' deep cells. Cells are alternately filled-and-drained 8 to 18 times a day. The system mimics the behavior of natural tidal wetland areas and uses gravel and plant roots to provide microbial habitat.



- 7 Clarifier Tank**
In a still-water tank, Phosphorus and any remaining solids are removed as the particles hit interior baffles and slide to the bottom.

- 8 Disk Filter**
Very clean water is sent through a felt filter to remove any remaining particulate material.

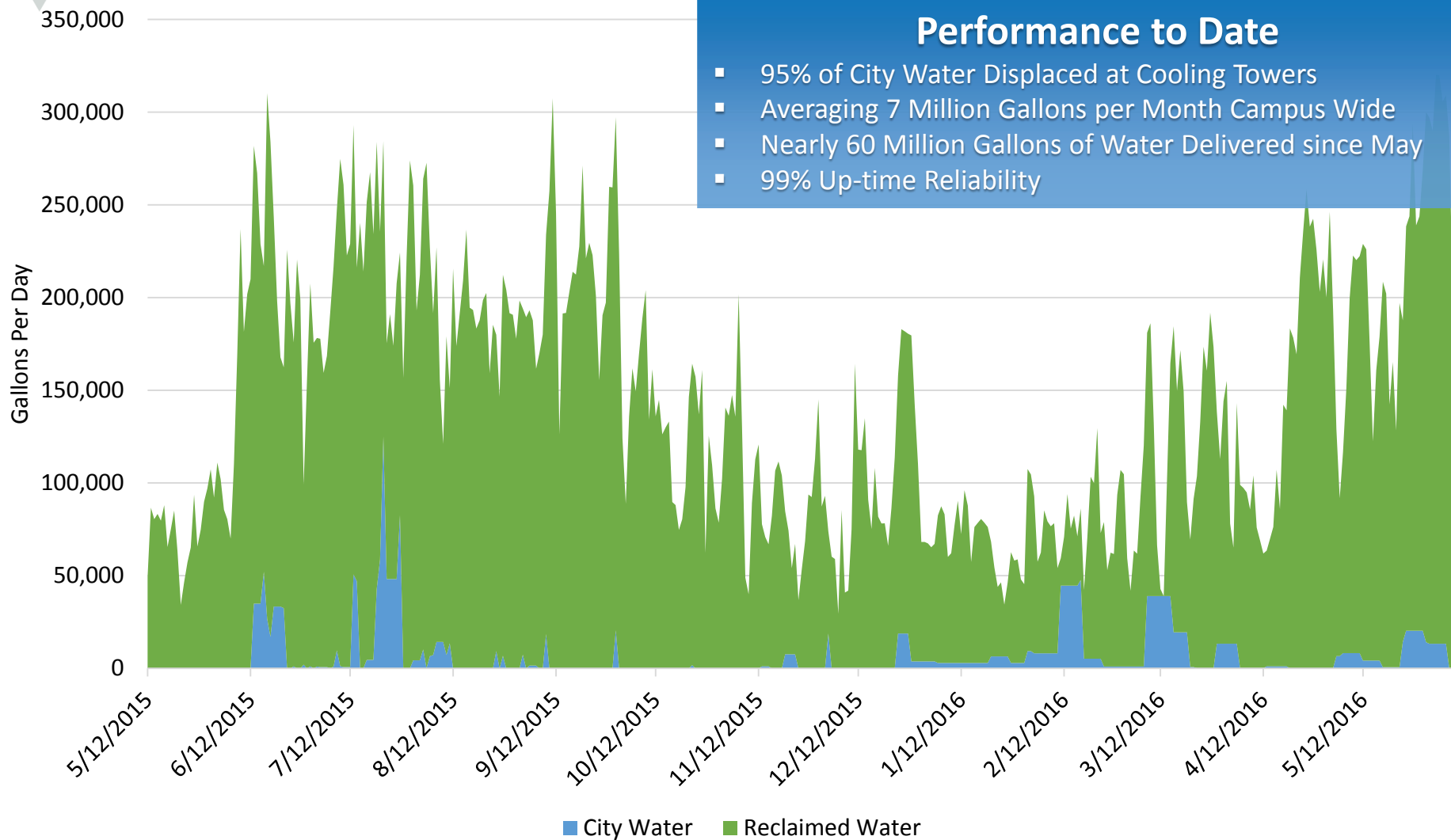
- 9 Ultraviolet Disinfection**
Water is treated with ultraviolet light that provides extensive disinfection, producing water that complies with state and local health requirements.

- 10 50,000 Gallon Storage Tank**
Fully treated water is stored underground as a reserve supply.

- 11 Campus Distribution**
Water is distributed to the steam and chiller plants for use as process make-up water. In the future, water will be sent to residence halls for toilet flushing.



HISTORICAL WATER USE AT END USERS



Reliable Supply of Reclaimed Water with Proven Results



UNIQUE DEVELOPMENT APPROACH

Water Purchase Agreement

Operating Lease | DABOOM Agreement | Performance Contract

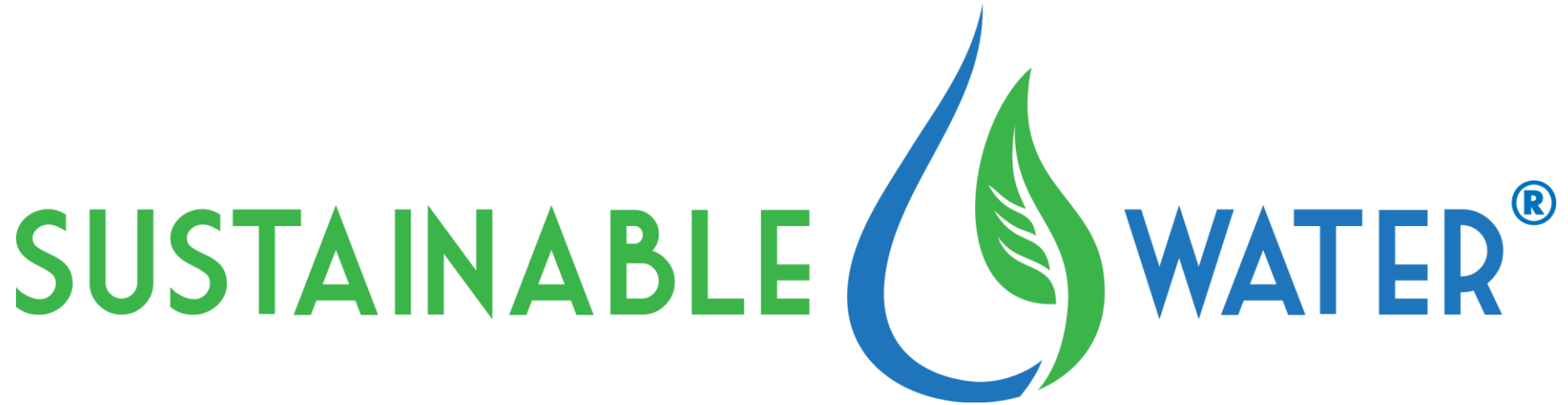
ZERO
CAPITAL EXPENSE
—AND—
DEVELOPMENT RISK
TO THE END USER

Benefits

- No up-front capital
- Innovative technologies
- Leverages superior credit rating
- Lifecycle savings
- Long-term pricing stability
- No O&M responsibilities
- SW bears majority of risk



Flexible, Innovative Vehicle that Yields Guaranteed Savings



EXTENDING THE LIFECYCLE OF WATER

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