Implementing Onsite Water Treatment Systems in San Francisco and North America

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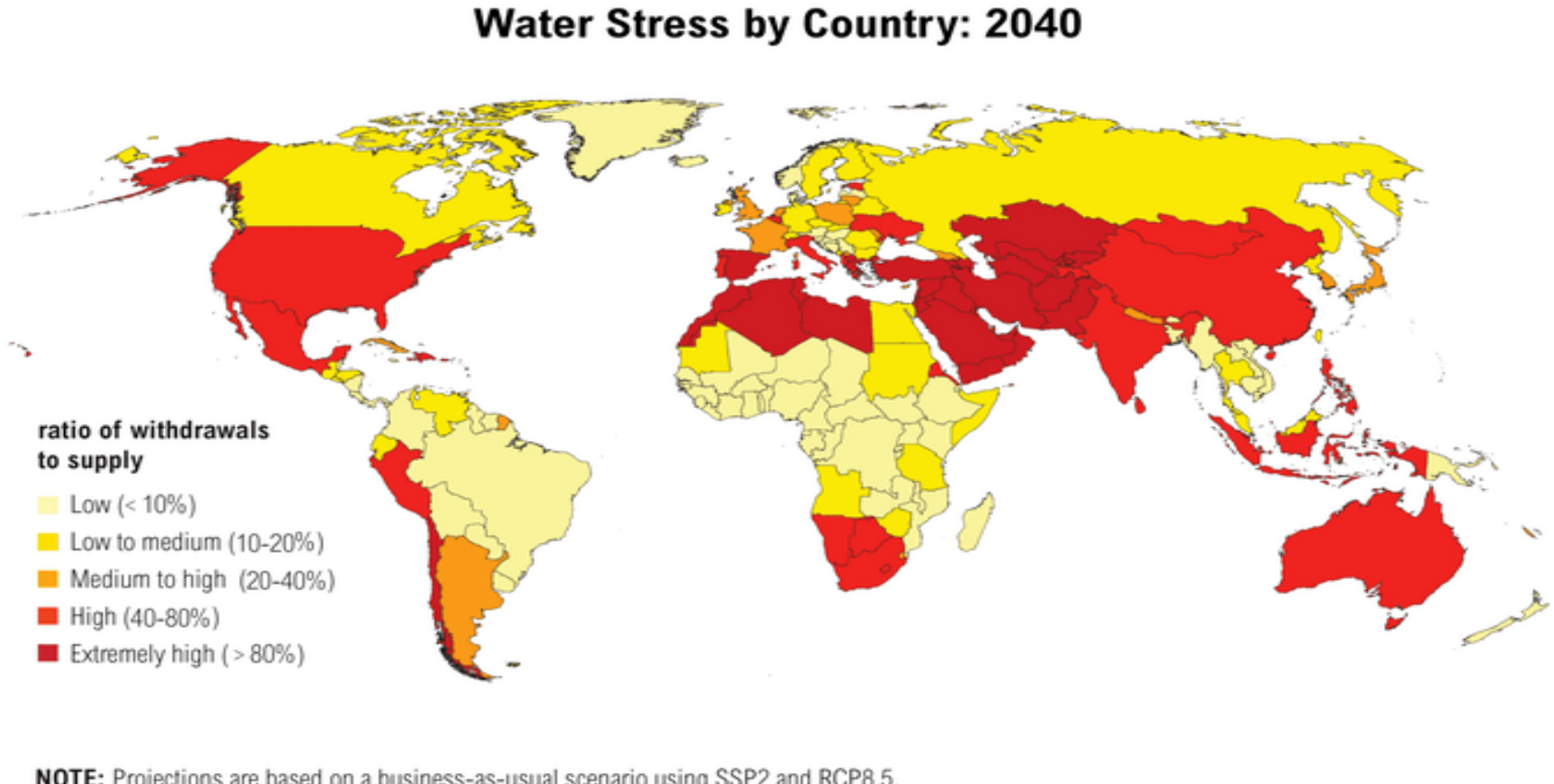
San Francisco Public Utilities Commission

January 2024

Water is one of the Most Critical Natural Resources Challenge Facing the World



Managing Water Supplies is Not an Easy Task

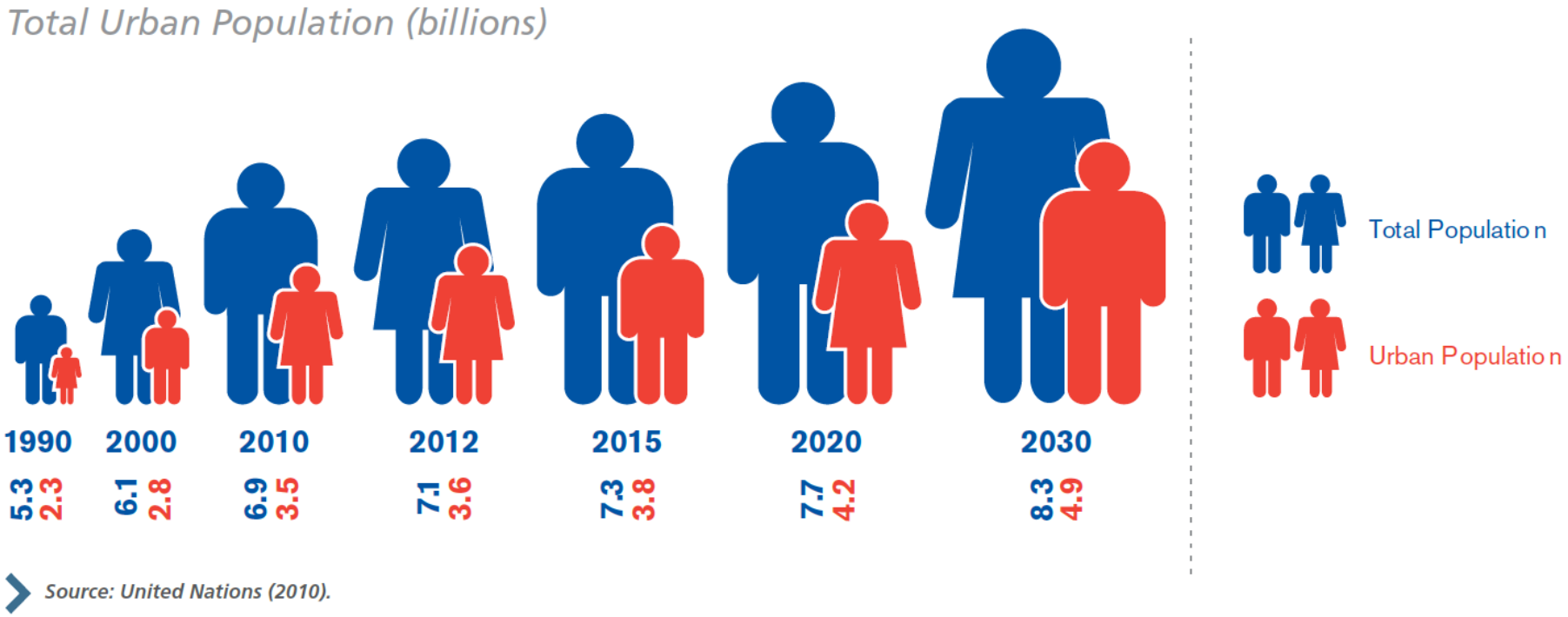
Droughts

Flooding

Aging Infrastructure

Rapid Urban Growth

Urbanization is a Defining Feature of the 21st Century



By 2050, two out of every three people are likely to be living in cities or other urban centers according to the United Nations

Opportunity to Re-think & Re-imagine Water Use in Buildings

Buildings are Water Resources

Water vapor collected from air conditioning systems

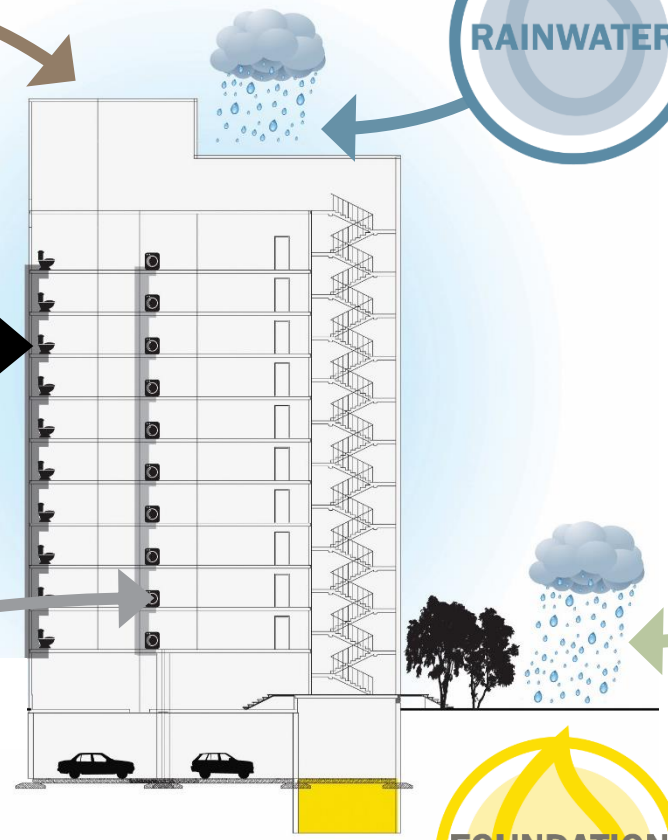
CONDENSATE

RAINWATER

Precipitation collected from roofs and above grade surfaces

Wastewater from toilets, dishwashers, kitchen sinks, and utility sinks

BLACKWATER



STORMWATER

Precipitation collected at or below grade surfaces

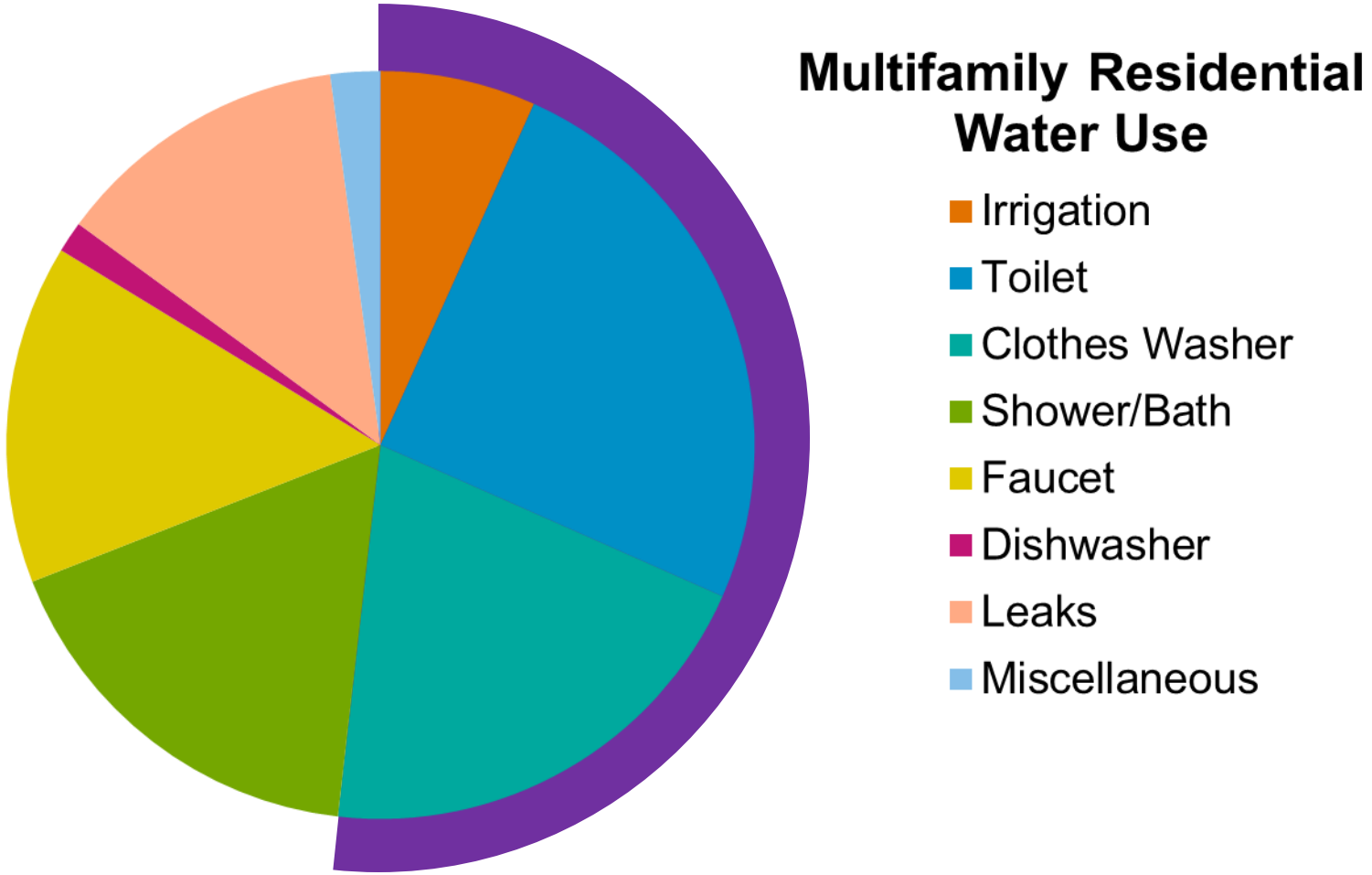
Wastewater from clothes washers, bathtubs, showers, and bathroom sinks

GRAYWATER

FOUNDATION DRAINAGE

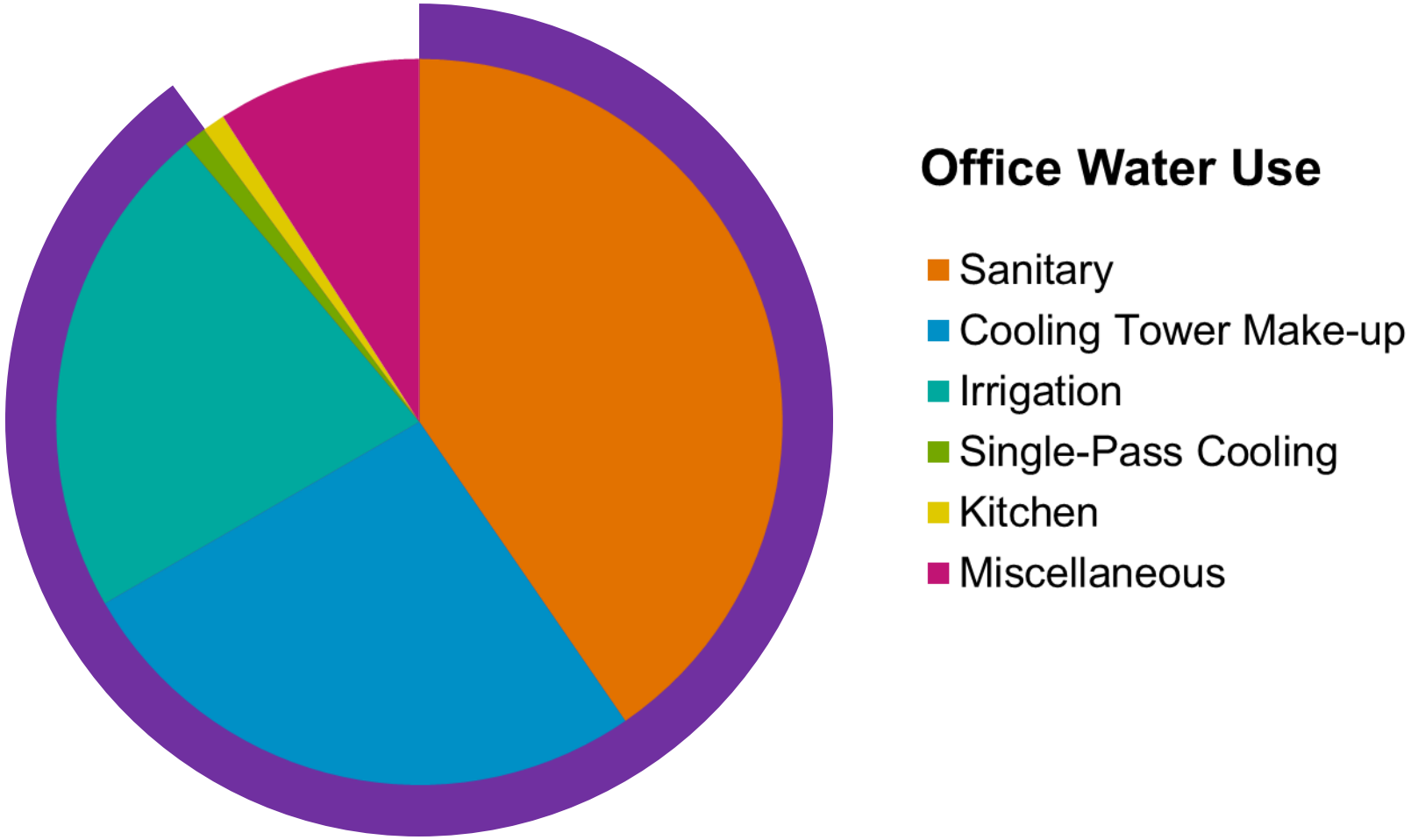
Nuisance groundwater from dewatering operations

Up to 50% of Demands are Non-potable in Multi-family Residential Buildings



Source: adapted from Alliance for Water Efficiency

Up to 95% of Demands are Non-potable in Commercial Buildings



Source: USEPA

Onsite Water Treatment Systems Alleviate Water Scarcity and Reduce Burden on Centralized Infrastructure

Limited Number of Onsite Water Systems Installed

We Asked Ourselves, Can We Do More and Move Faster to Adapt to Climate Change in San Francisco?

Biggest Barriers to Wide-Spread Onsite Water Treatment Systems

- Lack of appropriate water quality standards

- Lack of guidance on oversight and management for ongoing protection of public health

San Francisco Set out to Address Barriers and Change the Paradigm

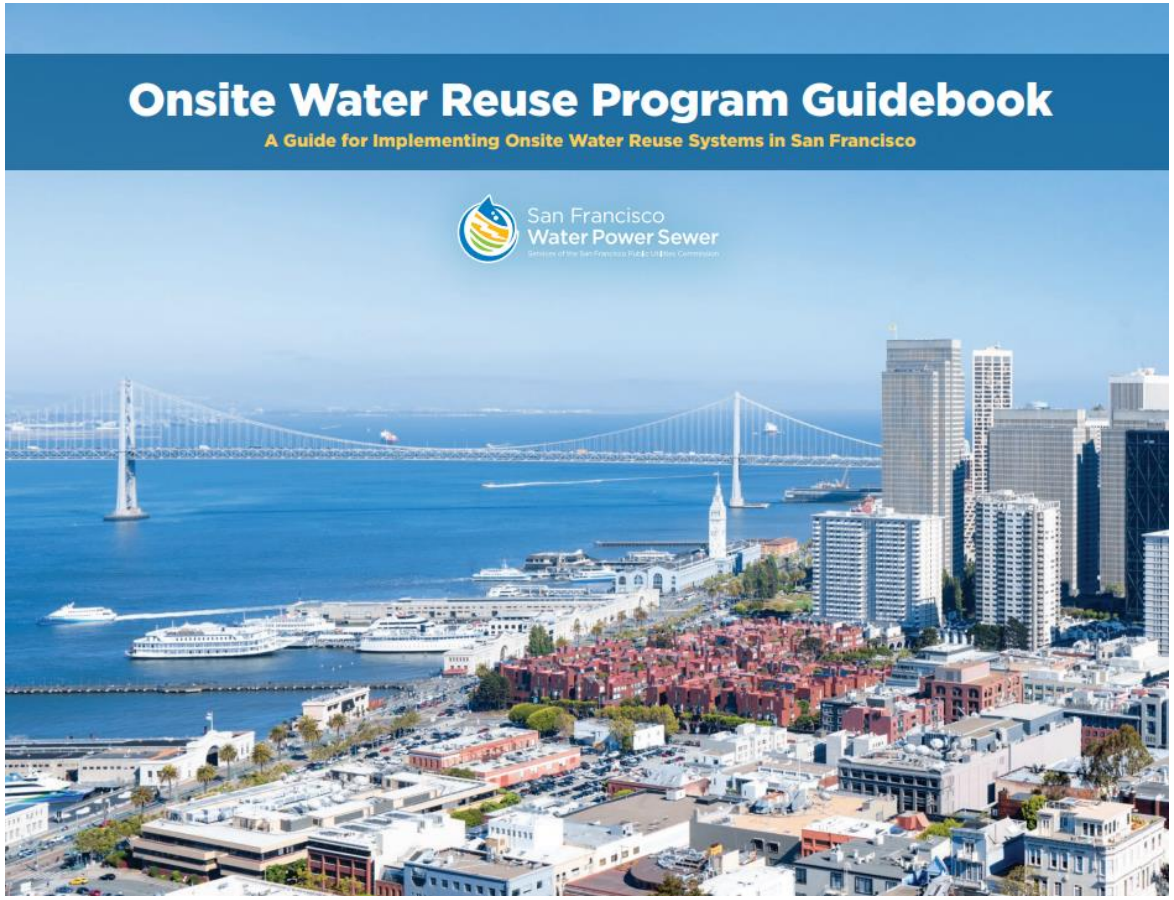
SF Ordinance Established Regulatory Program to Allow Buildings to Install Onsite Treatment Systems

SFPUC	SFDPH-EH	SFDBI	SFPW
Program Administration and Cross-Connection Control	Public Health	Construction	Right of Way and Mapping
Review onsite non-potable water supplies & demands Administer citywide project tracking & annual potable offset achieved Provide technical support & outreach to developers Manages Cross-Connection Control Program	Issue water quality & monitoring requirements Review and approve non-potable engineering report Issue permit to operate onsite systems Review water quality reporting	Conduct Plumbing Plan check and issue Plumbing Permit Inspect and approve system installations	Issue Encroachment Permits as needed for infrastructure in the Right-of-Way (if needed) Includes condition on a subdivision map or a parcel map requiring compliance with the Non-potable Ordinance prior to approval and issuance of said map (if applicable)

Streamlined Permitting Process

10 Steps for Successful Implementation of an Onsite Water Reuse System

1. **Submit a Water Budget Application to SFPUC-WRD**
2. **Submit a Non-potable Implementation Plan to SFPUC-WRD** (district-scale projects only)
3. **Submit Application for Permit to Operate to SFDPH-EH**
4. **Obtain Encroachment Permit from SFPW** (if applicable)
5. **Obtain Plan Check Approval from SFDBI-PID and SFDPH-EH and Complete System Construction**
6. **Conduct a Cross-Connection Test with SFPUC-WQD and Complete Post-Construction Inspection**
7. **Submit Documentation for a Permit to Operate from SFDPH-EH**
8. **Obtain a Permit to Operate from SFDPH-EH**
9. **Operate in Conditional Startup Mode**
10. **Operate in Final Use Mode with SFDPH-EH Approval**



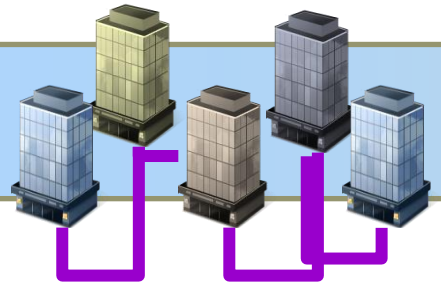
SF Integrating Decentralized and Centralized Infrastructure at the Building/District Scale

SF's Evolving Onsite Water Reuse Program- Incorporating Lessons Learned

2012

Single Building

2013



District-Scale

2015

Mandatory Requirement for 23,225 square meters

2021

Additional Ordinance Amendments

2021 Ordinance Requirements

- Applies to new developments 9,290 square meters or greater (building or district scale)
- Multi-family residential and mixed-use buildings to treat graywater for toilets, irrigation and clothes washers
- Commercial buildings must treat blackwater for toilet flushing as graywater does not produce enough supply

45 Permitted Onsite Water Treatment Systems; 29 projects planned for future

1550 Mission Street Residential Building

- 550 apartments
- Treating graywater for toilet/urinal flushing and irrigation
- Treats and uses approximately 7,500 gallons per day

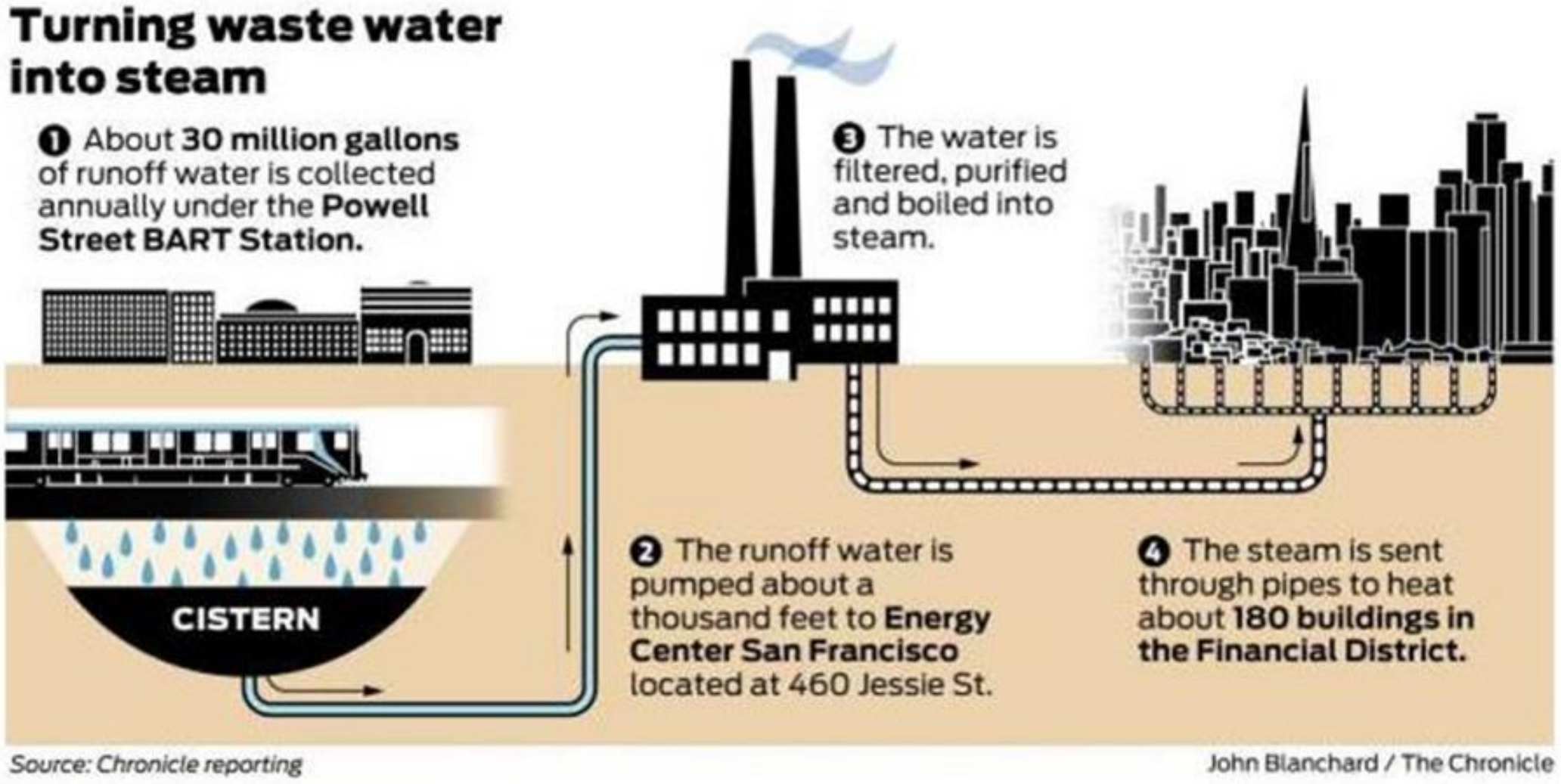
Chase Center

- State-of-the-art sports and entertainment facility and two office towers
- Treating rainwater, stormwater, condensate and graywater for toilet/urinal flushing and spray irrigation
- Approximately 35% reduction in potable use

Mission Rock-
District Scale Project Under Construction

- 11 buildings (residential and commercial)
- Blackwater treatment for cooling tower make-up water, toilet/urinal flushing and irrigation
- Expected to meet 100% of non-potable water demands

Building upon Commercial & Residential Onsite Water Recycling at Industrial

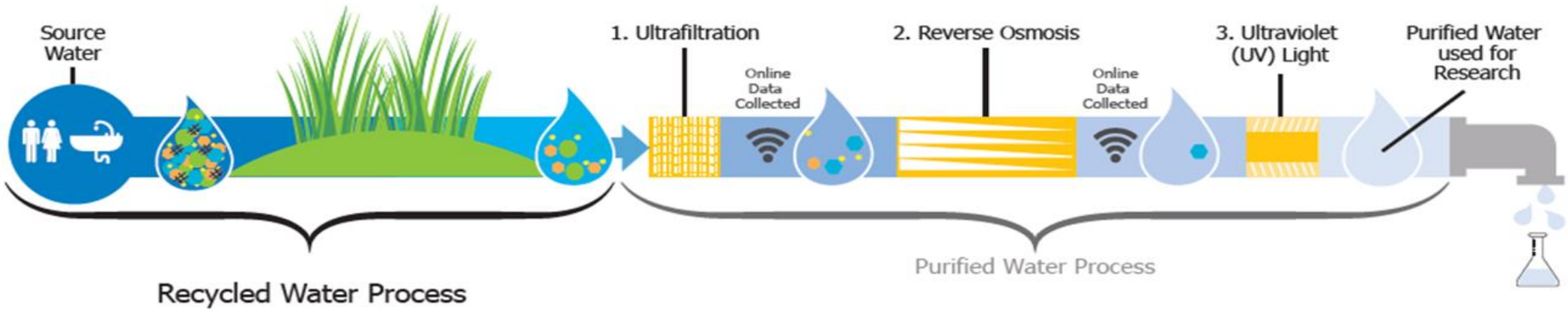


Building upon Commercial & Residential Onsite Water Recycling for Breweries

Approximately 5-7 gallons of water to produce 1 gallon of beer

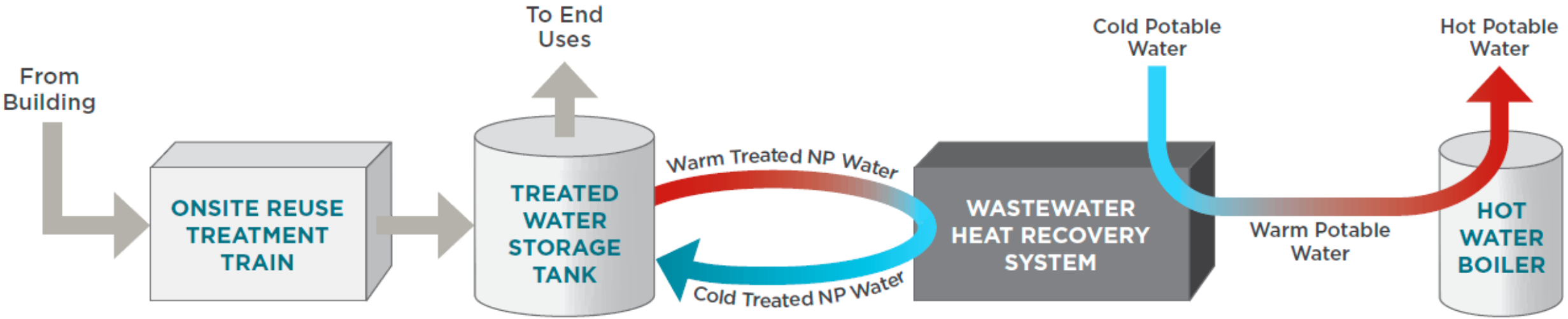
Most of the water is used for cleaning

Resource Recovery
Producing Drinking Water at SFPUC Headquarters



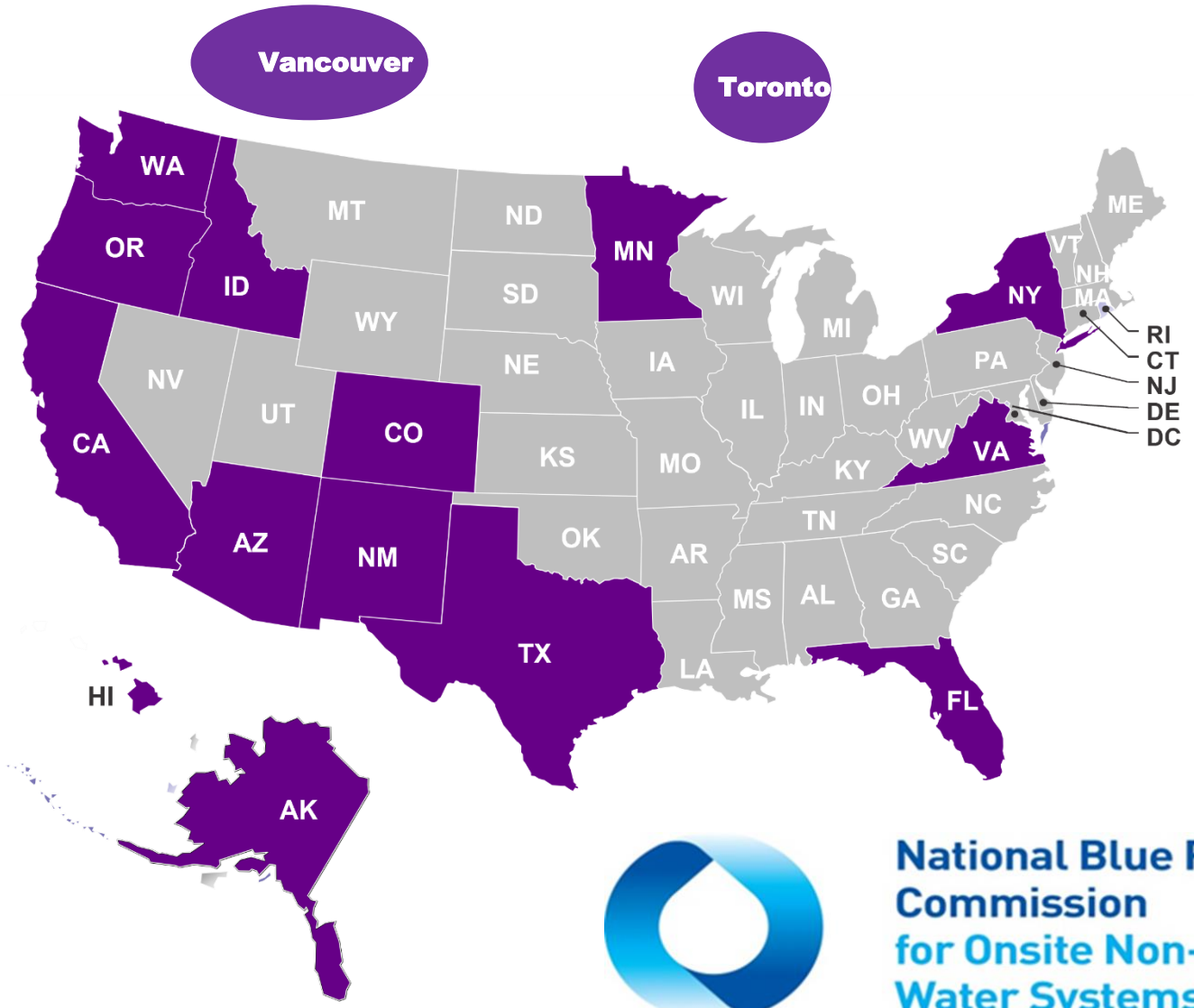
Resource Recovery
Producing Energy with Wastewater Heat Recovery

- Opportunity to recover thermal energy from graywater & blackwater
  - ➢ Can offset some or all of energy needed for onsite treatment



Wastewater Heat Recovery for Hot Water Pre-Heating

Collaborating on Onsite Water Recycling Across North America



Unique Partnership established in 2012:

- Public health regulators
- Water and wastewater utilities
- US EPA and US Army
- WateReuse Association, Water Research Foundation, and US Water Alliance

National Blue Ribbon Commission for Onsite Non-potable Water Systems

NBRC Goals

- Establish Appropriate Water Quality Standards and Promote Consistency among States
- Encourage Oversight and Management Programs
- Develop Technical and Policy Documents
- Forum for Peer- to- Peer Learning

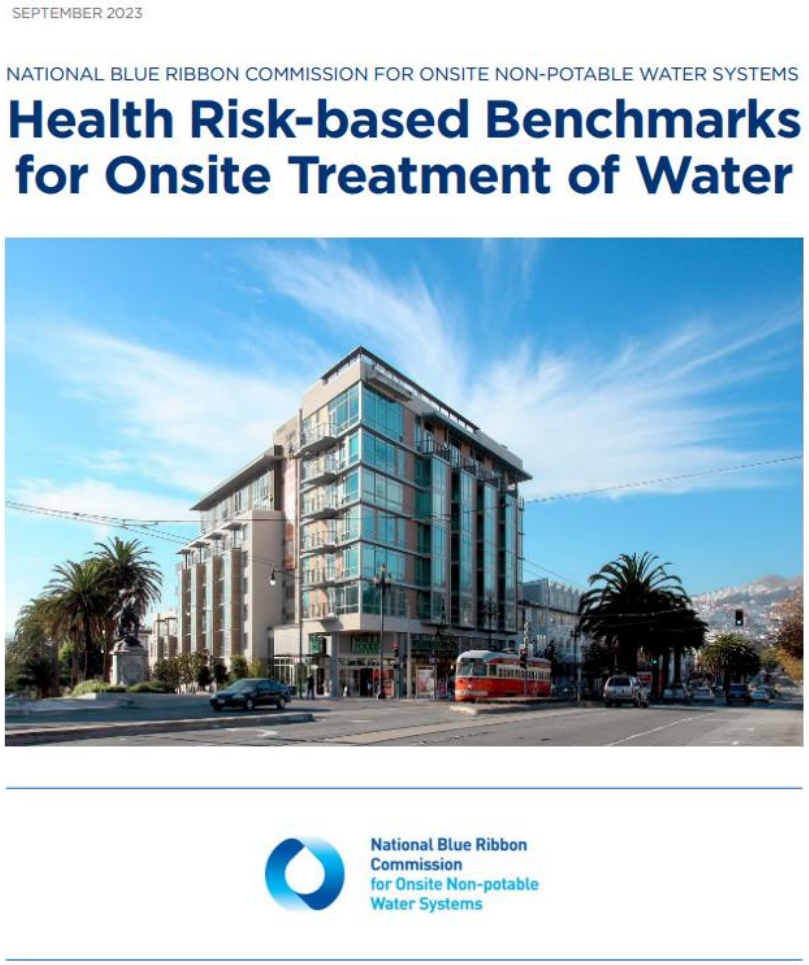
National Blue Ribbon Commission for Onsite Non-potable Water Systems

NBRC Adopts Health Risk-based Framework for Onsite Water Treatment Systems in 2017

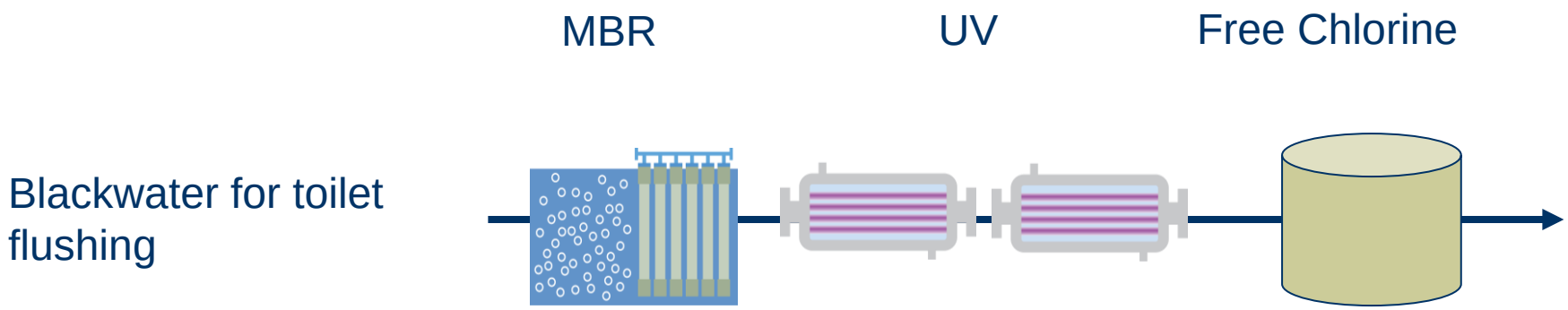
- Risk-based framework focusing on health consequence of exposure to a water source with appropriate treatment and online monitoring
- Shift from end-point monitoring (coliform) to risk-based framework
- Infection-based risk framework seeks to limit the infections on the exposed population (<1 in 10,000 per person per year)
- Established log reduction targets (LRTs) for bacteria, protozoa, and virus tailored to specific water quality challenges with onsite treatment systems

Since 2017, Additional Data and LRTs

- Updated infection-based LRTs
- California LRTs
- DALY-based LRTs
- *EPA State of the Science: Fit-for-Purpose QMRA Framework for Water Reuse Applications* with an anticipated publishing in 2024



Achieving LRTs with Appropriate Treatment Train and Online Monitoring



Continuous monitoring required:

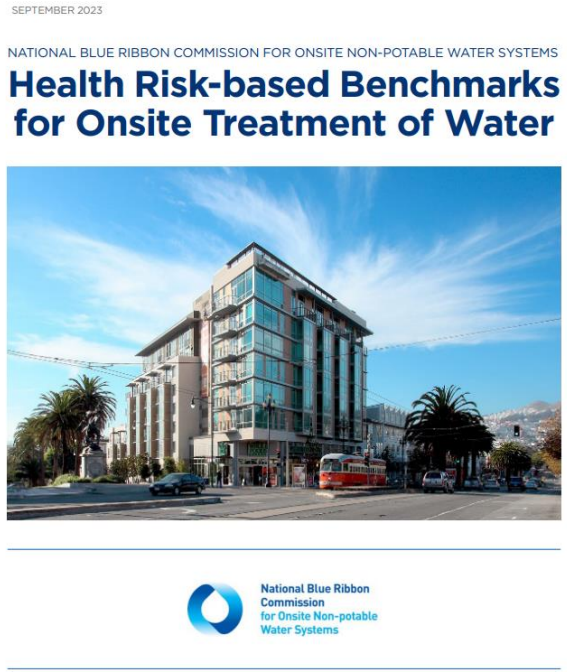
- MBR: Online monitoring of turbidity
- Online monitoring of UV intensity
- Online chlorine analyzer and flow meter

Jurisdictions Moving Forward with Health Risk-Based Approach (LRTs)

- San Francisco Ordinance
- Colorado, Regulation #84
- California, Senate Bill 966
- Hawaii House Bill 444
- Washington State House Bill 1184
- Minnesota and Washington, D.C Guidance
- Austin, Texas
- Alaska, New Mexico, Oregon and NYC

- Some states in US moving ahead with infection-based benchmarks, others with DALY
- Similar treatment trains
- Oversight by states or local communities

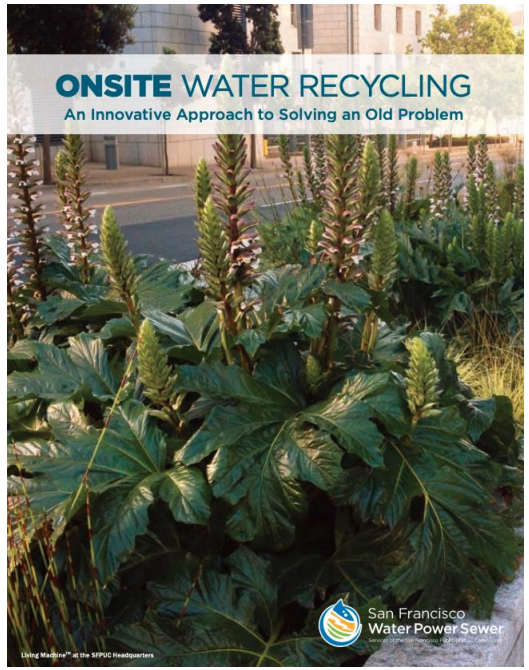
Resources for Onsite Water Recycling



Health Risk-based Frameworks

Step-by-Step Guide to Set up a Local Program

Guidance Manual



E-book with Case Studies

Market Transformation

- More technology providers
- Treatment systems: ROI less than 10 years
- Skid-mounted treatment systems
- Online monitoring and remote operations
- Incorporate resource recovery (heat exchangers, nutrient recovery, etc.)

Additional Work Underway by NBRC

- Addressing lack of skilled operators by developing a national certificate program
- Working with IAPMO, ICC and NSF to align LRTs
- Updated LRT table for NBRC

Work Underway by SFPUC for Single Family Applications

- Explore additional opportunities to further reduce potable water with new technologies in single family homes

- SFPUC assessing technologies:
  - Recirculating shower
  - Recirculating water in clothes washers
  - Single family graywater systems

- Hosted webinar October 19th to communicate “state of the science” for single family water reuse applications

- Organize an Independent Expert Advisory Panel to assess feasibility for San Francisco

Vision for the Future

- **Broad Acceptance**: onsite water recycling systems “just another appliance” in apartment building, office, industrial and individual homes
- **Reduced Costs/Energy**: market transformation to enable all communities to participate
- **Improved Monitoring**: increase online monitoring for more autonomous systems and plug and play systems
- **Expand Resource Recovery**: treatment systems on a decentralized scale produce other resources, such as energy, nutrients, drinking water

Thank You

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www.sfpuc.org/npo

www.watereuse.org/nbrc