WELCOME TO THE WATER REUSE SUMMIT

#WATERREUSESUMMIT
#GOALNETZEROWATER
#WILLIAMJWORTHENFOUNDATION

SENATOR SCOTT WIENER

CALIFORNIA, DISTRICT 11

OPENING KEYNOTE

WILLIAM "BILL" STRANG

PRESIDENT OF OPERATIONS AND ECOMMERCE

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

LEARNING OBJECTIVES - AIAWJWF10A – SELF REPORTING

Session Qualifies for 2 LUs

1. Identify what team members you need for a project that wants to incorporate a water reuse strategy

2. Identify the process to assess which water strategy is ideal for a project

3. Talk about the benefits of using the right water for the right job

4. Describe the differences between graywater, blackwater, and “fit for purpose” supply

WATER REUSE FOR DESIGNERS

MODERATOR: DR KARA NELSON, PROFESSOR, CIVIL AND ENVIRONMENTAL ENGINEERING, U.C. BERKELEY / ASSOCIATE DEAN FOR EQUITY AND INCLUSION, COLLEGE OF ENGINEERING

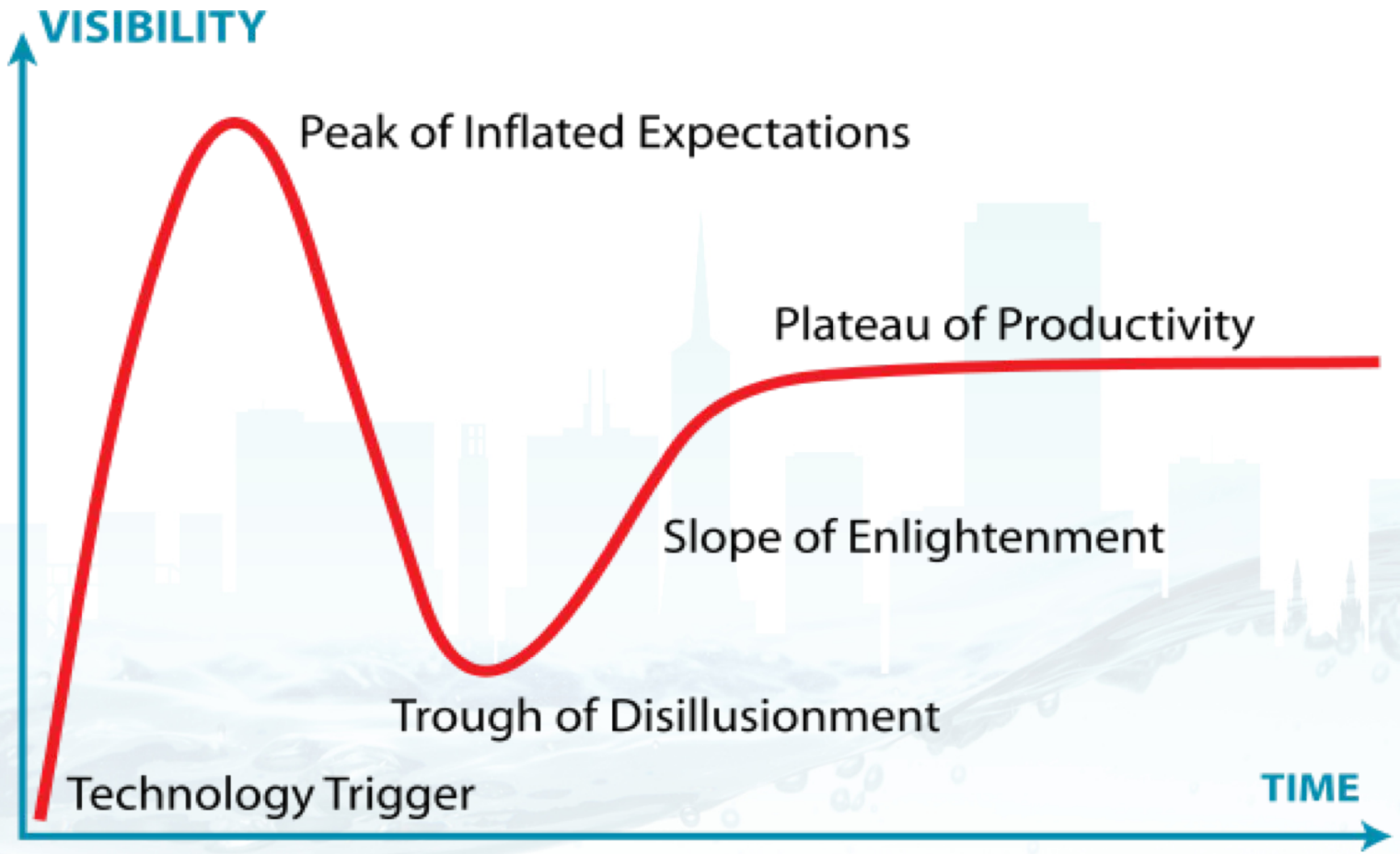
DANNY MURTAGH, VP ENGINEERING, BOSTON PROPERTIES, SF REGION

BRIAN PECSON, PRINCIPAL ENGINEER, TRUSSELL TECHNOLOGIES

PIPER KUJAC, DIRECTOR OF PROJECT MANAGEMENT, URBAN FABRICK INC

SYSTEM ELEMENTS

CAN WE AVOID THE HYPE CYCLE?

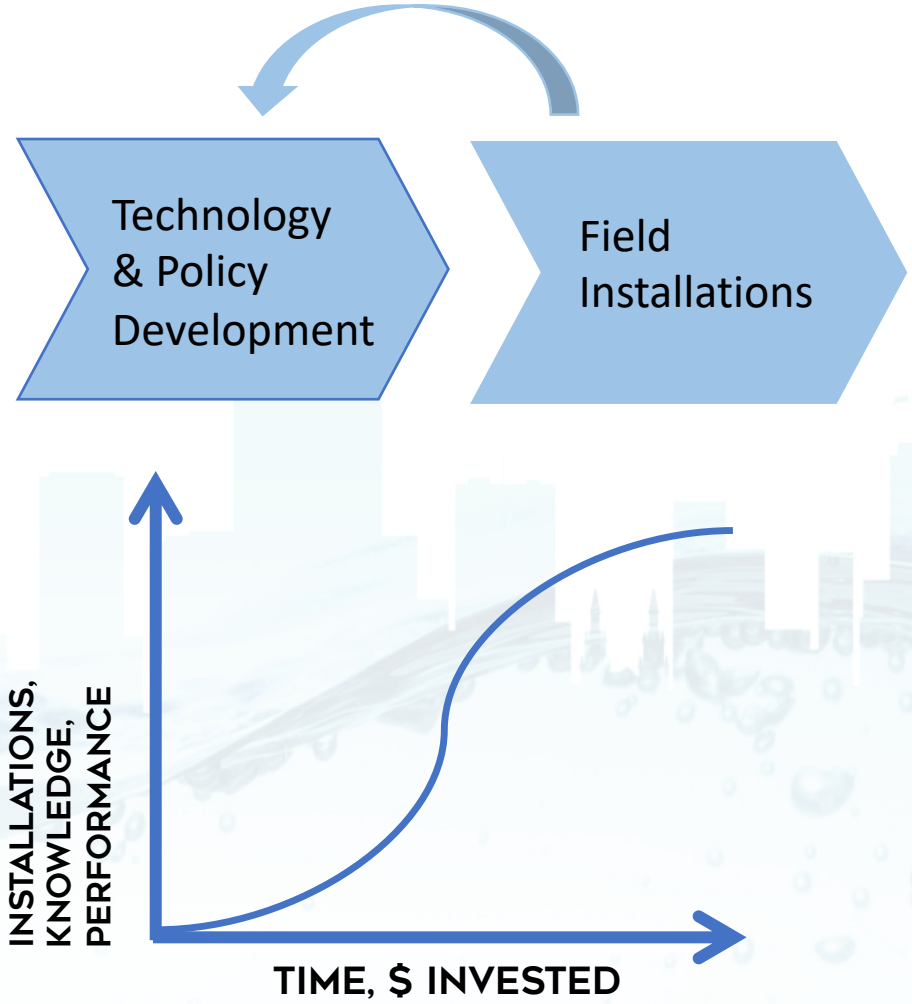


GARTNER HYPE CYCLE (IMAGE FROM WIKIPEDIA)

SAN FRANCISCO: AN EMERGING INNOVATION ECOSYSTEM?

COMPONENTS OF A HEALTHY INNOVATION ECOSYSTEM FOR TRANSITION OF SOCIO-TECHNICAL SYSTEMS

- EARLY ADOPTERS EMBRACE LEARNING
- VIEW "FAILURE" AS OPPORTUNITY
- SHARING OF KNOWLEDGE
- RAPID ITERATION
- COMPETITION AMONG TECHNOLOGIES
- PARTNERSHIPS BETWEEN:
  - BUILDING DEVELOPERS/OWNERS
  - ARCHITECTS/DESIGNERS
  - ENGINEERS
  - TECHNOLOGY PROVIDERS
  - GOVERNMENT AGENCIES
  - ADVOCACY GROUPS
  - ACADEMICS

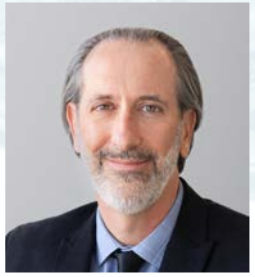


WATER REUSE FOR OWNERS

MODERATOR: DR ELIZABETH DOUGHERTY, EXECUTIVE DIRECTOR, WHOLLY H20

AMELIA LUNA, INNOVATION PROJECT MANAGER, SHERWOOD DESIGN ENGINEERS

ROBERT DUSENBURY, PRINCIPAL, LOTUS WATER



JOEL STOUT, VICE PRESIDENT, BUILDING SUSTAINABILITY PRACTICE
THORNTON TOMASETTI

Owner's Panel

The why, who, what, how and when of onsite non-potable water

Amelia Luna, Sherwood Design Engineers

Agenda

- Why: Rationale
  - Whether required or desired there you need a reason!
- Who: Project Stakeholders
  - Does my project have an onsite reuse opportunity?
- What: Project Scale
  - Does reuse at a building, site or district scale make the most sense for this project?
- How: Financial Feasibility
  - Is there a financial model best suited to my project?
- When: Future Readiness & Phasing
  - How does the timeline for my project align with other water infrastructure improvements planned?

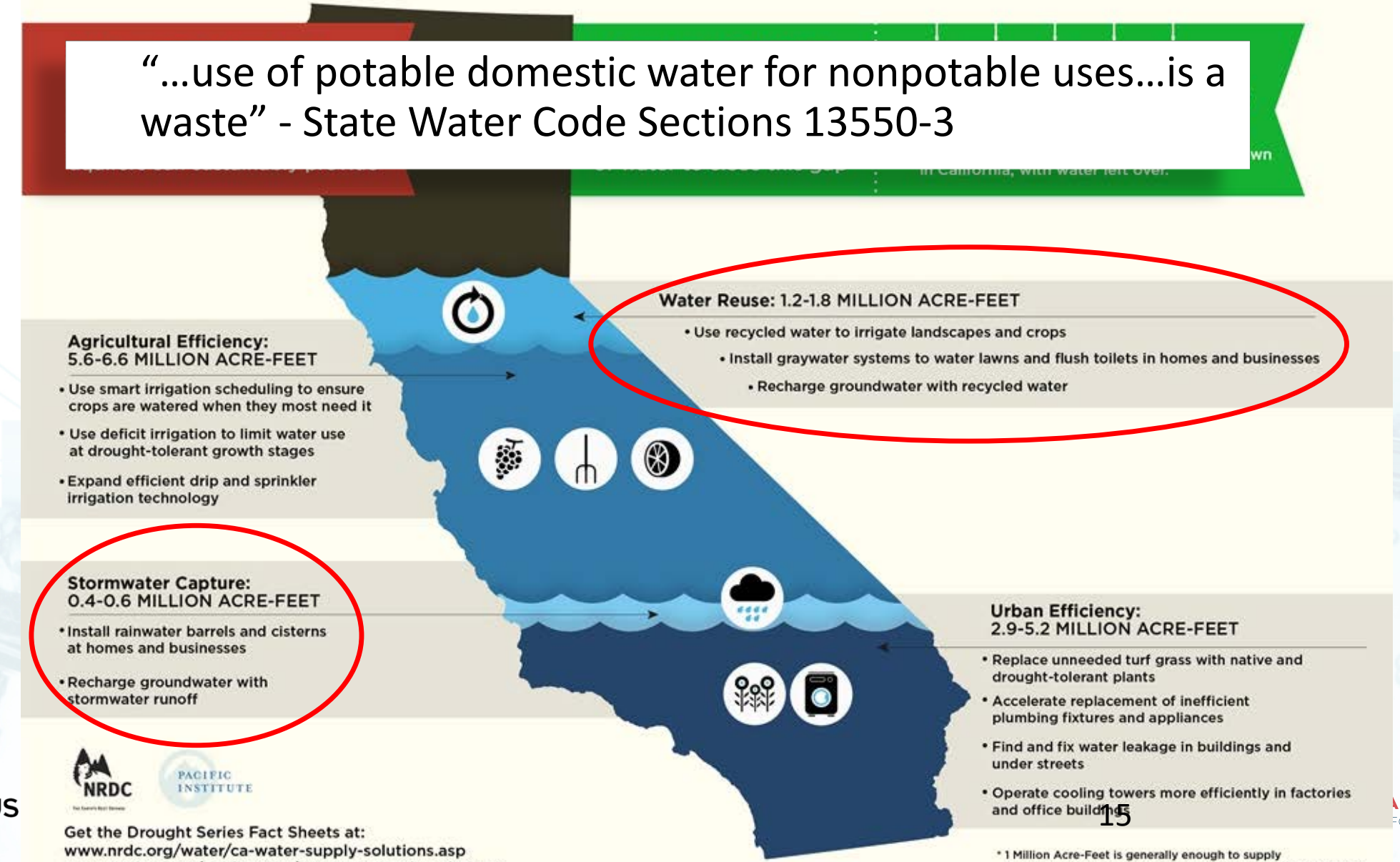
The Why

Why should you seize the opportunity for onsite water reuse?

Reliable & safe alternative to potable water

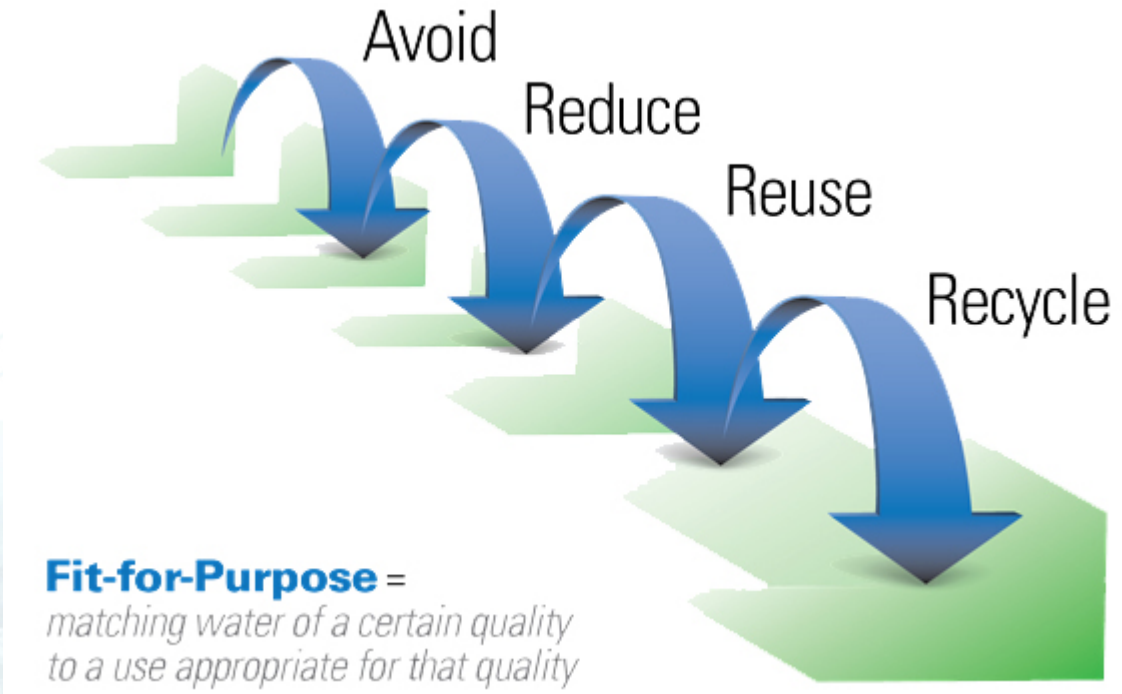
non-potable water for non-potable uses

"…use of potable domestic water for nonpotable uses…is a waste" - State Water Code Sections 13550-3

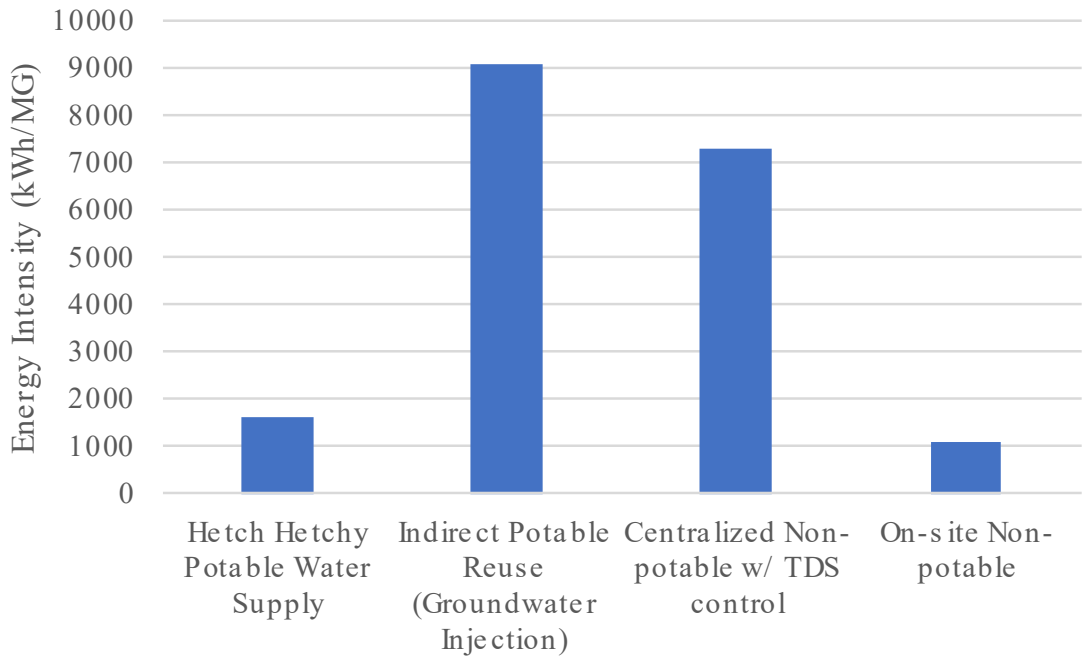


Fit-for-purpose water reuse

a critical step in the transition to a "one water" society

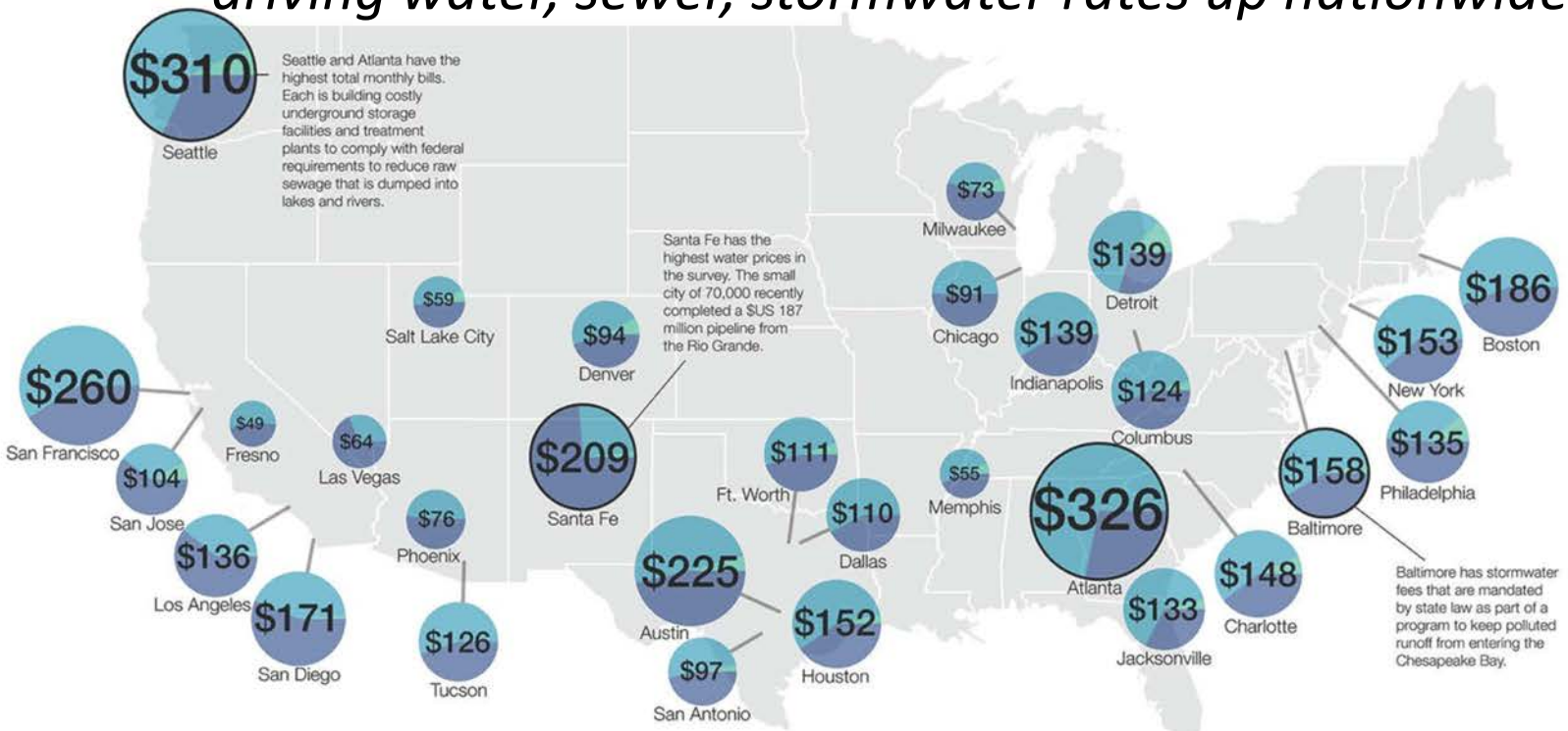


Graphic credit: Water Online/Art Umble



Cost of Infrastructure

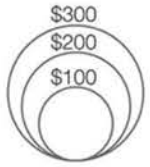
reinvestment in centralized infrastructure is driving water, sewer, stormwater rates up nationwide



Graphic credit: Circle of Blue

THE PRICE OF WATER: 2015

Combined water, sewer and stormwater prices for households in 30 major U.S. cities.



Water prices pay for treating, pumping, and delivering water, while sewer prices cover the cost of cleansing the water that goes down the drain.

Sewer prices are often higher than water prices because more energy and chemicals are required for treatment. Following the Clean Water Act, the federal government gave grants for new treatment plants during the 1970s and 1980s. Over the past three decades, however, new spending has been cut for local sewer infrastructure.

Stormwater fees are not included in every city's monthly bill. Some cities use general tax revenues to pay for projects to reduce polluted runoff from streets and parking lots. However, these projects must then compete for funds with other departments like police and schools.

Flexible integration into the built environment

centralized wastewater treatment plants
are becoming increasingly space constrained

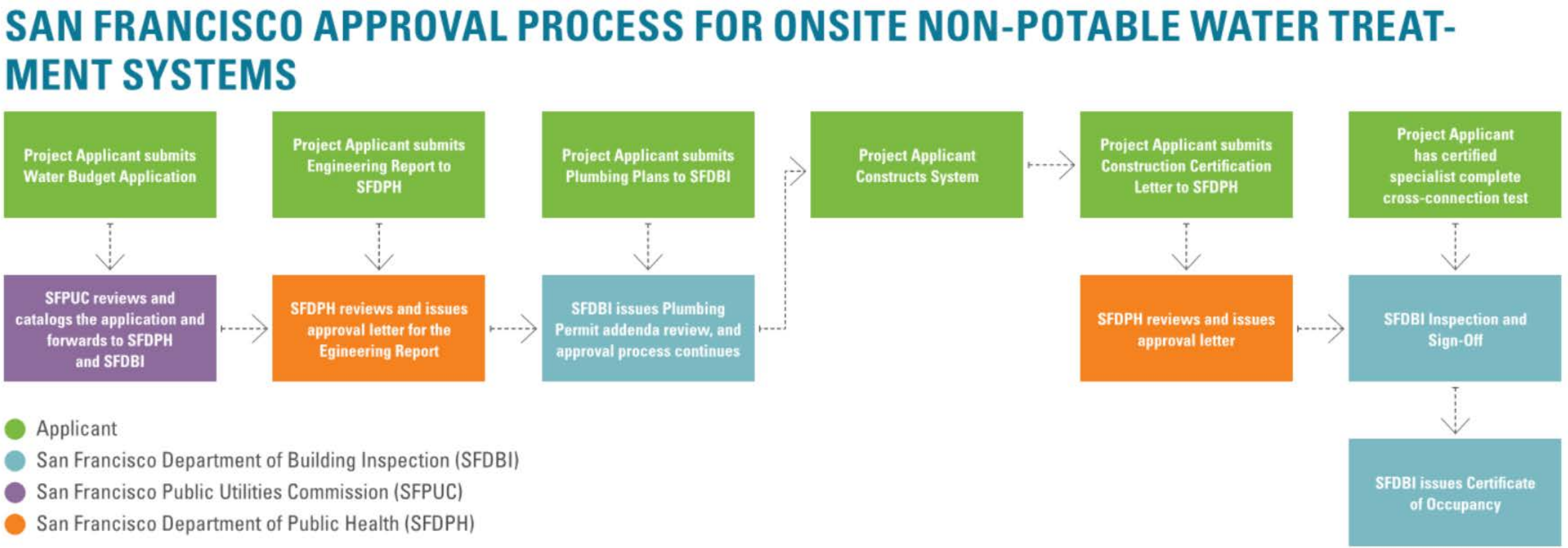
Your Development

- Insulation from market volatility
- Potential to reduce connection fees
  - e.g., San Francisco credit for potential water meter size reduction
- Redundant water supplies build resilience into your development
- Return on investment
  - Potential to make the business case – at the right scale, market conditions
  - Lifecycle costs over longer time horizon (if applicable)
- Development benefits
  - Increase allowable density (floor area ratio)
  - Meet sustainability targets

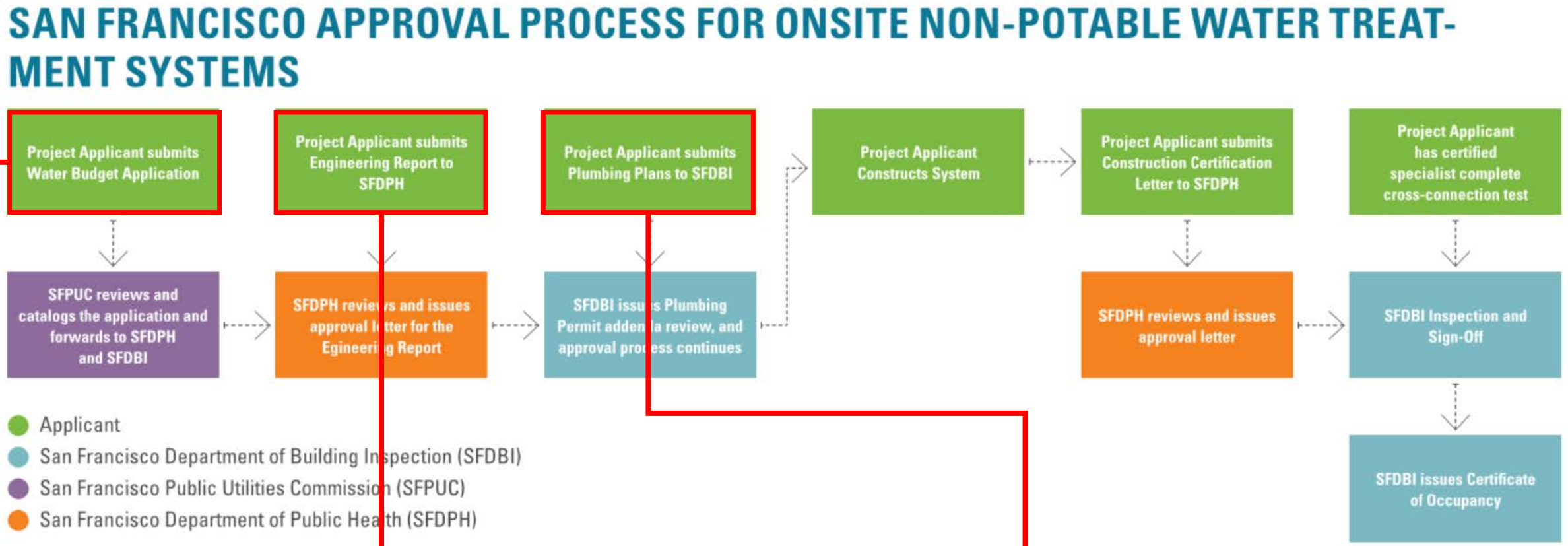
The Who

Who are the stakeholders?

Approval process - SF



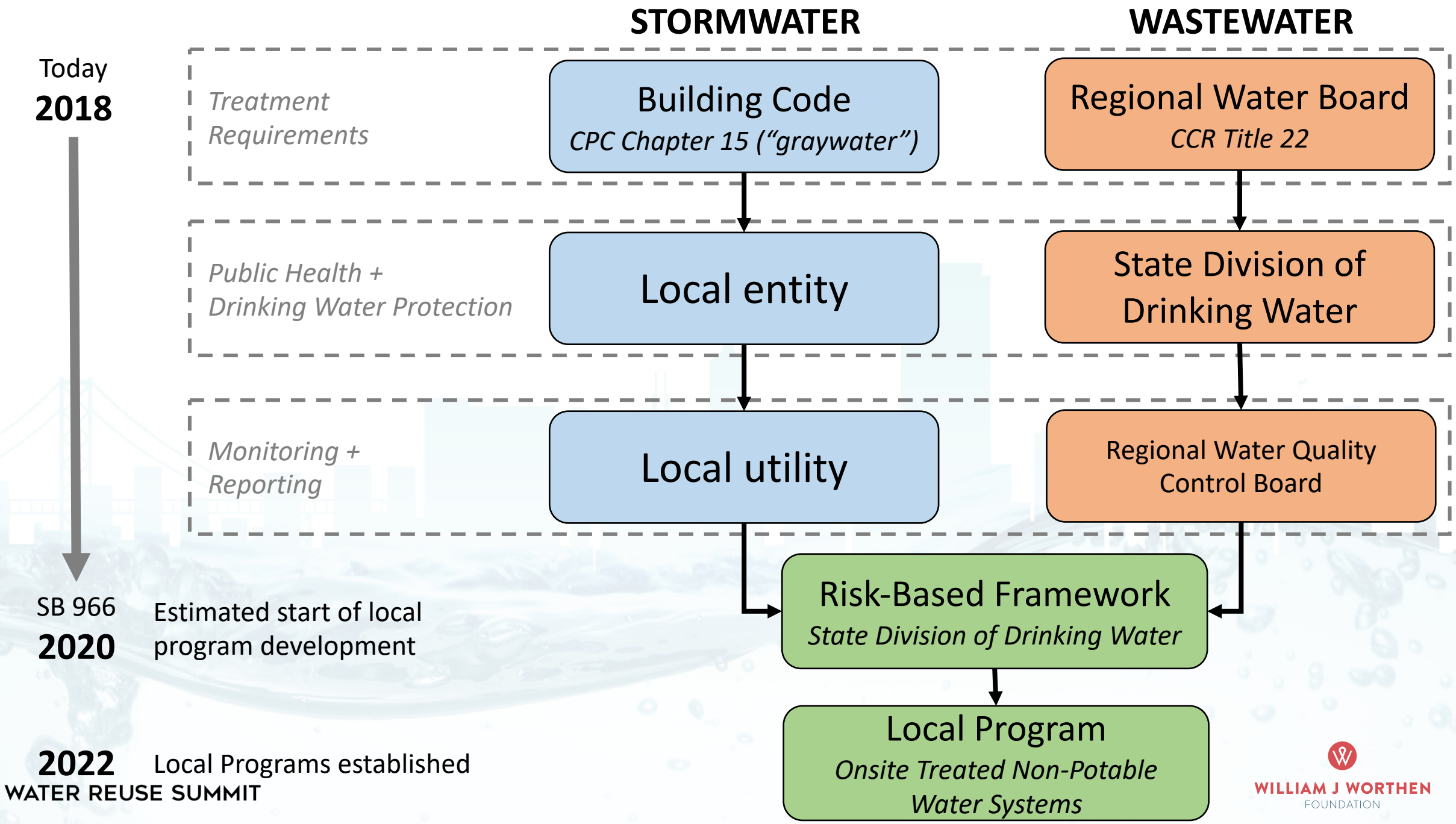
Design team needed



Integrated water management

Environmental / wastewater treatment design

Plumbing plans coordinated with NP water system design


STORMWATER
WASTEWATER
Today
2018
Treatment Requirements
Building Code
CPC Chapter 15 ("graywater")
Regional Water Board
CCR Title 22
Public Health + Drinking Water Protection
Local entity
State Division of Drinking Water
Monitoring + Reporting
Local utility
Regional Water Quality Control Board
Risk-Based Framework
State Division of Drinking Water
Local Program
Onsite Treated Non-Potable Water Systems
SB 966
2020
Estimated start of local program development
2022
Local Programs established

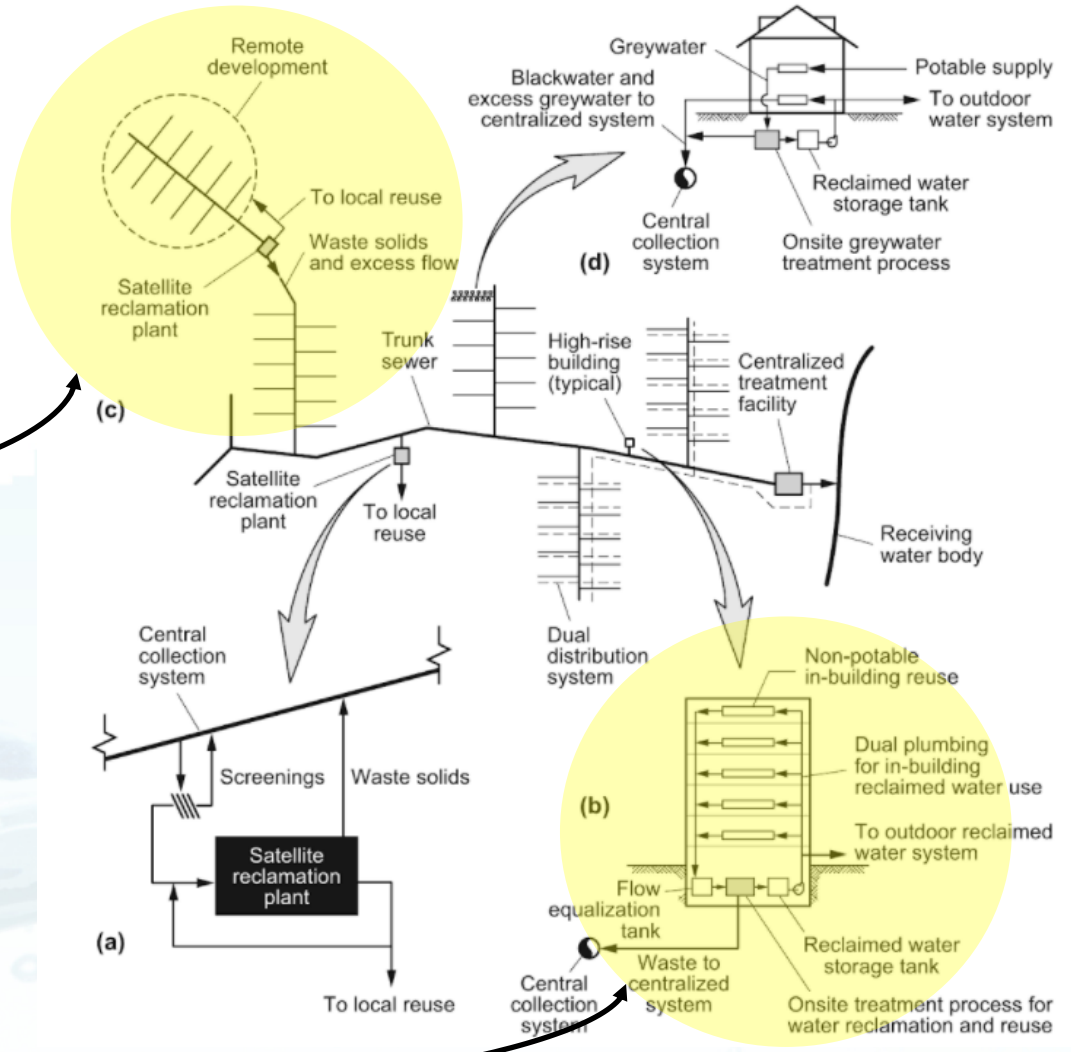
The What

What scale suits my development?

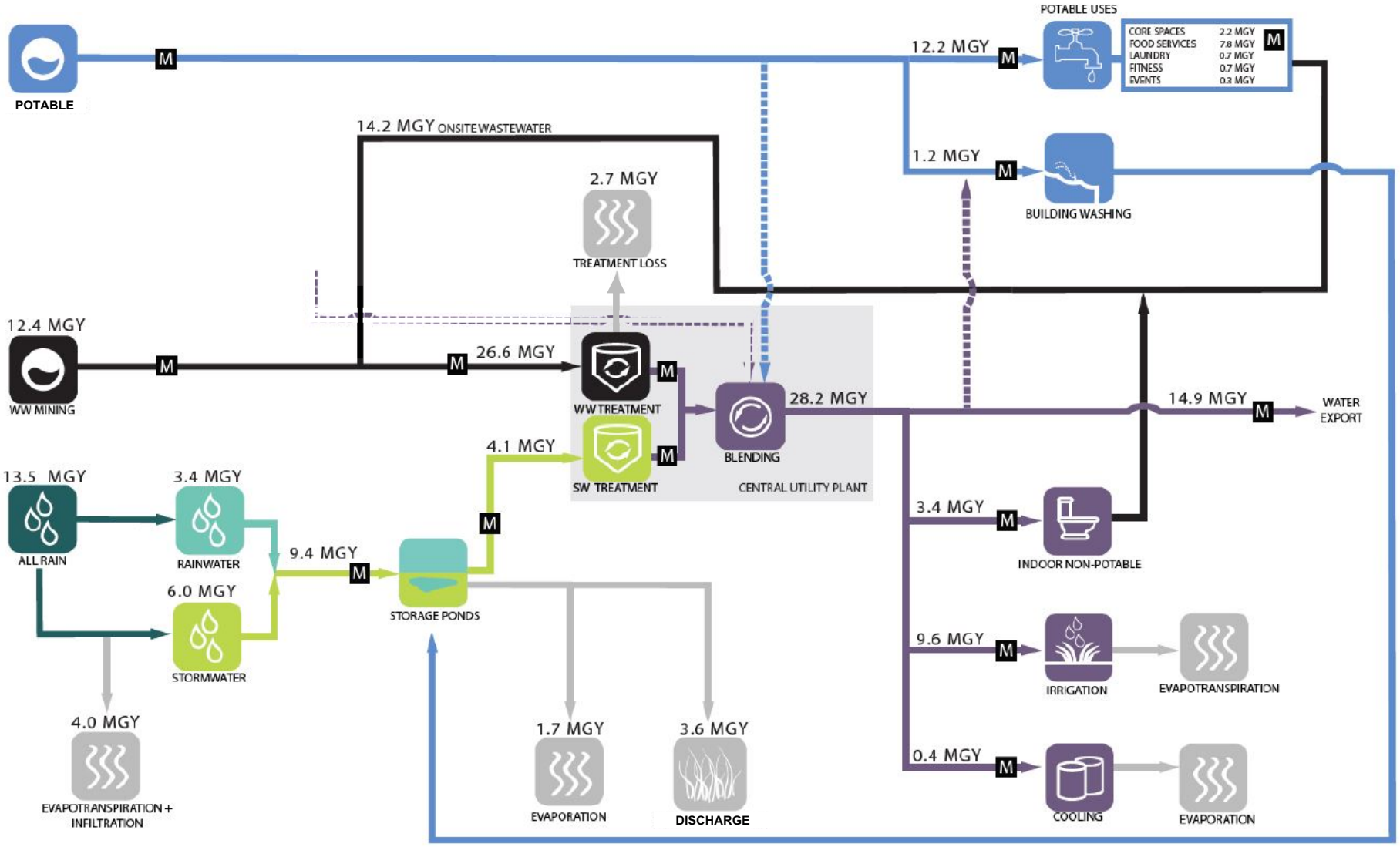
Satellite Non-Potable Water Systems

(c) upstream interception type

(b) commercial building interception type



Water Balance Concept



Process Design Approach

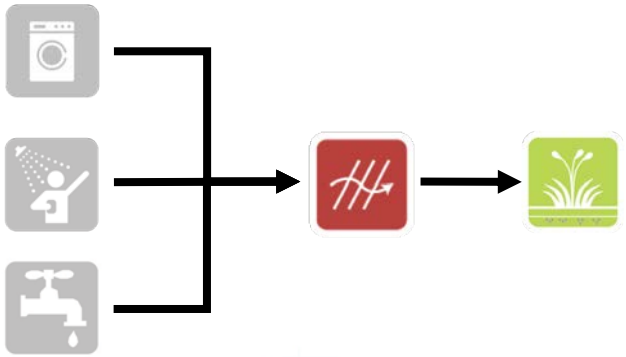
Full Time Equivalents (FTE)
x Daily Flows

FTE Dwell Time x Daily Load

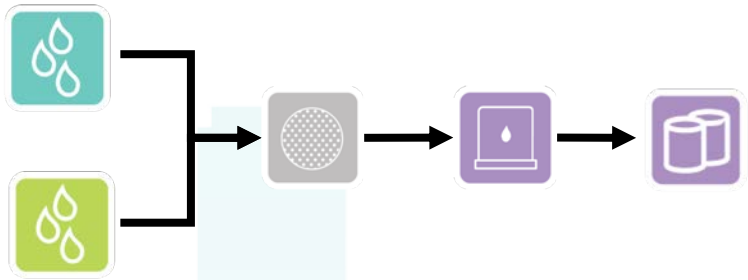
Wastewater Characterization
(anticipated constituent concentration)

What is the opportunity?

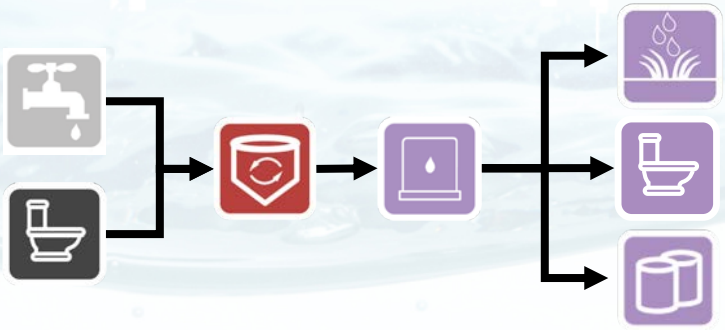
RESIDENTIAL BUILDING: graywater can be separately drained, filtered and reused for subsurface irrigation.



COMMERCIAL BUILDING: Precipitation can be harvested, treated, stored and reused as makeup for evaporative cooling applications.



SITE: Wastewater from buildings can be treated and reused to irrigate landscapes, flush toilets and provide cooling makeup.



DISTRICT: Wastewater can be mined from a nearby sanitary sewer, treated and reused to irrigate crops and golf courses.

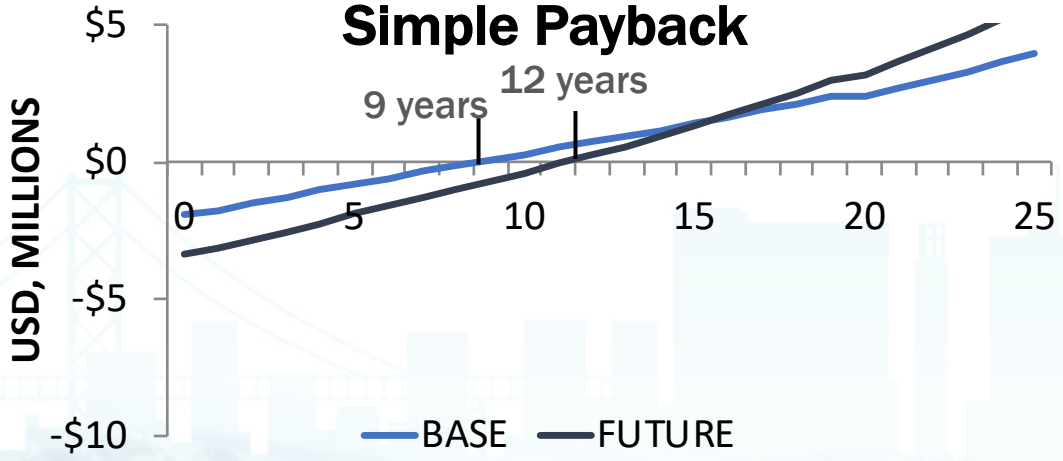
The How

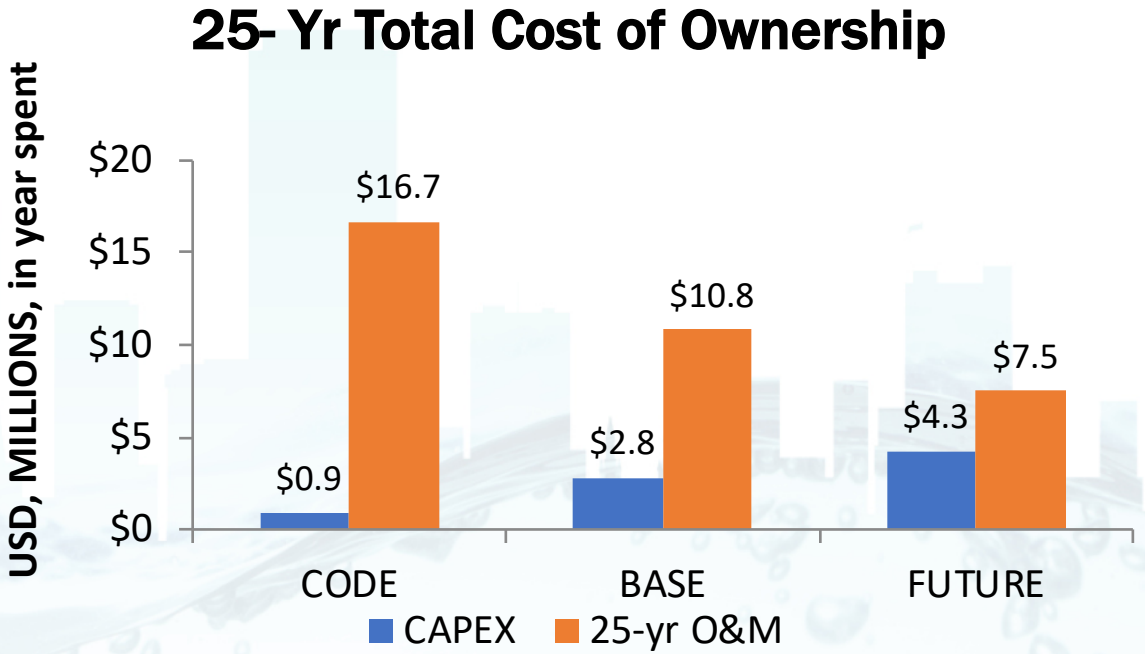
How will I pay for this investment?

How will I pay for this investment?

- Review true delta between “business as usual” and ONWS
  - e.g., cost of stormwater compliance
- Assess whether lifecycle costs are important for your development
  - If not, what costs can be recovered via water purchase agreement
- Determine first cost offsets
  - Identify incentives, connection fee discounts
- Articulate less tangible benefits
  - see “why” section
- Review water, sewer, stormwater rates
  - Create business case

Return on investment example

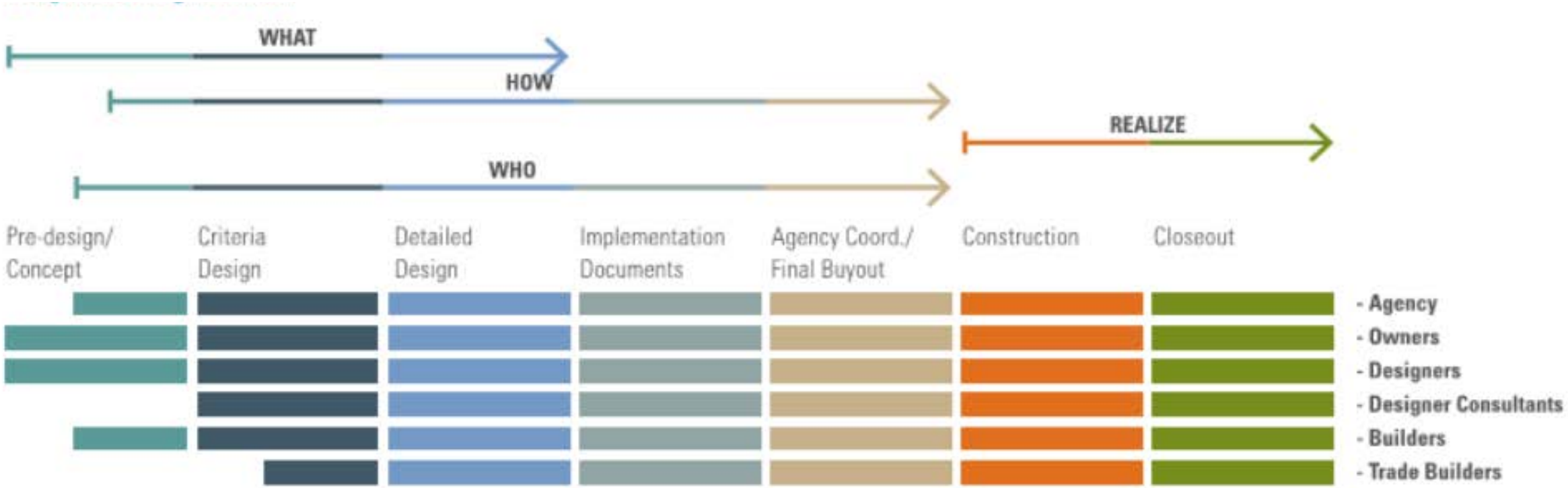




The When

When do I permit and build it?

Integrated project delivery now the standard



SHERWOOD
DESIGN ENGINEERS

Thank you!

Amelia Luna, Sherwood Design Engineers

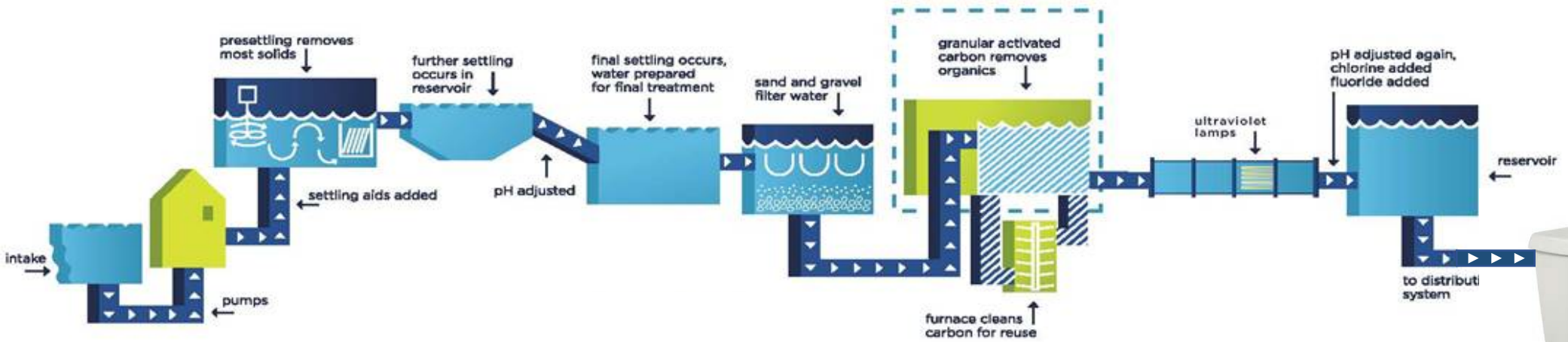
aluna@sherwoodengineers.com

Whetting the appetite for non-potable water projects

- **Coordination of water-related goals across design disciplines**
- **Architectural layout implications for graywater/blackwater systems**
- **How non-potable water benefits Owner's LEED certification goals**

Joel Stout, AIA, LEED AP
Thornton Tomasetti, Inc.

Making our drinking water clean and delicious

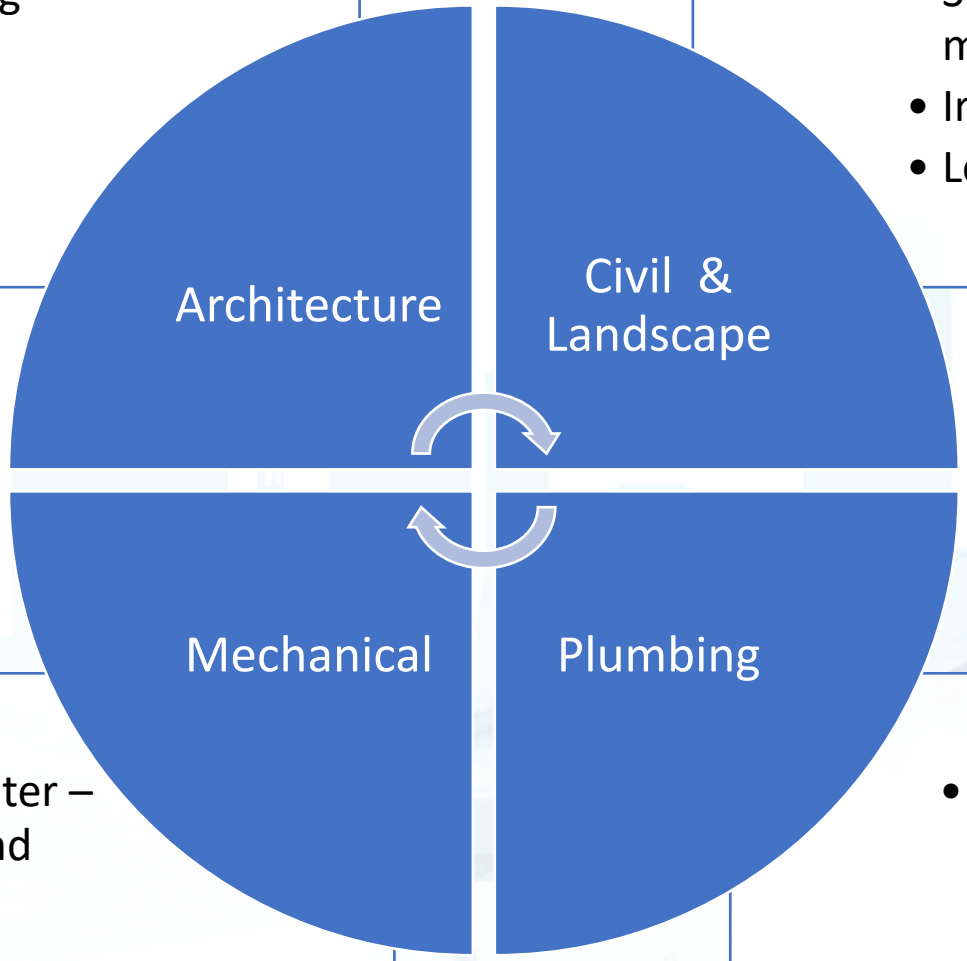


Flushed away

Coordination of on-site water-related issues

- Space planning
- Rainwater harvesting

- Stormwater management
- Irrigation
- Low-Impact design



- Equipment water – condensate and cooling tower

- Non-potable plumbing system – collection and distribution

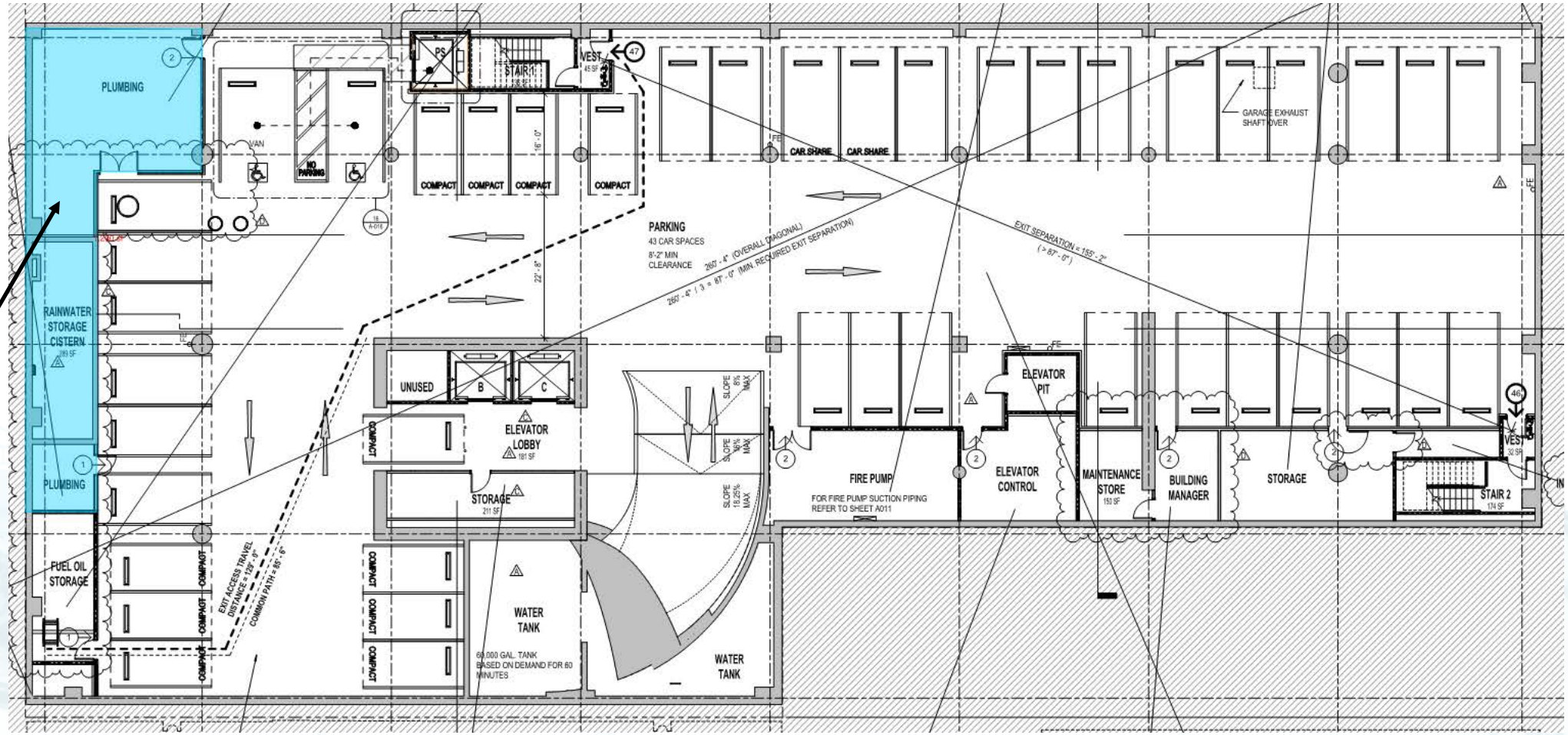

aquacell
PHOENIX

Core & Shell Office Space

Project GSF: 144,320

6 Stories

Level B2



1,230 GSF

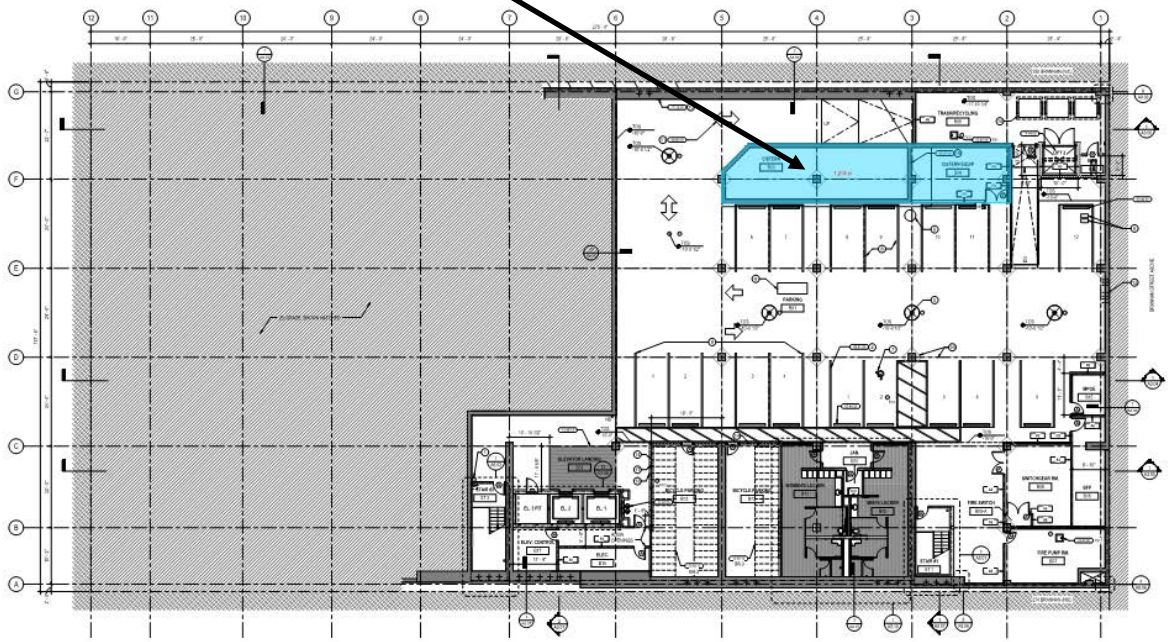
Core & Shell Office Space

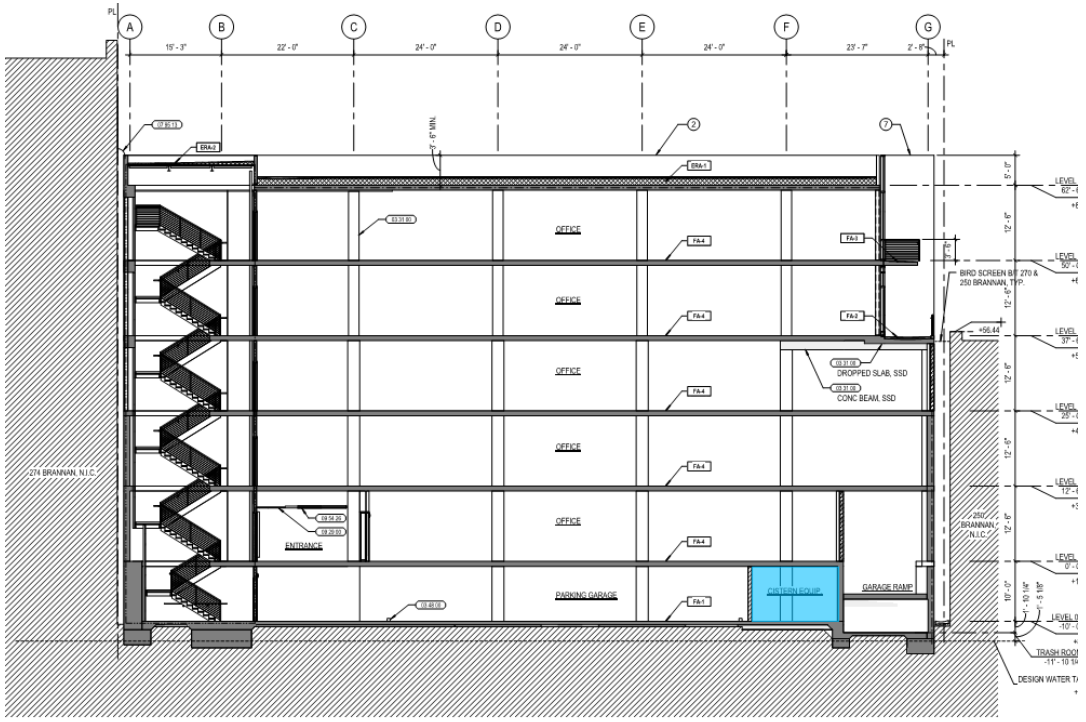
Project GSF: 189,000

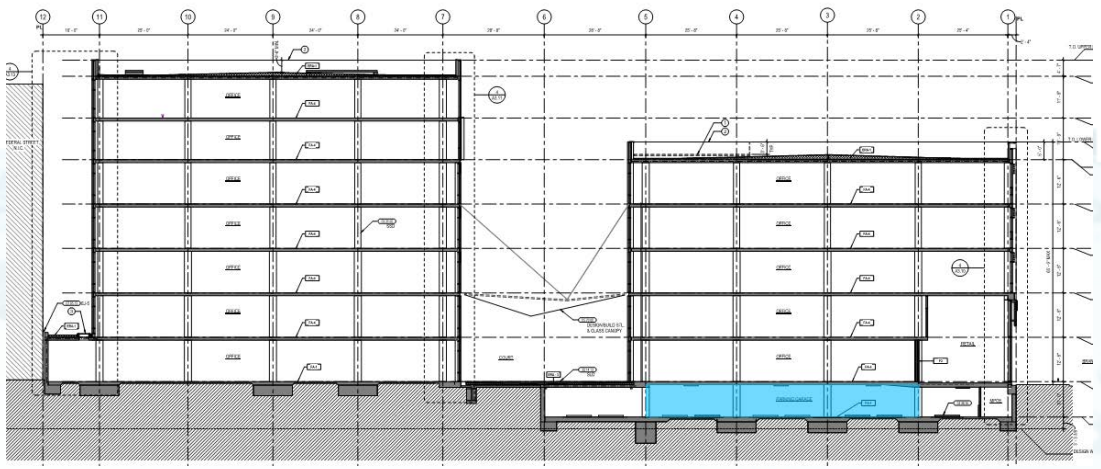
7 Stories

Basement

1,213 GSF







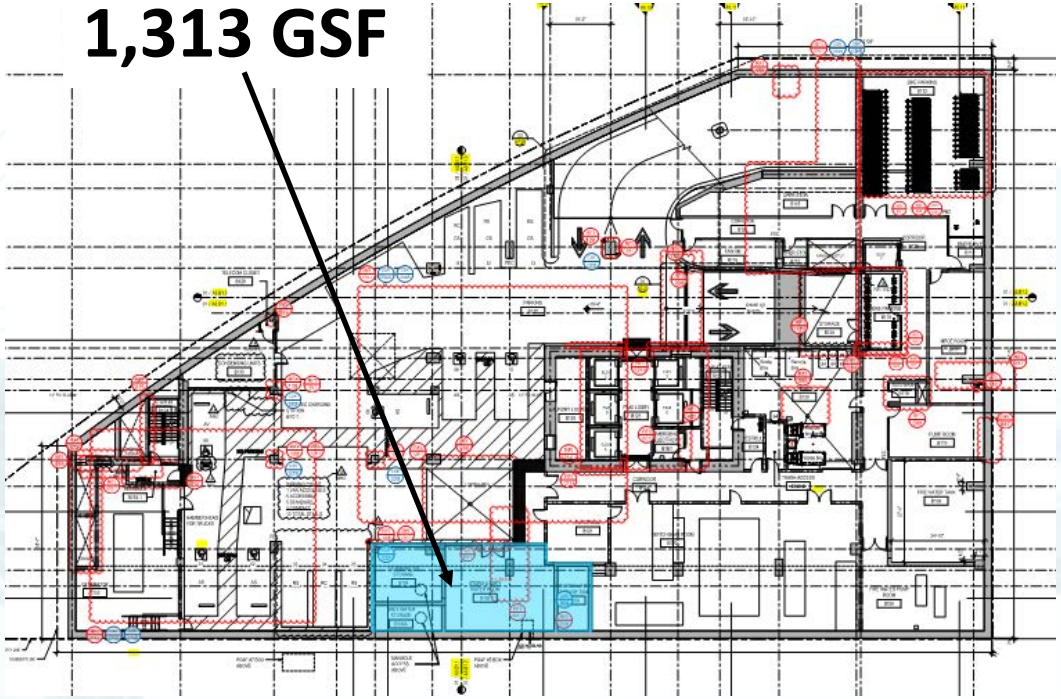
Highrise Residential

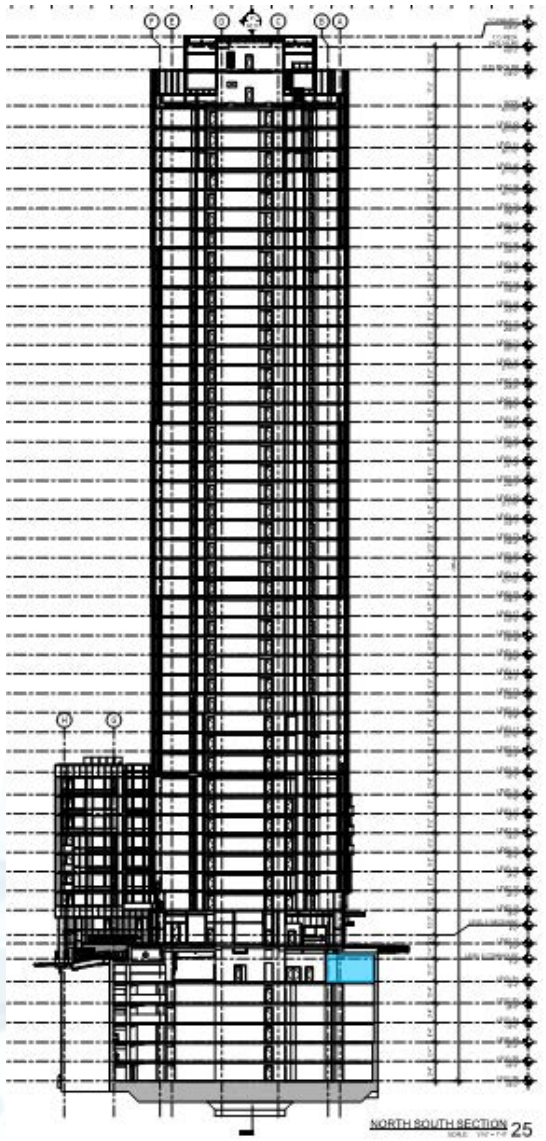
Project GSF: 551,736

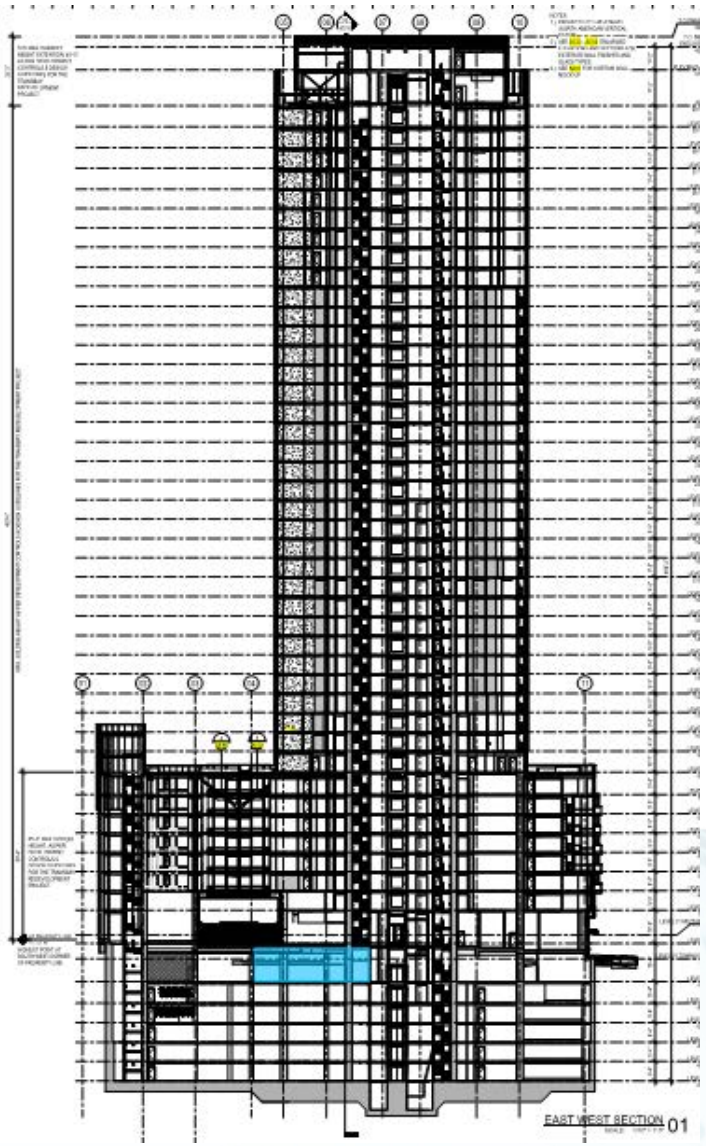
42 Stories

Level B1

1,313 GSF







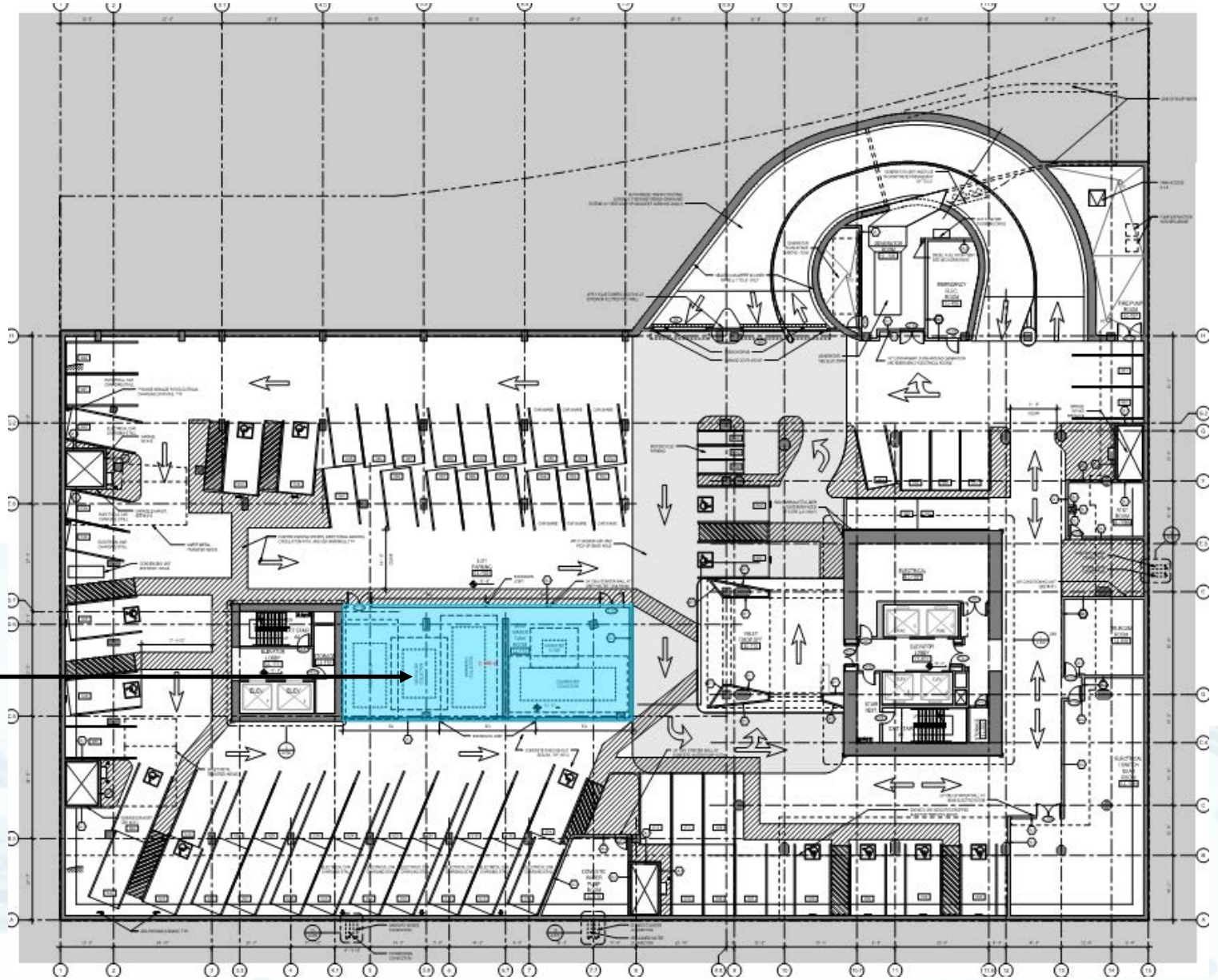
Highrise Residential

Project GSF: 663,673

40 Stories

Lower Level 01

2,148 GSF



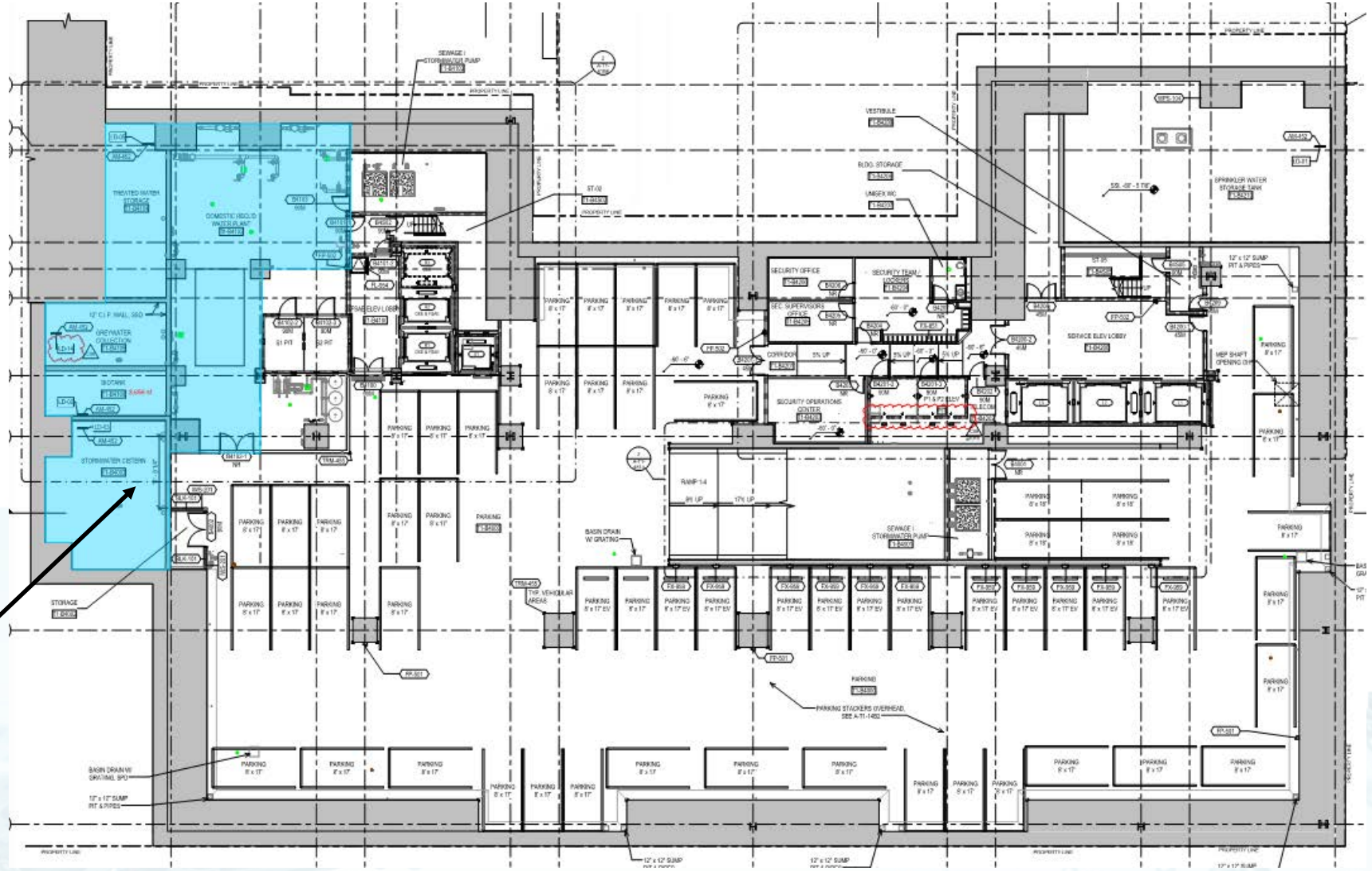
Mixed Use Office / Hotel / Residential

Project GSF: 2M

60 Stories

Basement Level 4

3,656 GSF



LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name: **POINTS FROM WATER REUSE**

Date:

Y	?	N			
			Credit	Integrative Process	1

0	0	0	**Location and Transportation**		16
			Credit	LEED for Neighborhood Development Location	16
			Credit	Sensitive Land Protection	1
			Credit	High Priority Site	2
			Credit	Surrounding Density and Diverse Uses	5
			Credit	Access to Quality Transit	5
			Credit	Bicycle Facilities	1
			Credit	Reduced Parking Footprint	1
			Credit	Green Vehicles	1

3	0	0	**Sustainable Sites**		10
Y			Prereq	Construction Activity Pollution Prevention	Required
			Credit	Site Assessment	1
			Credit	Site Development - Protect or Restore Habitat	2
			Credit	Open Space	1
3			Credit	Rainwater Management	3
			Credit	Heat Island Reduction	2
			Credit	Light Pollution Reduction	1

5	0	0	**Water Efficiency**		11
Y			Prereq	Outdoor Water Use Reduction	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
2			Credit	Outdoor Water Use Reduction	2
2			Credit	Indoor Water Use Reduction	6
1			Credit	Cooling Tower Water Use	2
			Credit	Water Metering	1

0	0	0	**Energy and Atmosphere**		33
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
			Credit	Enhanced Commissioning	6
			Credit	Optimize Energy Performance	18
			Credit	Advanced Energy Metering	1
			Credit	Demand Response	2
			Credit	Renewable Energy Production	3
			Credit	Enhanced Refrigerant Management	1
			Credit	Green Power and Carbon Offsets	2

0	0	0	**Materials and Resources**		13
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
			Credit	Building Life-Cycle Impact Reduction	5
			Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
			Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
			Credit	Building Product Disclosure and Optimization - Material Ingredients	2
			Credit	Construction and Demolition Waste Management	2

0	0	0	**Indoor Environmental Quality**		16
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
			Credit	Enhanced Indoor Air Quality Strategies	2
			Credit	Low-Emitting Materials	3
			Credit	Construction Indoor Air Quality Management Plan	1
			Credit	Indoor Air Quality Assessment	2
			Credit	Thermal Comfort	1
			Credit	Interior Lighting	2
			Credit	Daylight	3
			Credit	Quality Views	1
			Credit	Acoustic Performance	1

1	0	0	**Innovation**		6
1			Credit	Innovation	5
			Credit	LEED Accredited Professional	1

2	0	0	**Regional Priority**		4
1			Credit	Regional Priority: Specific Credit	1
1			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1

11	0	0	**TOTALS**	Possible Points:	110

Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110

One Water Approach

Achieving Multiple Objectives with Alternate Source Water Harvesting Systems in San Francisco

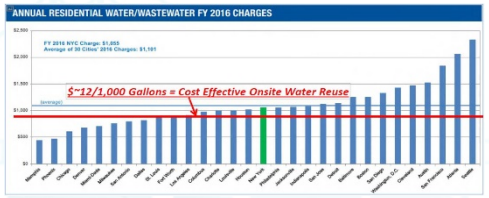
Why owners want to do it?

Resource Conservation

Regulatory Drivers

Potable offset requirements

Stormwater management requirements



Potential Savings (over the long term)

Marketability

Heat Exchange Potential (wastewater)

WILLIAM J WORTHEN FOUNDATION

Why owners don’t want to do it?

- Financial Requirements
  - Installation costs
  - Ongoing operations, maintenance, and monitoring

- Spatial Requirements
  - Tanks consume valuable space
  - Usually in basement or parking areas

- Technical and Operational Requirements
  - Specialized professionals
  - Integrate into building systems
  - Unique maintenance and monitoring

Relevant San Francisco Agencies

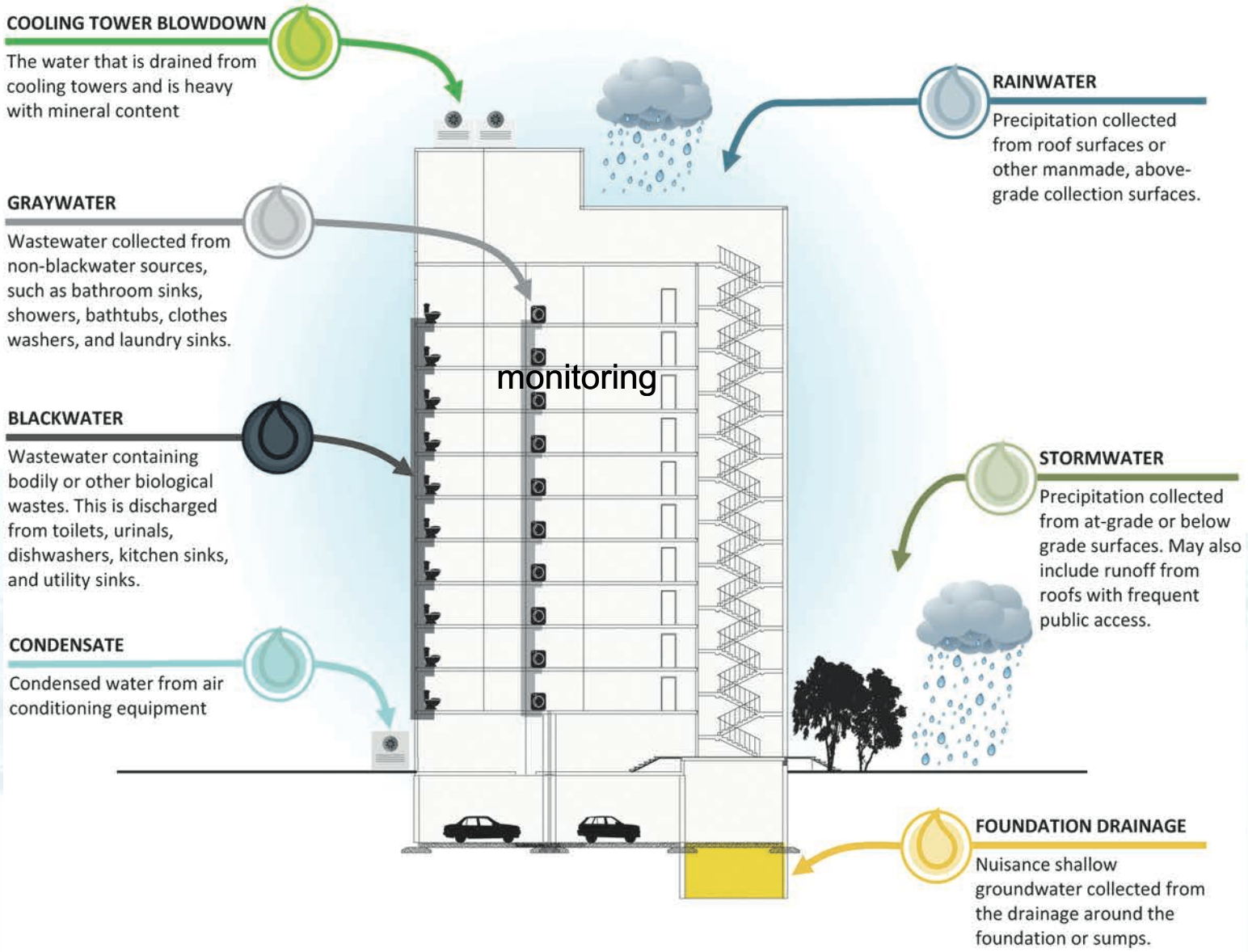
SFPUC	SFDPH	SFDBI
Program Administration and Cross-Connection Control	Public Health	Construction
Review onsite non-potable water supplies & demands Administer citywide project tracking & annual potable offset achieved Provide technical support & outreach to developers Manages Cross-Connection Control 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

Finding the System that Makes Sense for Your Project

Set specific goals based on general objectives

- Size for regulatory compliance
- Optimize for cost effectiveness
- Minimize long-term O&M burden

What are alternate water sources?



What makes a good alternate water source?

What makes a good alternate water source?

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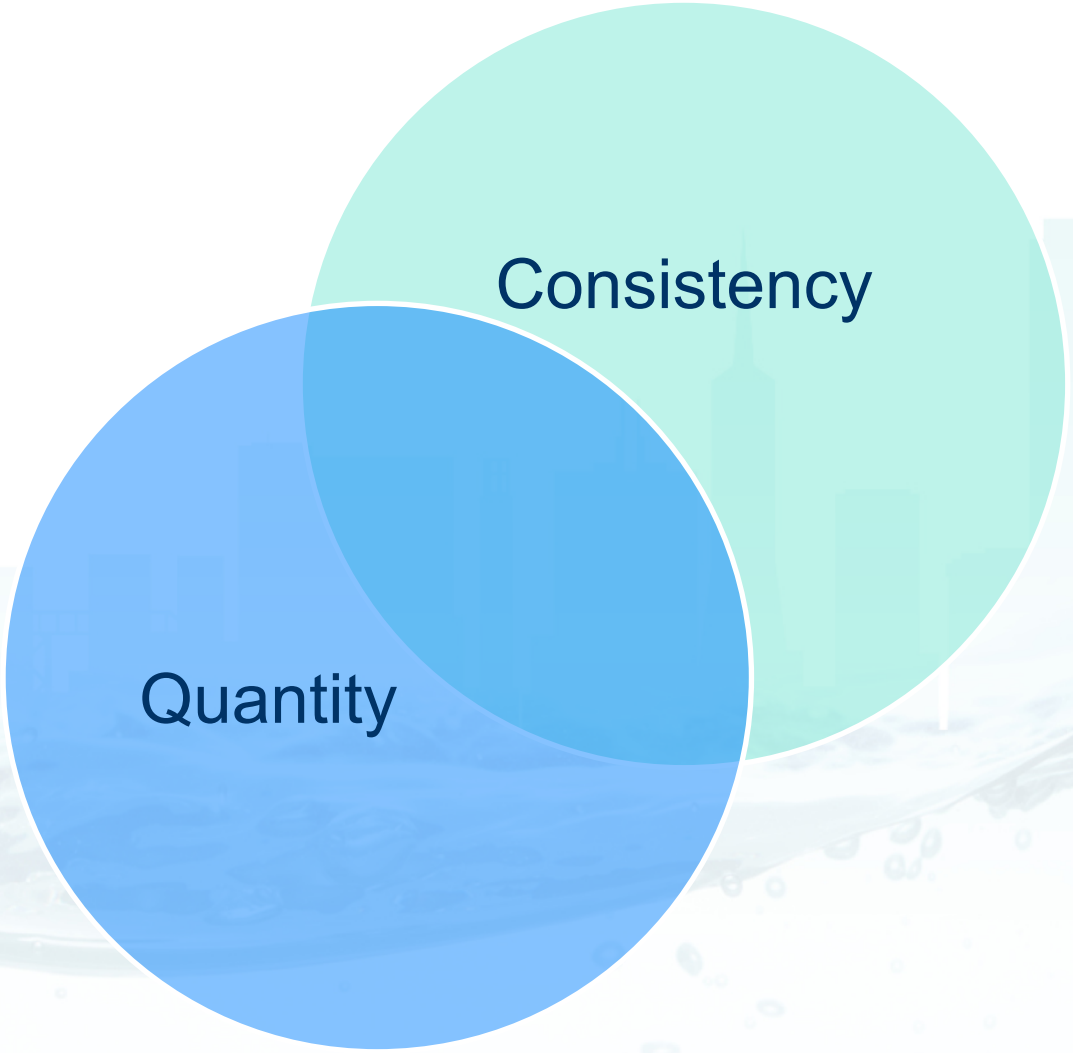
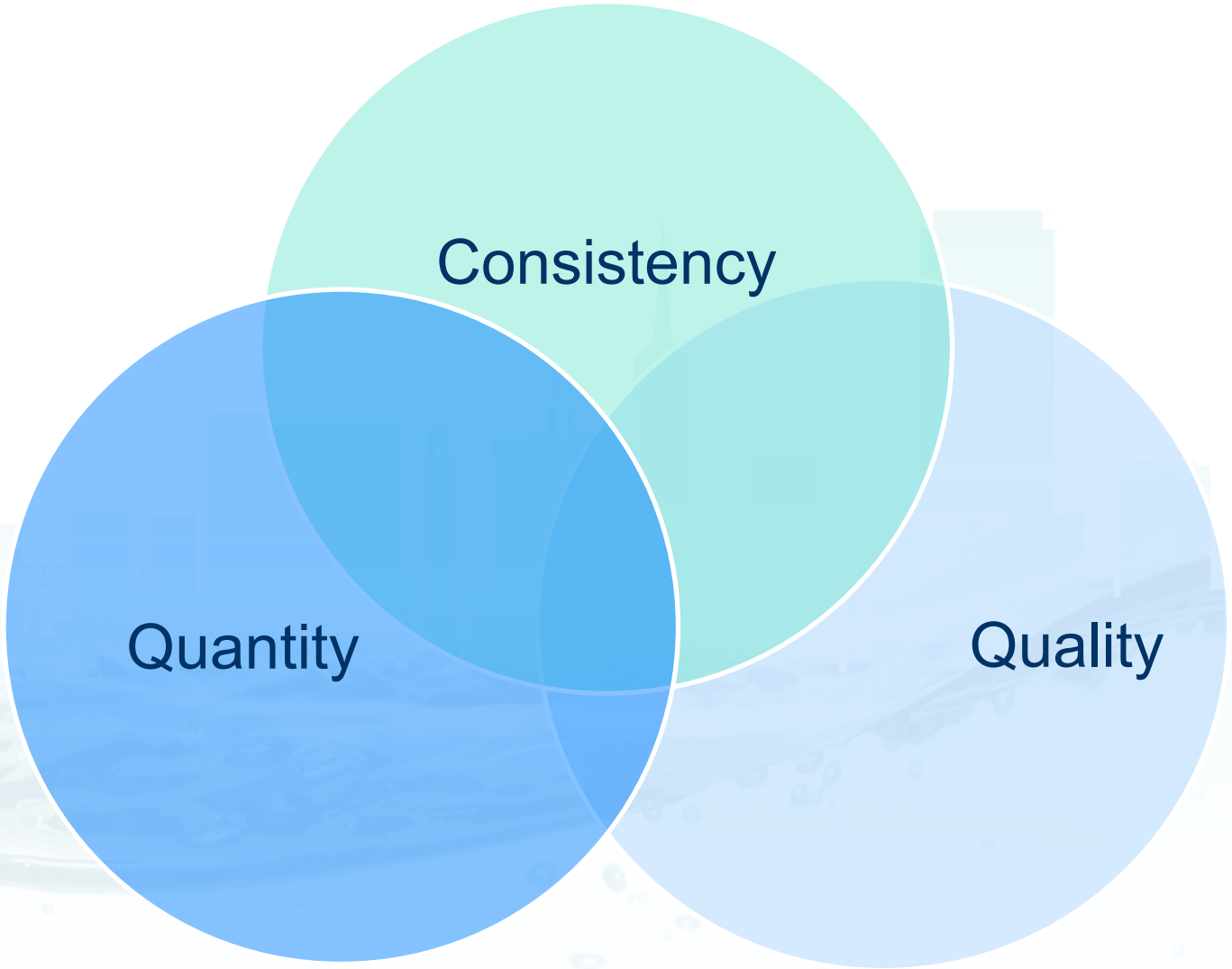


What makes a good alternate water source?



What makes a good alternate water source?

Water Quantity – Demand vs Supply

Typical Annual NPO Demand and Supplies					
Building Type	Building Use	Annual NPO Demand (MG/yr/acre)	Annual NPO Sources [MG/yr/acre (% of NPO Demand)]		
			Available Graywater	Available Rainwater	Available Blackwater
Low-Rise	Multi-Family Residential	1.56	5.84 (>100%)	0.36 (23%)	10.37 (>100%)
High-Rise	Multi-Family Residential	2.07	7.89 (>100%)	0.35 (15%)	14.02 (>100%)
Low-Rise	Mixed-Use Residential with Ground Floor Retail	0.62	1.65 (>100%)	0.36 (60%)	3.02 (>100%)
Mid-Rise	Mixed-Use Residential with Ground Floor Retail	1.05	3.52 (>100%)	0.34 (33%)	6.31 (>100%)
High-Rise	Mixed-Use Residential with Ground Floor Retail	1.94	7.03 (>100%)	0.32 (17%)	12.54 (>100%)
Low-Rise [1]	Commercial/Office	1.19	0.13 (11%)	0.47 (39%)	1.20 (>100%)
High-Rise [1]	Commercial/Office	1.54	0.17 (11%)	0.27 (17%)	1.57 (>100%)
District Scale	Residential	0.56	1.86 (>100%)	0.30 (53%)	3.30 (>100%)
District Scale	Mixed-Use Residential with Commercial/Office	2.11	6.28 (>100%)	0.24 (11%)	11.50 (>100%)

Note: 1) These building categories are the only two analyzed that cannot typically meet 100% of NPO demands using only graywater.

When does Rainwater Harvesting make sense?

RAINWATER

- Rainwater Harvesting has the greatest potential benefits for:
  - Commercial/Office sites with high non-potable demand (>4,000 gpd/acre)
  - Sites harvesting other sources that do not meet all NP Demand by themselves
- For projects where rainwater harvesting systems are less efficient (non-potable demand <2,500 gpd/acre), stormwater reduction is still achieved.

Building Type	Building Use	Rainwater Harvesting Potential (% of NP Demand)
Low-Rise	Multi-Family Residential	23%
High-Rise	Multi-Family Residential	15%
Low-Rise	Mixed-Use Residential/ Ground Floor Retail	60%
Mid-Rise	Mixed-Use Residential/ Ground Floor Retail	33%
High-Rise	Mixed-Use Residential/ Ground Floor Retail	17%
Low-Rise	Commercial/Office	39%
High-Rise	Commercial/Office	17%
District Scale	Residential	53%
District Scale	Mixed-Use Residential with Commercial/Office	11%

How much Foundation Drainage/Condensate/ Blowdown is enough?

Foundation Drainage / Condensate / Blowdown

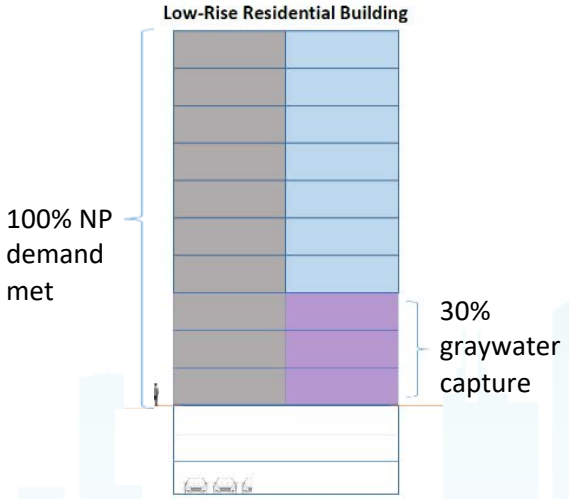
- When these sources are short of meeting 100% of NP demand, RWH can bridge a 20-45% shortfall.

Building Type	Building Use	Total Production (gpd/acre) needed to Meet NP Demand
Low-Rise	Multi-Family Residential	4,300
High-Rise	Multi-Family Residential	5,700
Low-Rise	Mixed-Use Residential/ Ground Floor Retail	1,700
Mid-Rise	Mixed-Use Residential/ Ground Floor Retail	2,900
High-Rise	Mixed-Use Residential/ Ground Floor Retail	5,300
Low-Rise	Commercial/Office	3,300
High-Rise	Commercial/Office	4,300
District Scale	Residential	1,600
District Scale	Mixed-Use Residential with Commercial/Office	5,800

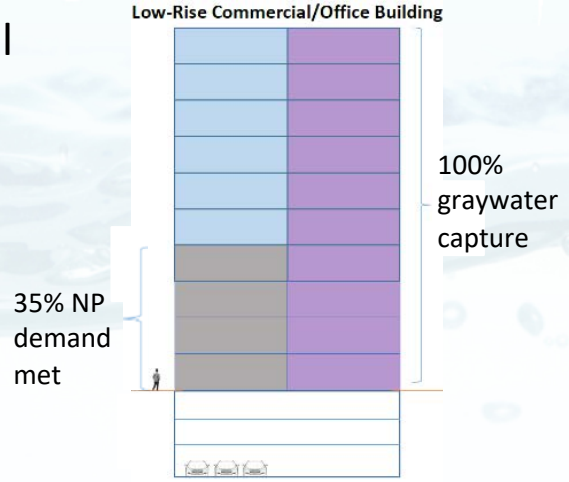
How much Graywater capture is enough?

GRAYWATER

- Residential building types can meet all NP Demand



- Office/Commercial buildings cannot meet 100% NP Demand using graywater only



Building Type	Building Use	% Graywater Capture needed to Meet NP Demand
Low-Rise	Multi-Family Residential	27%
High-Rise	Multi-Family Residential	27%
Low-Rise	Mixed-Use Residential/ Ground Floor Retail	38%
Mid-Rise	Mixed-Use Residential/ Ground Floor Retail	30%
High-Rise	Mixed-Use Residential/ Ground Floor Retail	28%
Low-Rise	Commercial/Office	100%*
High-Rise	Commercial/Office	100%*
District Scale	Residential	31%
District Scale	Mixed-Use Residential with Commercial/Office	34%

* Total NP demand not met

Water Quality

Condensate	Rainwater	Foundation	Blowdown	Stormwater	Graywater	Blackwater
- Clean - Consistent in warm season	- Clean - SW mgmt benefits	- Clean (usually) - Consistent (when present)	- Fairly clean - Consistent (when present)	- Fairly clean - SW mgmt benefits	- Consistent - Abundant (residential)	- Consistent - Abundant
- Seasonal variation	- Inconsistent	- Subject to groundwater contamination - Often not present	- Pathogens, high minerals - May not be present	- Ground-level contaminants - Inconsistent	- Comm/Office cannot meet NP demand - Separated drain piping - Tertiary treatment	- Tertiary treatment - O&M and testing requirements
Small Storage	Large Storage	Small Storage	Small Storage	Large Storage	Small Storage	Small Storage

Matching Supplies with Demands

"Fit-for-Purpose" Use: matches source water quality to an end-use for which that water quality is adequate.

Ranking (relative amount of reclaimed water used annually)	Reclaimed Water Use Category	Potable or Nonpotable Reuse?	Treatment Typically Required beyond Secondary Treatment to Meet Regulations
Highest	Landscape irrigation	Nonpotable	Tertiary filtration and disinfection
	Agricultural irrigation of fodder crops and processed food crops	Nonpotable	None
	Potable reuse	Potable	Advanced treatment through multiple barriers
	Industrial cooling	Nonpotable	Tertiary filtration and disinfection
	Irrigation of food crops eaten raw	Nonpotable	Tertiary filtration and disinfection
Lowest	Other	Nonpotable	Varies

Figure is WateReuse Research Foundation's Intellectual Property

Appropriate Treatment by Source Type

ALTERNATE WATER SOURCE	TREATMENT				
	Primary	Secondary	Tertiary		
			Filtration	Disinfect.	RO
Condensate			■	□	
Rainwater	■		■	□	
Stormwater	■		■	■	
Foundation Drainage	□	□	■	■	
Cooling Tower Blowdown	■	□	■	■	
Graywater	■	■	■	■	□
Blackwater	■	■	■	■	□

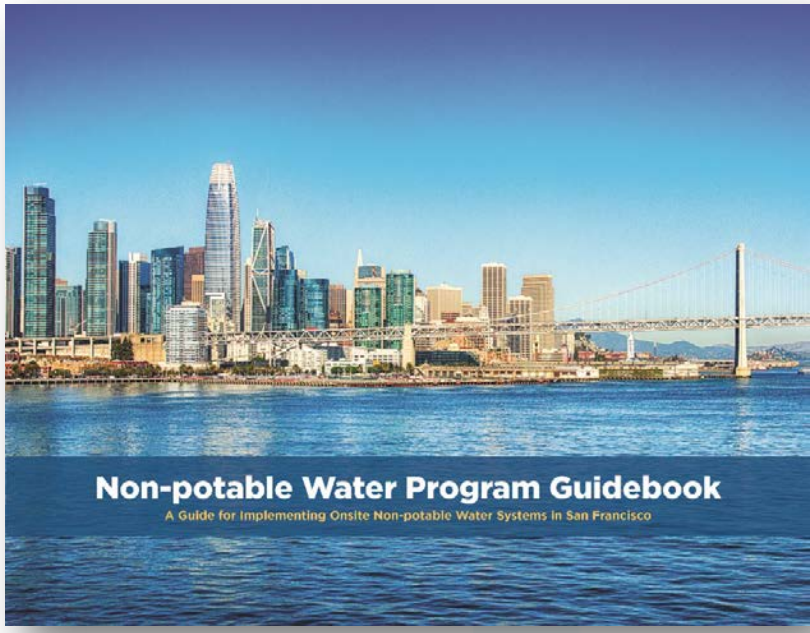
■ Typically Required
□ Project Specific Requirements

Common Challenges that San Francisco Owners Face

- Fear of the unknown: Overly conservative design (over-engineered/oversized pre-packaged systems)
- Long-term Budgeting: Operations, maintenance, and monitoring
- Permitting Challenges: Soft costs inflated due to multiple iterations of design
- Unexpected Water Quality: Greywater BOD levels approaching those of blackwater

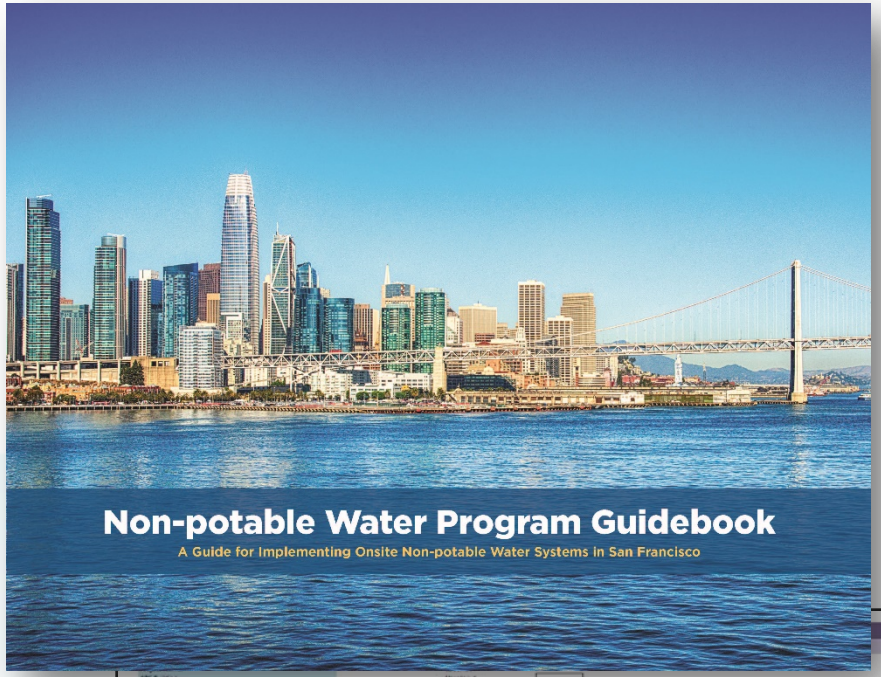
Resources for San Francisco Owners

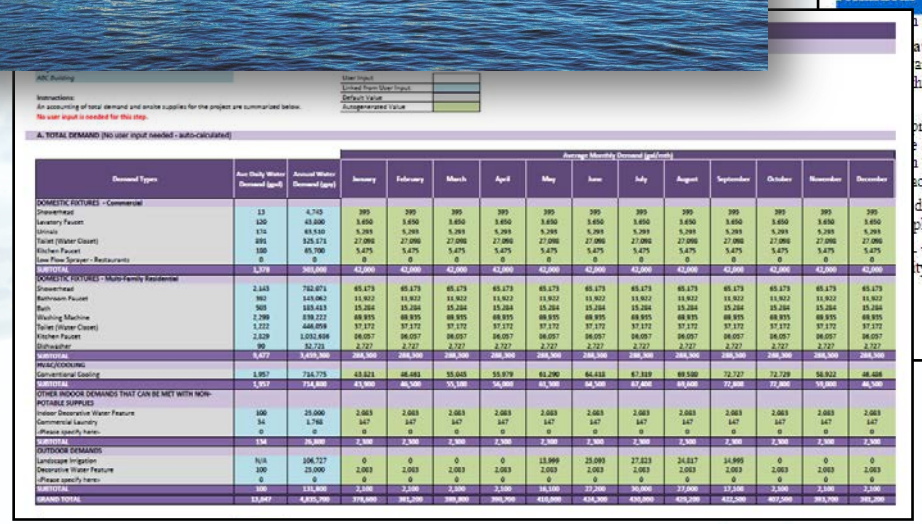
- Non-Potable Water Program Guidebook
- NPO-SMO guidance
- Sizing Calculators (NPO and SMO)
- SB 966

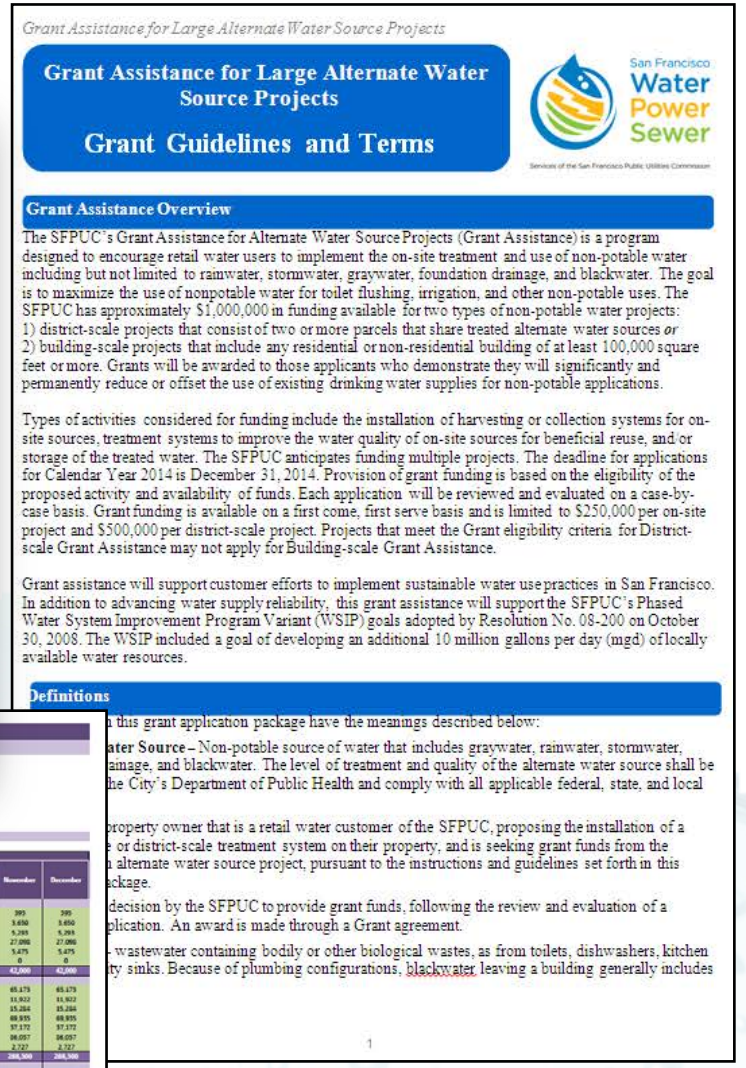


Non-potable Water Program Guidebook

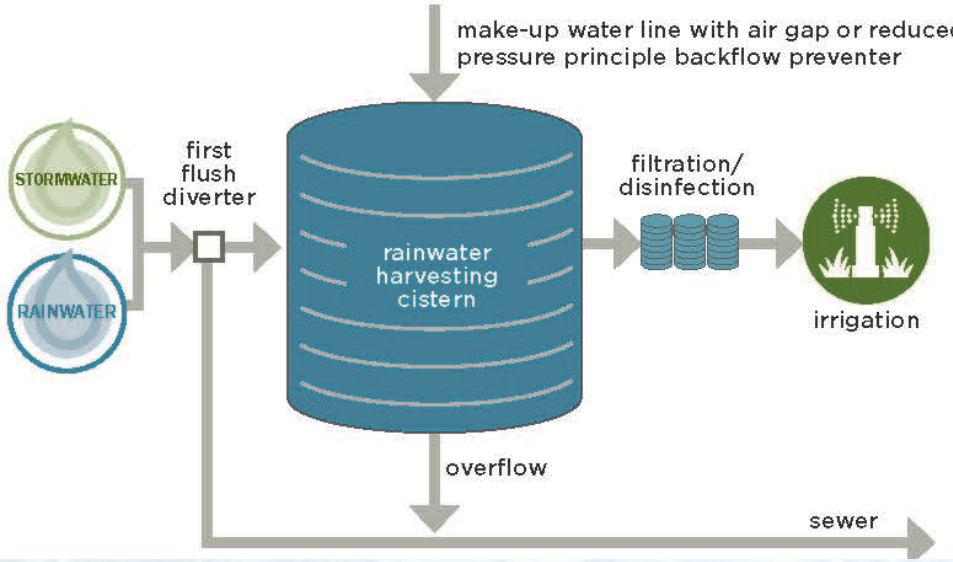
- Technical and Financial Assistance



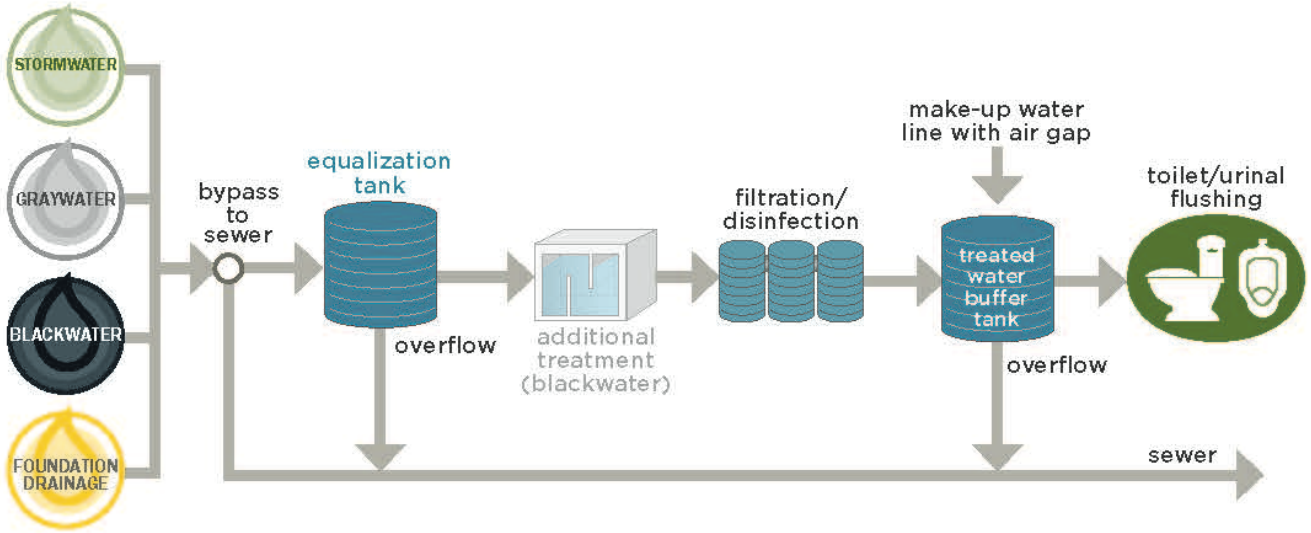




NPO-SMO: Typical Reuse System Configurations

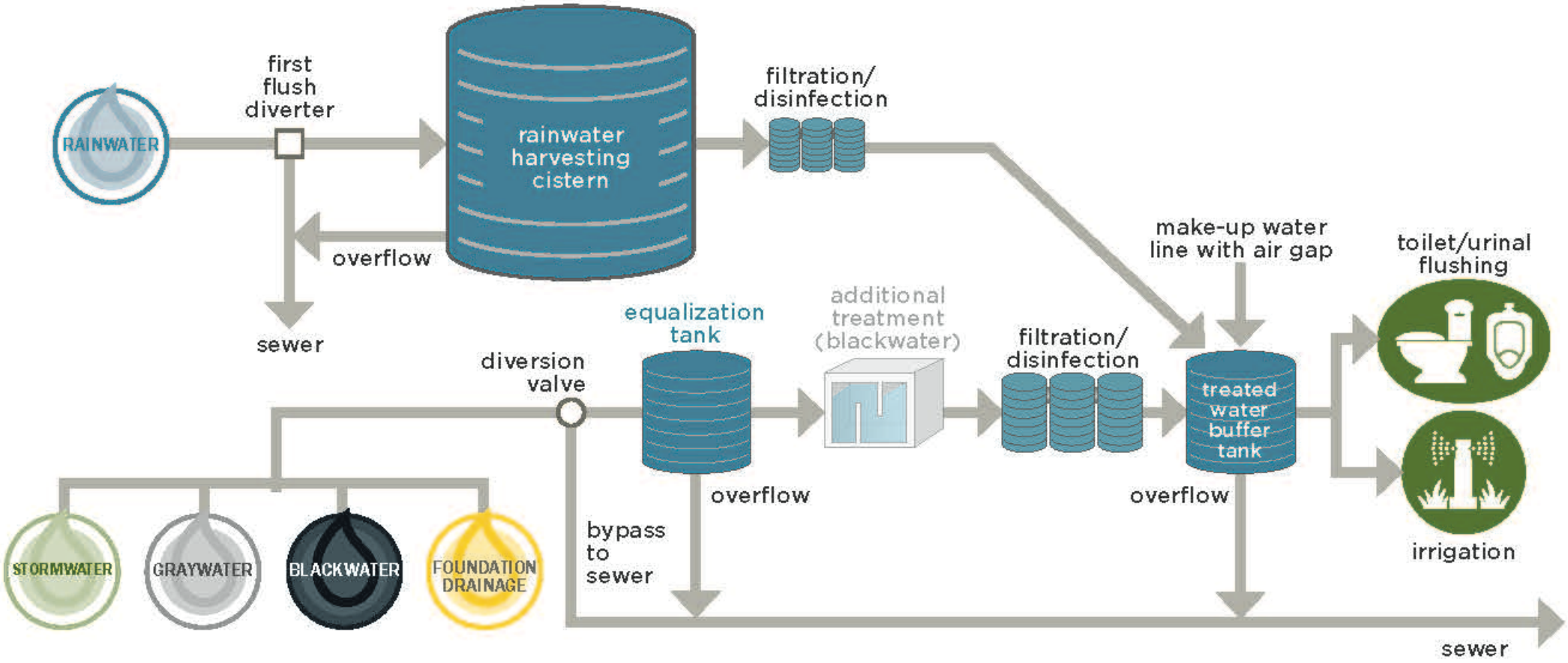


Outdoor Irrigation

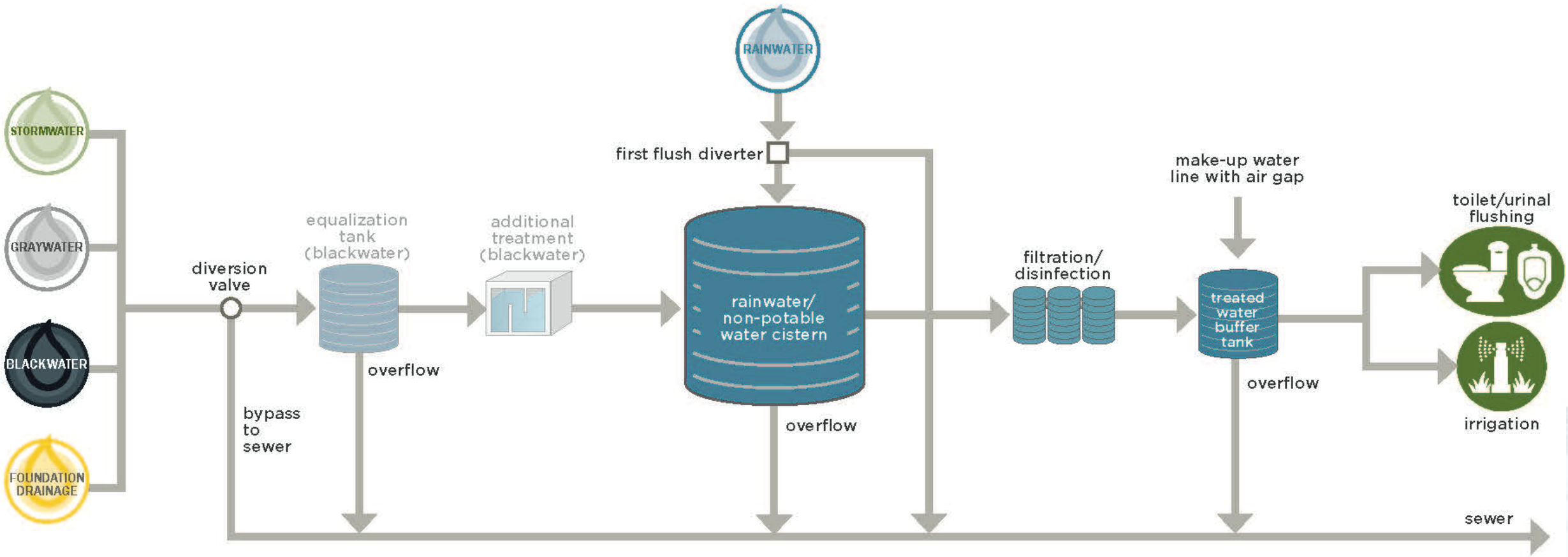


Indoor Reuse

NPO-SMO: Integrated 2-Tank System Configuration



NPO-SMO: Integrated 1-Tank System Configuration

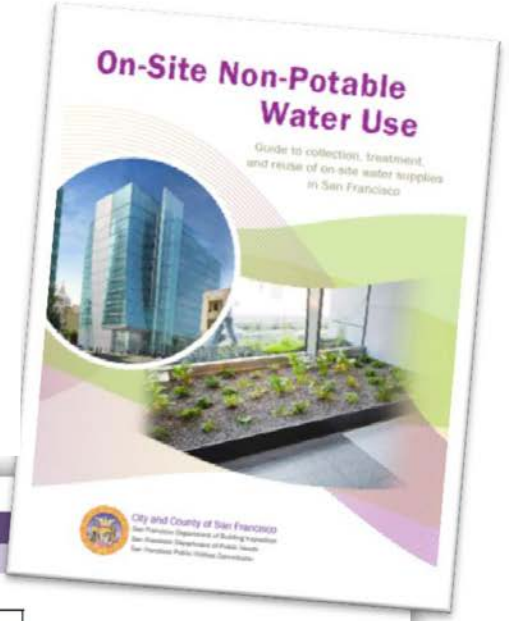


NPO-SMO: Planning Level Tank Sizing

Land Use Type		Tank Configuration	Minimum Equalization Tank Size (gal/acre)	COMBINED SEWER SYSTEM: STANDARD Minimum Cistern Size[1] (gal/acre)	MUNICIPAL SEPARATE STORM SEWER SYSTEM Minimum Cistern Size (gal/acre)
Mixed-Use Residential/Retail	Low-Rise	Traditional	1,900	60,000	230,000
		Integrated 2-Tank	1,900	18,500	25,500
		Integrated 1-Tank	**0**	**20,000**	**17,500**
	Mid-Rise	Traditional	3,000	60,000	210,000
		Integrated 2-Tank	3,000	14,000	17,500
		Integrated 1-Tank	**0**	**16,000**	**13,000**
	High-Rise	Traditional	5,500	80,000	200,000
		Integrated 2-Tank	5,500	11,000	12,500
		Integrated 1-Tank	**0**	**15,500**	**10,000**
Commercial/Office	Low-Rise	Traditional	3,400	207,000	390,000
		Integrated 2-Tank	3,400	20,000	26,000
		Integrated 1-Tank	**0**	**20,000**	**20,000**
	Mid-Rise	Traditional	3,900	211,000	300,000
		Integrated 2-Tank	3,900	18,000	17,500
		Integrated 1-Tank	**0**	**18,000**	**14,000**
	High-Rise	Traditional	4,300	215,000	220,000
		Integrated 2-Tank	4,300	15,000	10,500
		Integrated 1-Tank	**0**	**15,000**	**8,500**
District Scale	Residential	Traditional	1,700	53,500	140,000
		Integrated 2-Tank	1,700	18,000	20,000
		Integrated 1-Tank	**0**	**18,000**	**14,000**
	Mixed-Use	Traditional	6,000	51,500	50,000
		Integrated 2-Tank	6,000	10,500	8,500
		Integrated 1-Tank	**0**	**15,500**	**7,000**

Sizing Calculators: Tank Sizing for Design

Quantity Control Parameter	Existing Conditions	Proposed Conditions	% Reduction From Existing Conditions	Target % Reduction	Requirement Met?
1-yr, 24 hr: Peak Flow (cfs)	1.568	0.706	55%	N/A	N/A
1-yr, 24 hr: Runoff Volume (ft^3)	10,081	5,376	47%	N/A	N/A
2-yr, 24 hr: Peak Flow (cfs)	1.899	1.372	28%	25%	YES
2-yr, 24 hr: Runoff Volume (ft^3)	10,921	6,066	44%	25%	YES



NON-POTABLE WATER CALCULATOR

Step 2 of 7: Calculate Indoor Water Demand (Indoor Fixtures and Fittings)

Project Name:
ABC Building

LEGEND:

User Input	
Linked from User Input	
Default Value	
Autogenerated Value	

Instructions:

Annual indoor water demand is calculated based on water demand from domestic fixtures and fittings, using assumed usage rates based on the building uses and occupancy profiles entered in Step 1.
User input is required in Section D at the end of this page.

A. COMMERCIAL WATER DEMAND (No user input needed - auto-calculated from Step 1 inputs)

Total Water Demand (gpd) = (Flow Rate x Duration x Ave Daily Use x No. of FTEs) + (Flow Rate x Duration x Ave Daily Use (Transient FTE) x No. of Transient FTEs)

Fixture Type	Flow Rate	Unit	Duration	Unit	Ave Daily Use	No. of FTEs	Ave Daily Use (Transient) [6]	No. of Transient FTEs	Total Water Demand (gpd)	Allowable End Use for Non-Potable?
Showerhead [1][2]	2	gpm	5	min	0.65	2	0	0	13	No
Lavatory Faucet [2]	0.4	gpm	0.25	min	3	400	0.5	0	120	No
Urinals [2][3]	0.5	gpf	1	flush	1.74	200	0.4	0	174	Yes
Toilet (Water Closet) [2][3]	1.28	gpf	1	flush	1.74	400	0.5	0	891	Yes
Kitchen Faucet [2][4]	1.8	gpm	0.25	min	1	400	0	0	180	No
Low Flow Sprayer - Restaurants [5]	82.51	gal/emp/day	1	-	1	0	0	0	0	No
								TOTAL	1,378	

THANK YOU!!

LUNCH HAS BEEN GENEROUSLY SPONSORED BY

TOTO®

WATER REUSE FOR REGULATORS & UTILITIES

MODERATOR: CYNTHIA CLARK, SENIOR WATER DIRECTOR, SUSTAINABLE SILICON VALLEY

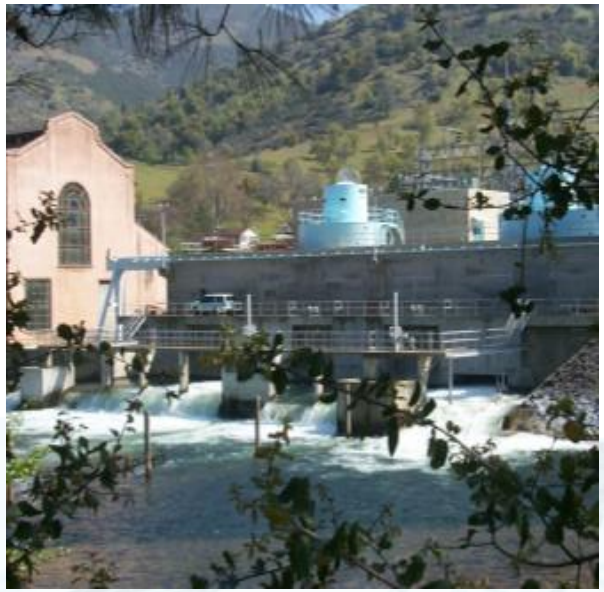
PAULA KEHOE, DIRECTOR OF WATER RESOURCES, SAN FRANCISCO PUBLIC UTILITIES COMMISSION

BRIAN BERNADOS, DIVISION OF DRINKING WATER, STATE WATER RESOURCES CONTROL BOARD

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

WATER: DELIVERING HIGH QUALITY WATER EVERY DAY TO 2.7 MILLION PEOPLE

WASTEWATER: PROTECTING PUBLIC HEALTH AND THE ENVIRONMENT



POWER: GENERATING CLEAN ENERGY FOR VITAL CITY SERVICES

DEVELOPING A PROGRAM TO ALLOW ONSITE WATER SYSTEMS

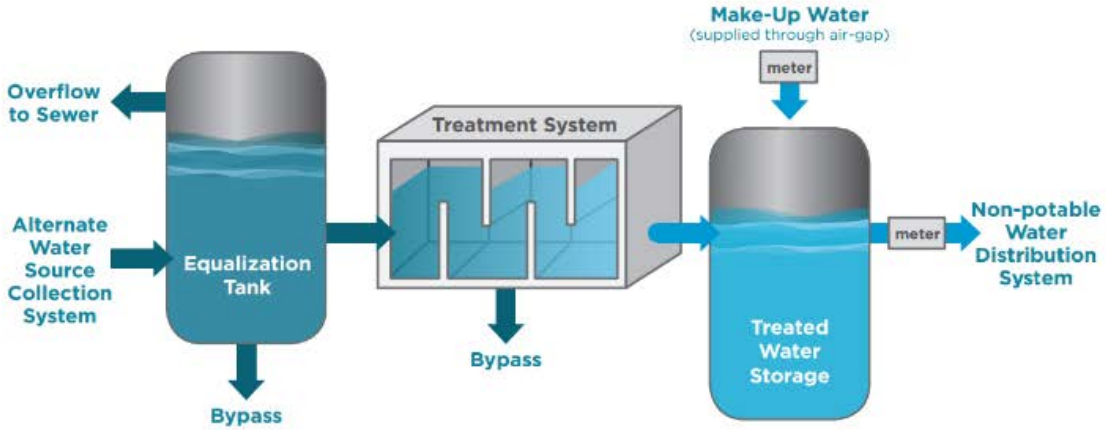
2010	RESEARCH AND DEVELOP PROGRAM CONCEPT AND WITH SFPUC WATER AND WASTEWATER STAFF
2011	DISCUSSION WITH BUILDING AND HEALTH DEPARTMENTS
2012	CONSULTATION WITH STATE AND EXTENSIVE STAKEHOLDER OUTREACH
2012	PREPARE ORDINANCE FOR SF

SF ORDINANCE OUTLINES ROLES AND RESPONSIBILITIES

SFPUC	SFDPH	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)

KEY PROGRAM CONSIDERATIONS

- WATER AND SEWER CONNECTIONS
- BACKFLOW PROTECTION REQUIREMENTS
- CROSS CONNECTION TEST PRIOR TO OPERATION
- OPERATOR CAPACITY



KEY LESSONS LEARNED

- CULTURAL SHIFT
- INTERAGENCY COLLABORATION AND REQUIRES DEDICATED STAFF FOR OVERSIGHT AND MANAGEMENT
- VOLUNTARY PROGRAM BEFORE MANDATORY PROGRAM
- ADAPT TO AN EVOLVING INDUSTRY (TECHNOLOGY, SCIENCE, AND REGULATIONS)
- TRANSFORMING THE WAY WE LIVE AND DO BUSINESS

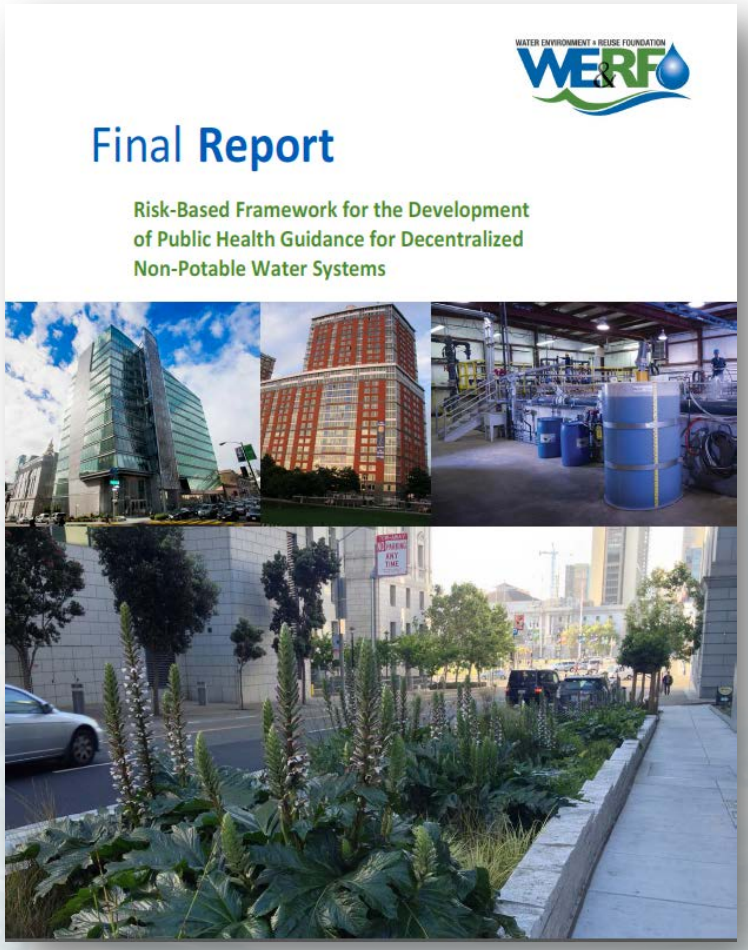
EXPANDING NON-POTABLE PROGRAM

- EXPANDING FOCUS TO INCLUDE BREWERY PROCESS WATER ONSITE TREATMENT AND REUSE
- CONTACT AND NON-CONTACT USES
- GRANT OPPORTUNITIES

PILOTING DECENTRALIZED PURIFIED WATER

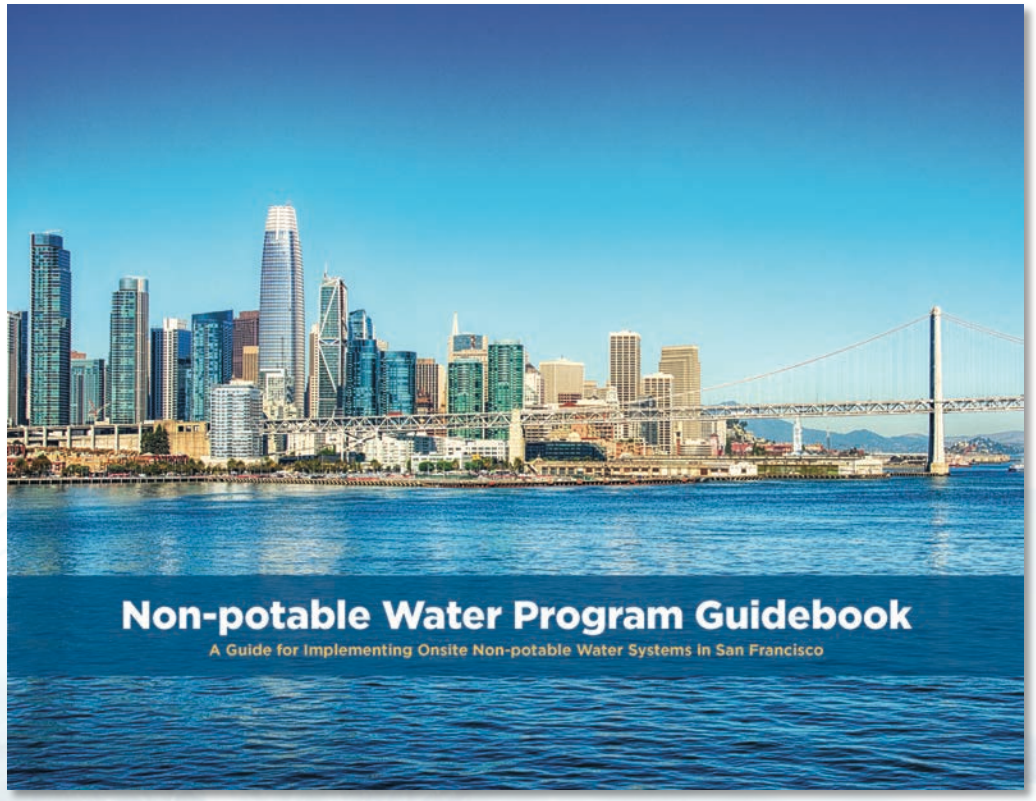
- PRODUCE PURIFIED WATER FROM RECYCLED WATER AT SFPUC HEADQUARTERS
- RESEARCH PROJECT INCLUDING ADDITIONAL TREATMENT AND REAL TIME MONITORING
- COMMUNITY OUTREACH AND PUBLIC EDUCATION

COLLABORATING ON NATIONAL LEVEL TO ADDRESS BARRIERS



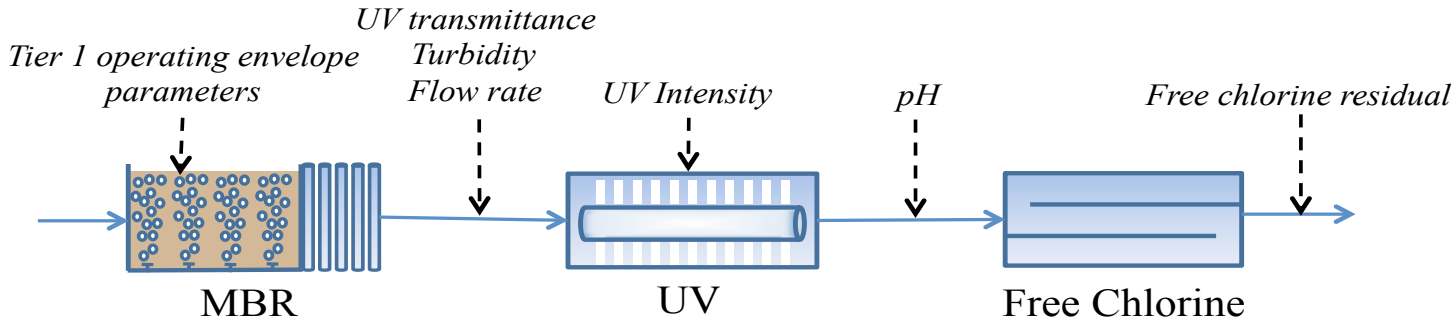
National Blue Ribbon Commission for Onsite Non-potable Water Systems

2017 NON-POTABLE PROGRAM UPDATES



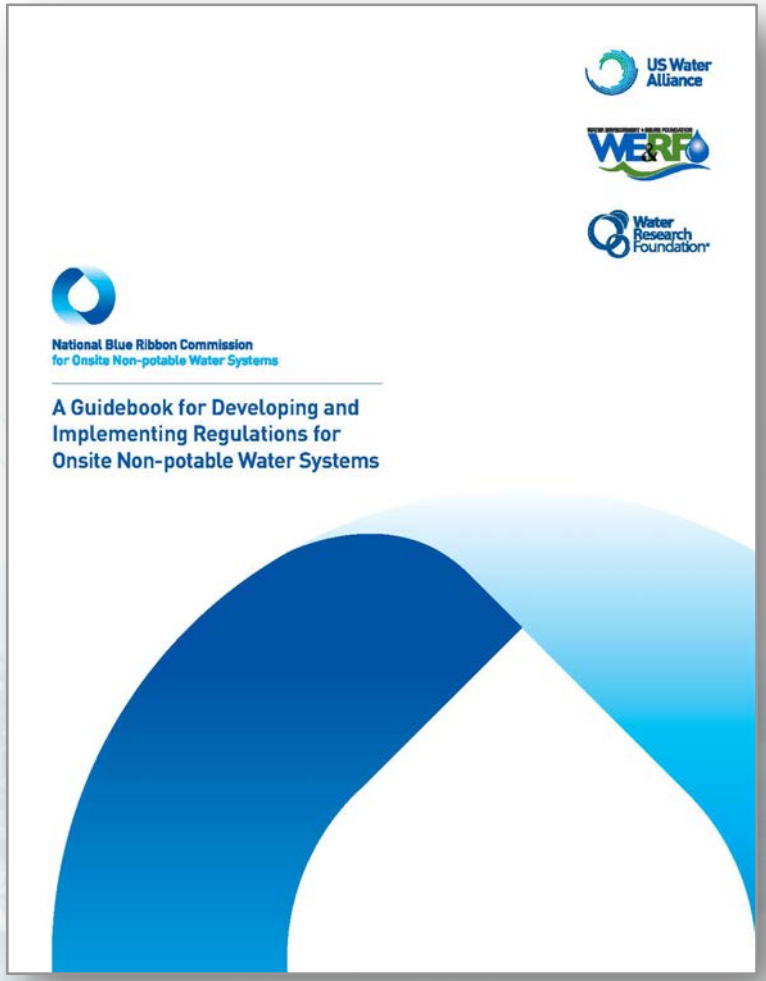
- BASED ON RESEARCH, SAN FRANCISCO AMENDED PROGRAM TO ADOPT A RISK-BASED WATER QUALITY APPROACH:
  - WATER QUALITY CRITERIA BASED ON LOG REDUCTION TARGETS (LRTS)
  - CONTINUOUS ONLINE MONITORING REQUIREMENTS
- UPDATES SHAPED BY OUTREACH AND REVIEW FROM DESIGNER/DEVELOPER COMMUNITY

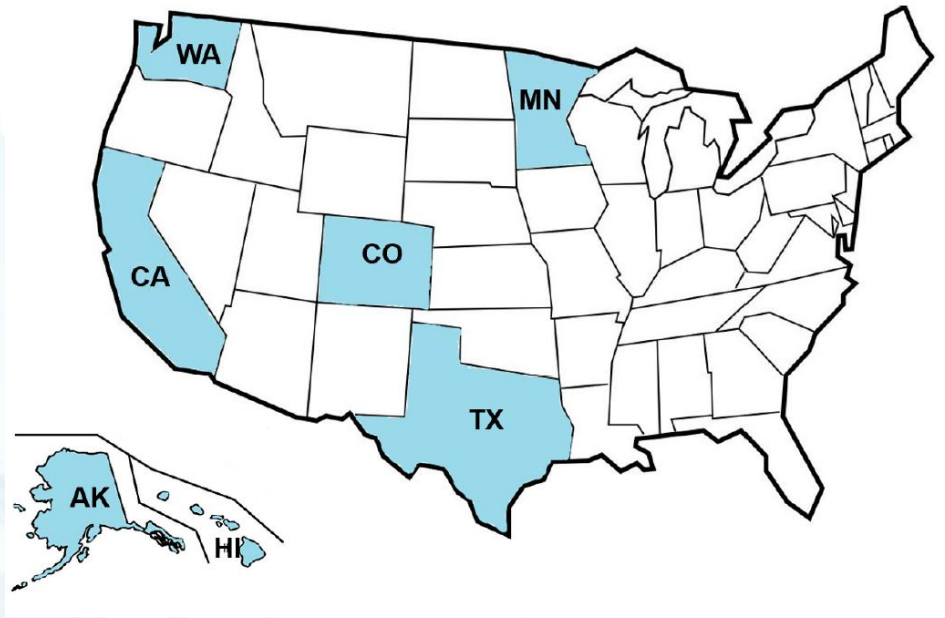
EXAMPLE BLACKWATER TREATMENT TRAIN



					Total	Required
Pathogen Crediting	Virus	1.5	3.5	5	10	8.5
	Protozoa	2	6	0	8	7
	Bacteria	4	3.5	5	12.5	6
Validation		Field verification of operation within Tier 1	Validation for dose of 80 mJ/cm^2 per USEPA, NSF, or DVGW	Tracer study or assumed baffling factor of 0.1		
Operation Requirements		Effluent turbidity ≤ 0.2 NTU -Operation within Tier 1	-UV dose > 80 mJ/cm^2 -Influent UVT ≥ minimum validated value for UV reactor	CT no less than 10 mg-min/L with verified free chlorine residual		

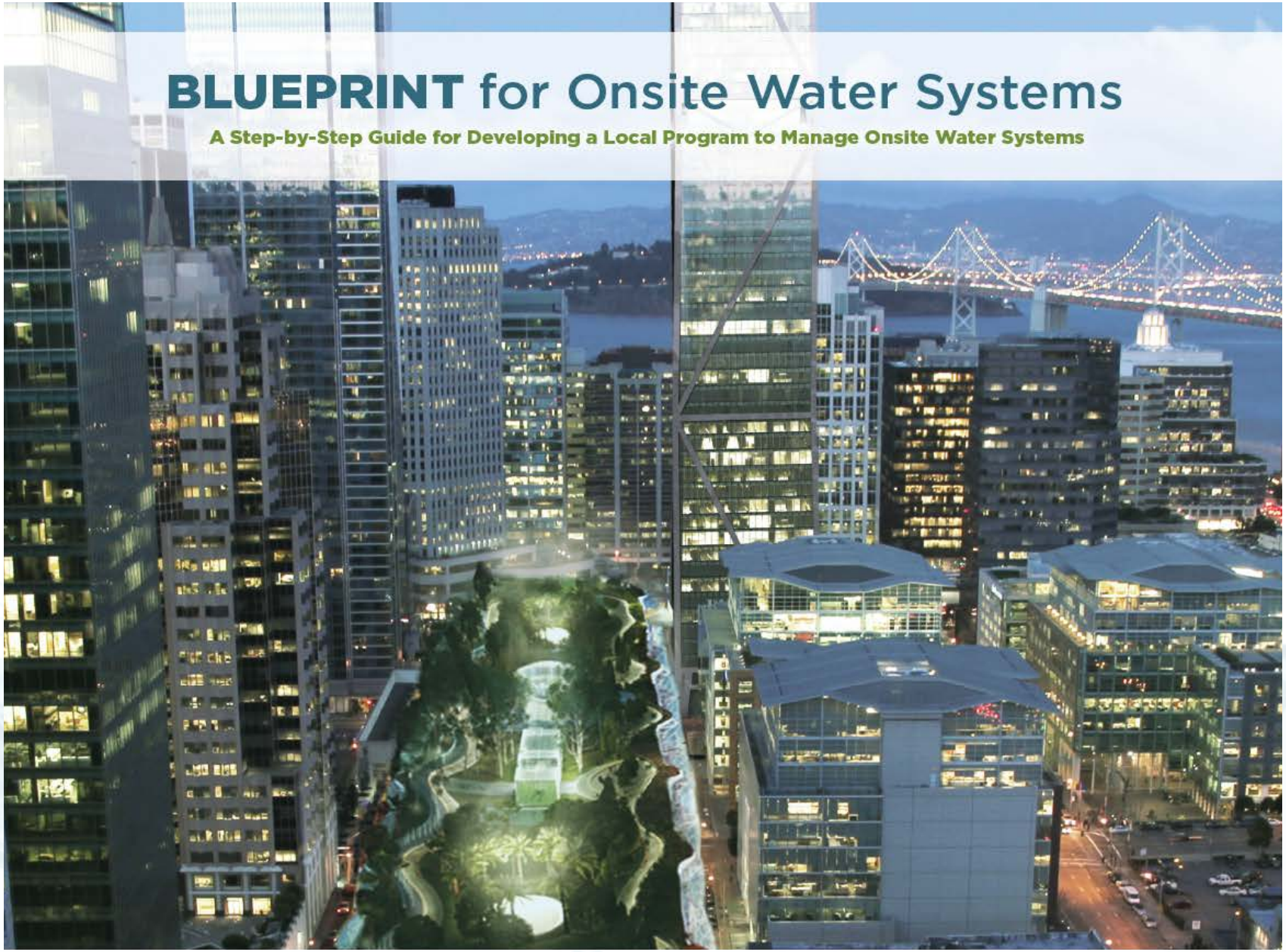
CALIFORNIA AND OTHERS MOVING FORWARD WITH RISK BASED APPROACH





WHY SFPUC SPONSORED SB 966

- WE ARE COMMITTED TO ADAPTING OUR GOVERNANCE AND UTILITY PRACTICES IN RESPONSE TO INCREASING WATER CHALLENGES
- SB 966 WILL HELP OTHER INTERESTED COMMUNITIES BY PROVIDING A CLEAR PATH FORWARD
- COMMUNITIES WILL BENEFIT FROM CONSISTENT STATEWIDE WQ STANDARDS
- OVERSIGHT AND MANAGEMENT PROGRAMS ARE CRITICAL TO PROTECT PUBLIC HEALTH


BLUEPRINT for Onsite Water Systems
A Step-by-Step Guide for Developing a Local Program to Manage Onsite Water Systems

BLUEPRINT FOR DEVELOPING A LOCAL PROGRAM

Developing a local program to manage onsite water systems offers a proactive way to increase water resiliency and promote green building practices while protecting public health. The development of a program should follow a sequence of steps and associated actions, which will inform critical decisions regarding the scope, structure, and implementation of the program.

1 **Convene a Working Group**

Establish a small working group to guide the development of the local program.

2 **Select the Types of Alternate Water Sources**

Narrow the specific types of alternate water sources covered in the program.

3 **Identify End Uses**

Classify specific non-potable end uses for your program.

4 **Establish Water Quality Standards**

Establish water quality standards for each alternate water source and/or end use.

5 **Identify and Supplement Local Building Practices**

Integrate your program into local construction requirements and building permit processes.

6 **Establish Monitoring and Reporting Requirements**

Establish water quality monitoring and reporting requirements for ongoing operations.

7 **Prepare an Operating Permit Process**

Establish the permit process for initial and ongoing operations for onsite water systems.

8 **Implement Guidelines and the Program**

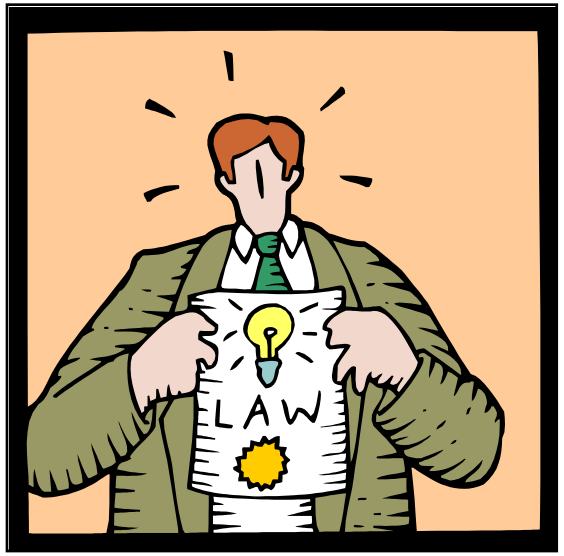
Publicize the program to provide clear direction for project sponsors and developers.

9 **Evaluate the Program**

Promote best practices for onsite water systems.

10 **Grow the Program**

Explore opportunities to expand and encourage onsite water systems.



Senate Bill 966

Brian Bernados, P.E.
Technical Operations Section
Division of Drinking Water (DDW)
State Water Resources Control Board
brian.bernados@waterboards.ca.gov

SB 966 Covers

- Uses where public may contact
  - Toilet flushing & unrestricted irrigation
- NOT “untreated graywater systems that are used exclusively for subsurface irrigation”
- NOT “untreated rainwater systems that are used exclusively for surface, subsurface, or drip irrigation”

Division of Drinking Water (DDW)

- Regulates public drinking water systems (tap water):

- Water Recycling Criteria (Title 22) treatment & reuse requirements

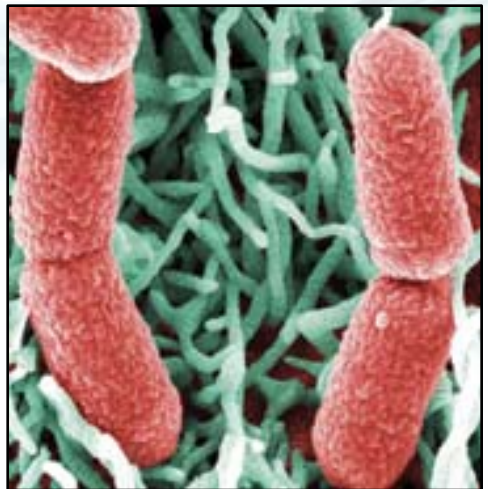
- Review new & emerging treatment technologies
  - Ultra-violet (UV) disinfection
  - Membrane filtration

Tertiary recycled water

60301.230. Disinfected tertiary recycled water . . .

"**(b)** The median concentration of **total coliform** bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days . . .

Burden for ONWS



Risk Basis

- Independent Advisory Panel of Experts report:

"Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems"

(Project # SWIM10C15, Sharvelle et al. 2017) published by Water Research Fund &

National Water Research Institute

NSF 350

- National Water Research Institute (NWRI) Independent Advisory Panel (IAP) Experts
- NSF 350 is not risk based (device certification, not a standard)
- Public health standard needed

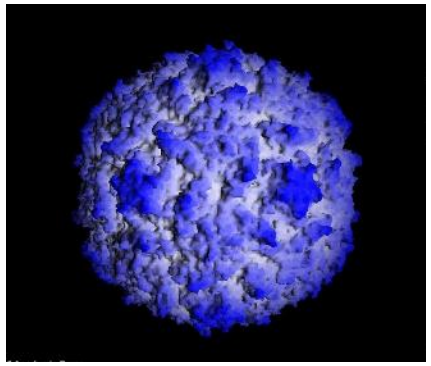
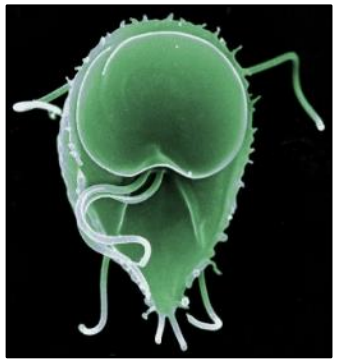
- Quantitative Microbial Risk Assessment (QMRA)

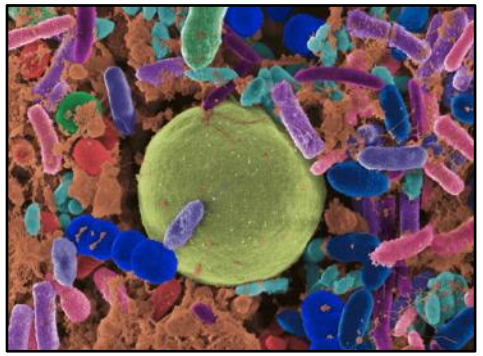
National Blue Ribbon Commission

- 33 utilities & public health agencies in 11 states
- Developed consensus consistent policies
- "A Guidebook for Developing and Implementing Regulations for Onsite Non-potable Water Systems"

Log_{10} Pathogen Reduction Targets (LRTs)

90% = 1 log
99% = 2 log



Indoor Water Use Scenario (toilet flushing)	Enteric Viruses	Parasitic Protozoa	Enteric Bacteria
Blackwater	8.5	7.0	6.0
Graywater	6.0	4.5	3.5
Stormwater (10^{-1} dilution ww)	5.5	5.5	5.0
Stormwater (10^{-3} dilution ww)	3.5	3.5	3.0
Roof Runoff	??	??	3.0

ONWS Guidance Manual

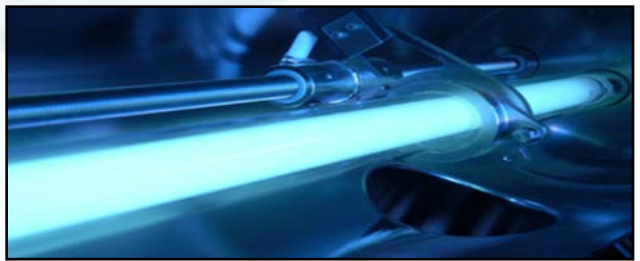
1. Overview of Onsite Non-Potable
2. Public Health Goals for Different Water Sources
3. Multiple Barrier Treatment Processes
4. Treatment with Critical Control Points (CCPs)
5. Importance of On-Line Monitoring @ CCPs

ONWS Guidance continued

6. Operational Guidelines, Compliance Reporting, Maintenance

7. Permitting, Engineering Report, Inspection, Startup, Commissioning, Operations Plan, Monitoring Plan

8. Appendix – Technical Memo on Pathogen Crediting



DDW Tentative Plan

- Budget Change Proposal
- Assemble SB 966 expert panel
- Stakeholder input
- Draft regulation
- Consult with Housing & Community Development and with Building Standards Commission

Questions?

DDW Recycled Water (RW) staff

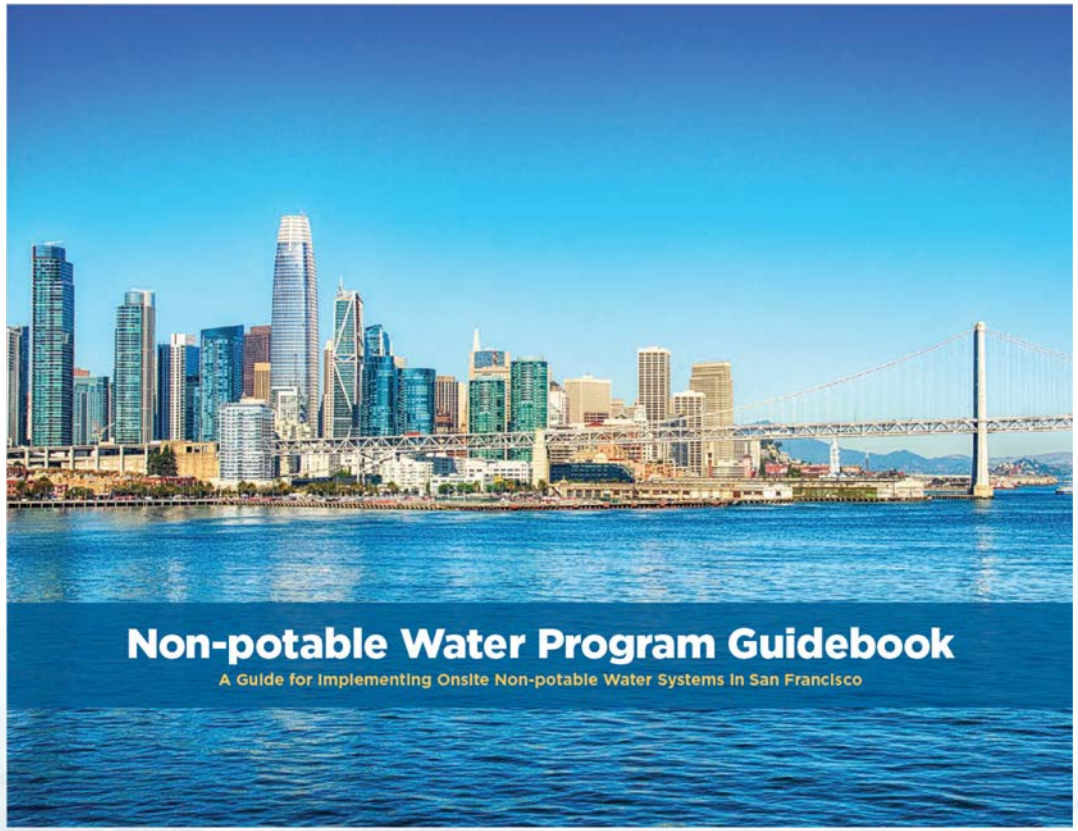
- Brian Bernados, Treatment Technology Specialist
  - Brian.bernados@waterboards.ca.gov
- Randy Barnard, RW Unit Supervisor
  - Randy.Barnard@waterboards.ca.gov

- Updates at DDW website:
- http://www.waterboards.ca.gov//drinking_water/certlic/drinkingwater/RecycledWater.shtml

CORNER CONVERSATION FORUM

2:00-2:10	ORGANIZE YOURSELVES INTO CORNERS
2:10-2:50	INTIMATE FORUM WITH PANELISTS
2:50-3:10	MODERATORS REPORT
3:10-3:15	RESOURCES

RESOURCES



SFWATER.ORG/NP

San Francisco
Water Power Sewer
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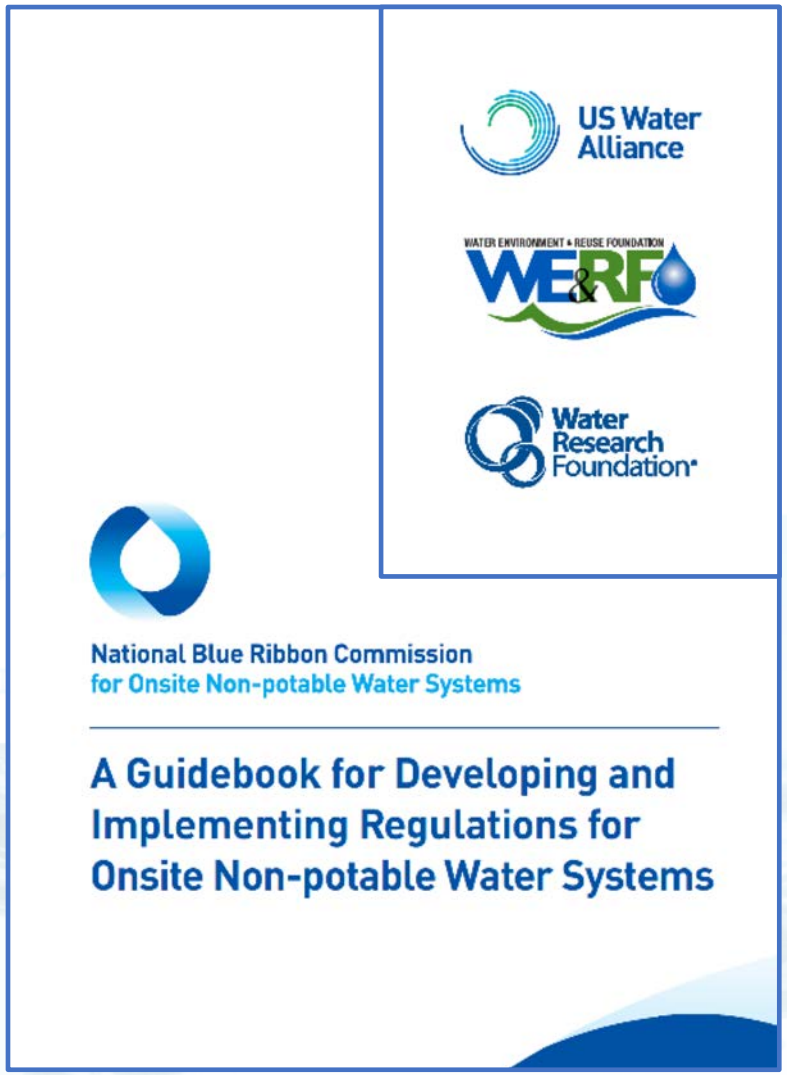
RESOURCES

WILLIAM J WORTHEN
FOUNDATION

FREE DOWNLOAD - COLLABORATIVEDESIGN.ORG

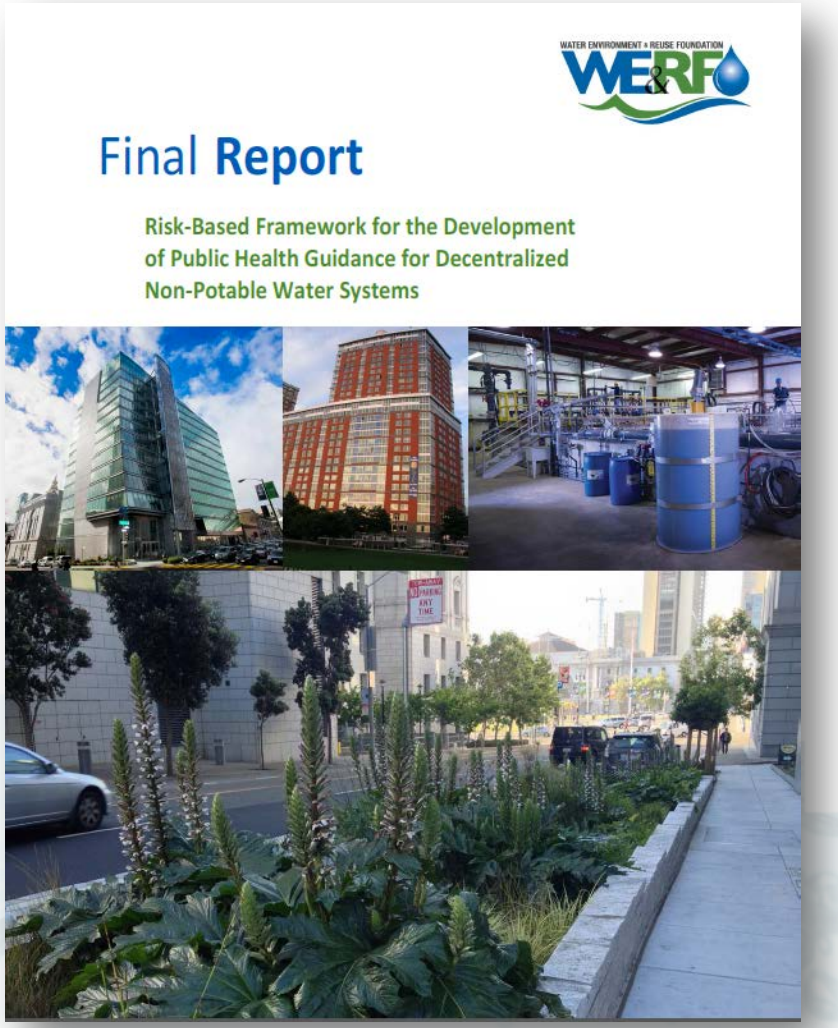
RESOURCES



THE Water Research FOUNDATION

THE BLUE RIBBON COMMISSION'S "TRAINING MANUAL FOR ONSITE NON-POTABLE WATER SYSTEMS"

COMING EARLY 2019



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KYLE J. PICKETT

CO-FOUNDER & EXECUTIVE DIRECTOR /
THE WILLIAM J. WORTHEN FOUNDATION

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CLOSING REMARKS

THANK YOU

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