

Direct Water Reuse in New England – Today & Tomorrow

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1. HOW MANY NON-POTABLE DIRECT WATER REUSE PROJECTS IN NEW ENGLAND ARE EACH OF YOU PERSONALLY AWARE OF?

1. ZERO TO FIVE?

2. FIVE TO TEN?

3. TEN TO TWENTY?

4. TWENTY TO FORTY?

5. GREATER THAN FORTY?



TYPICAL DRIVERS FOR NON-POTABLE WATER REUSE



Rising Costs
of Alternatives

Sustainability &
Resiliency



Limited Potable
Supply



Limited
Dispersal Capacity

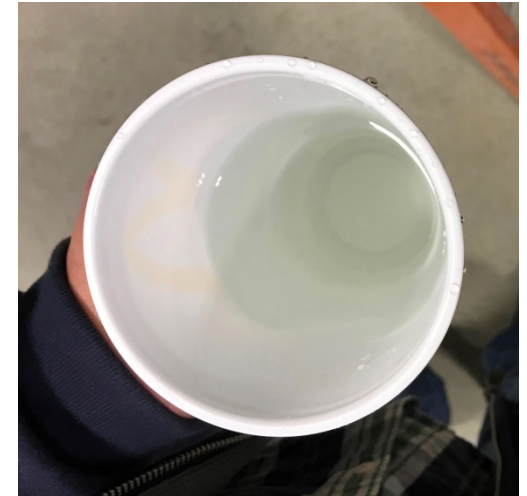


TERMINOLOGY FOR PRESENTATION :

- **NON-POTABLE – FIT FOR PURPOSE RECLAIMED WATER, SUITABLE FOR USES, SUCH AS: IRRIGATION, COOLING WATER, TOILET FLUSHING, VEHICLE WASHING, COMMERCIAL LAUNDRIES, FIRE SUPPRESSION, SNOW-MAKING, ETC**
- **WASTEWATER – MIXED SEWAGE FROM BUILDING SANITARY DRAINS (NON-INDUSTRIAL)**
- **BLACKWATER – SUBSET OF WASTEWATER DERIVED FROM TOILETS, KITCHEN SINK & DISHWASHER**
- **GREYWATER – RESTRICTED TO NON-BLACKWATER SOURCES: BATHROOM SINKS, SHOWERS, BATHTUBS, CLOTHES WASHERS, AND LAUNDRY SINKS**

OBJECTIVES FOR PRESENTATION

1. **SHARE SOME OF THE HISTORY OF DISTRIBUTED DIRECT NON-POTABLE WATER REUSE IN NEW ENGLAND**
2. **CASE STUDY OF WATER REUSE INNOVATIONS IN THE NORTHEAST US**
3. **DISCUSS HOW WE CAN INCREASE THE EFFECTIVENESS OUR NON-POTABLE WATER REUSE MANAGEMENT PROGRAMS IN NEW ENGLAND**



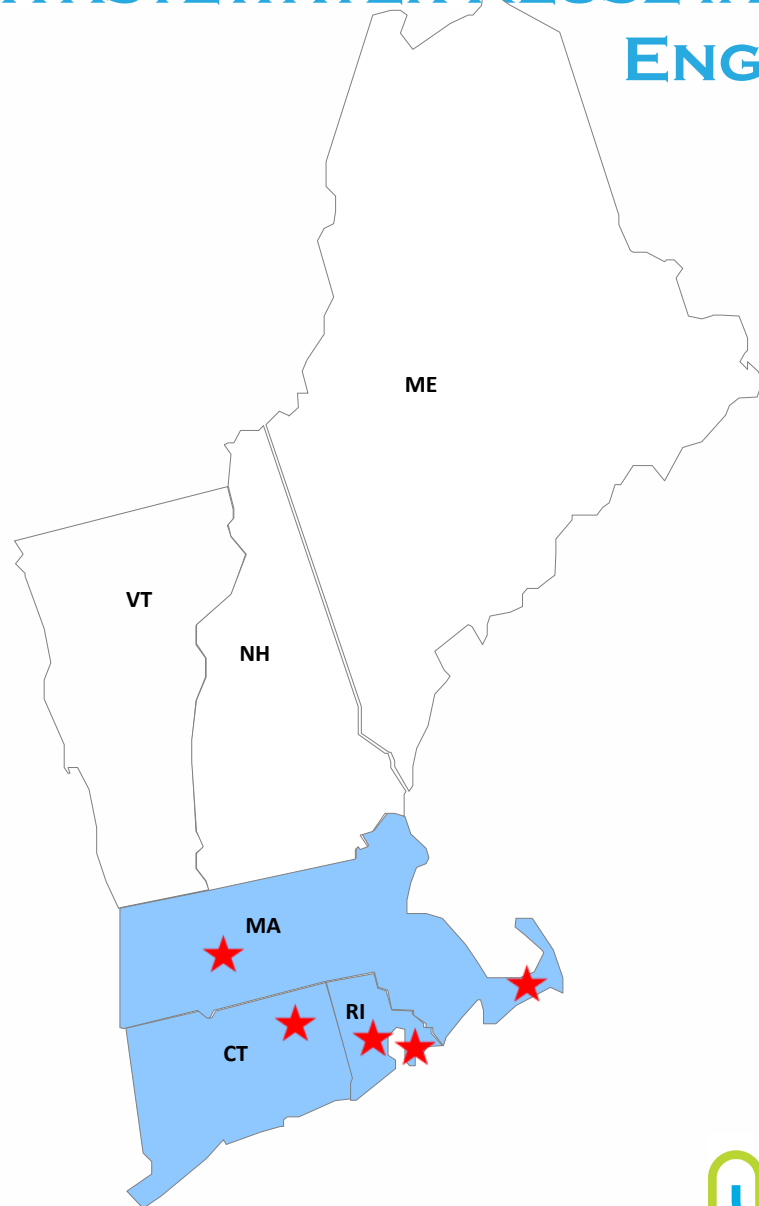
PRESENTATION OUTLINE

- **HISTORY AND GEOGRAPHIC DISTRIBUTION OF DECENTRALIZED NON-POTABLE WATER REUSE SYSTEMS IN NEW ENGLAND**
- **INNOVATIONS IN ONSITE WATER REUSE IN NORTHEASTERN UNITED STATES (NYC)**
- **RISK-BASED FRAMEWORK FOR THE DEVELOPMENT OF PUBLIC HEALTH GUIDANCE FOR DECENTRALIZED NON-POTABLE WATER SYSTEMS**
- **Q&A**

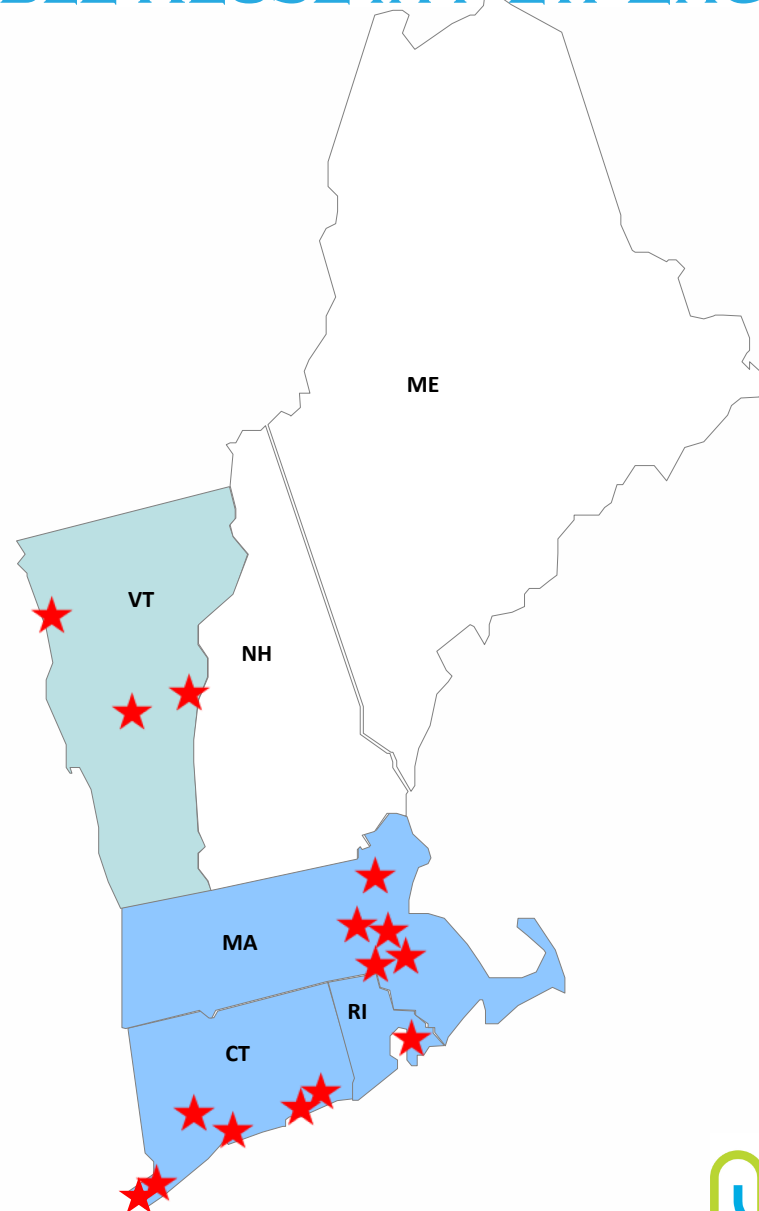


LOCATIONS & USES: REPRESENTATIVE MUNICIPAL NON-POTABLE WASTEWATER REUSE IN NEW ENGLAND

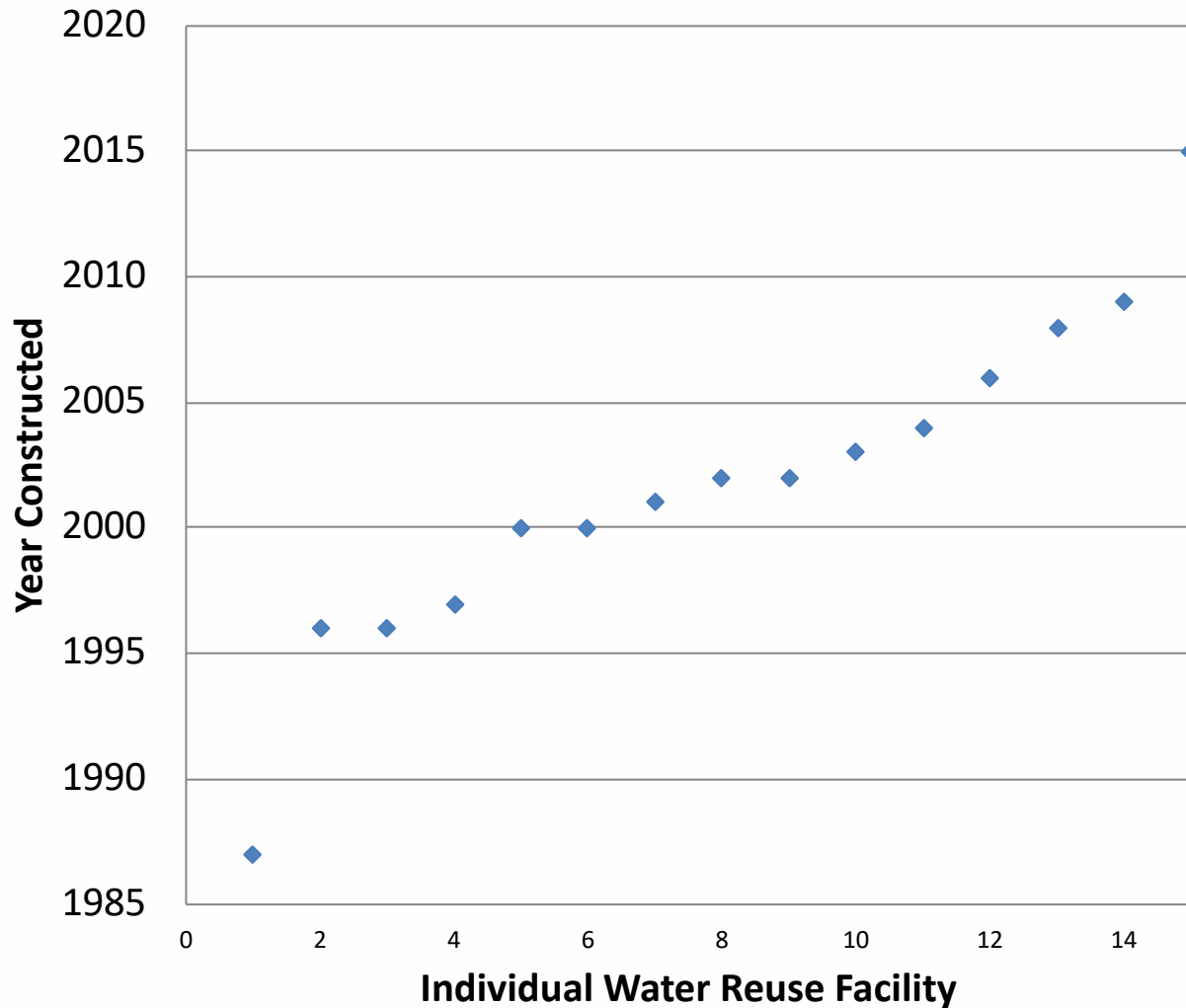
Project Location	State	Use
UConn/Storrs	CT	Cooling Water
Lake of Isles	CT	Golf Course Irrigation
Cranston/Johnston	RI	Cooling Water
Jamestown	RI	Golf Course Irrigation
Yarmouth	MA	Golf Course Irrigation
UMass-Amherst	MA	CHP Steam & Hot Water, Cooling Water, Dust Control, Irrigation



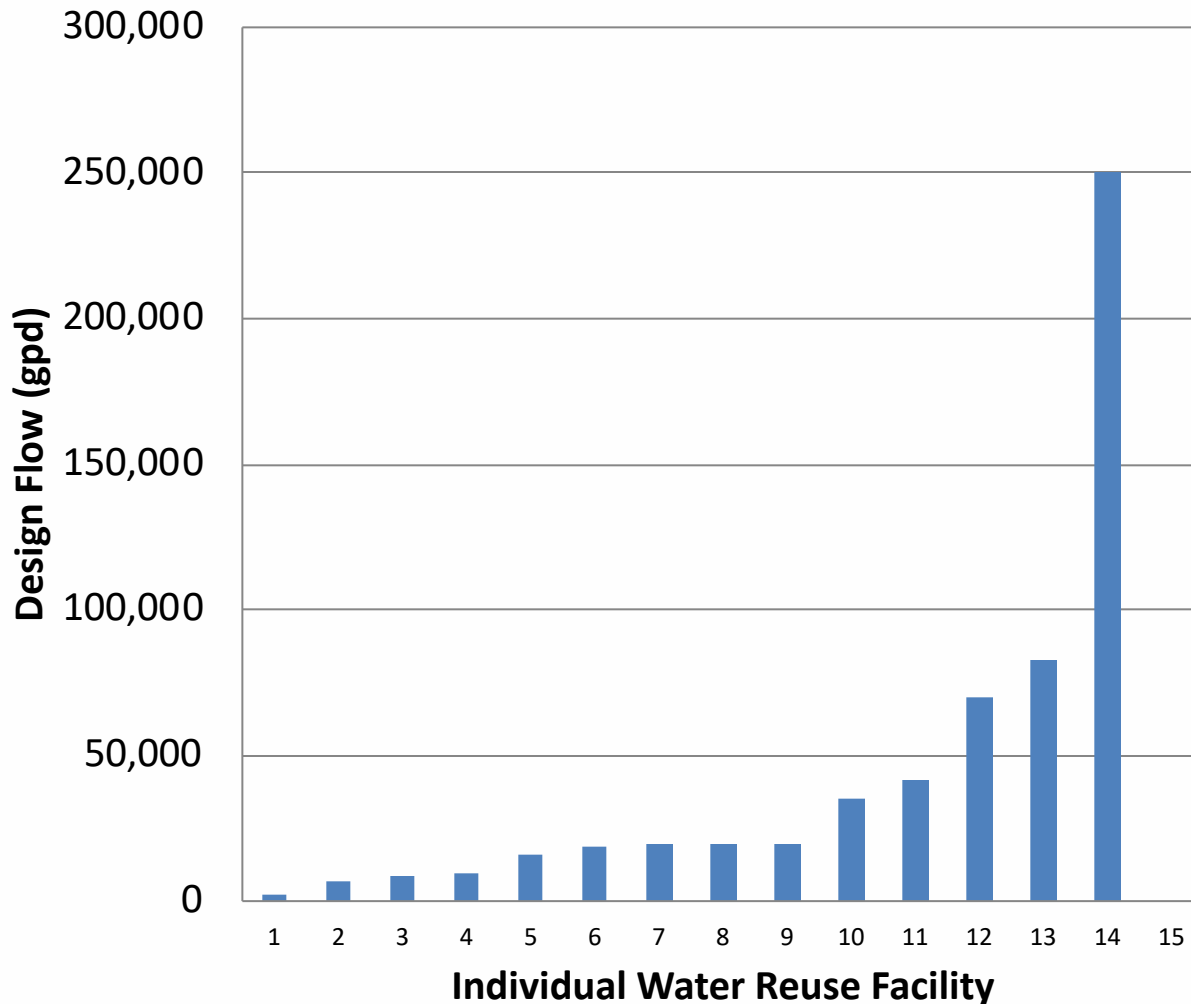
LOCATIONS OF REPRESENTATIVE DECENTRALIZED NON-POTABLE REUSE IN NEW ENGLAND



TIMELINE FOR DECENTRALIZED NON-POTABLE WATER REUSE IN NEW ENGLAND

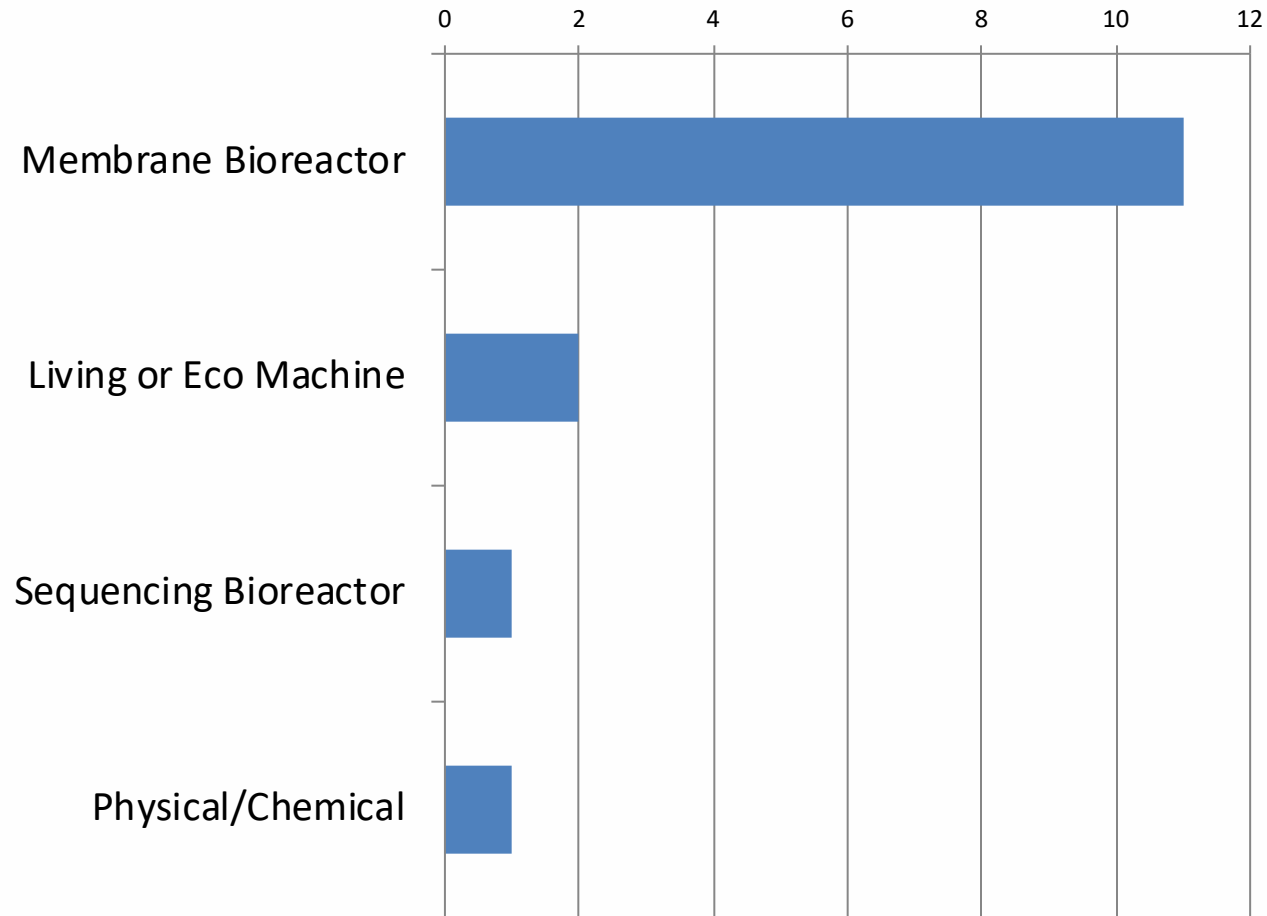


SCALE OF DECENTRALIZED NON-POTABLE WATER REUSE IN NEW ENGLAND BASED ON CAPACITY

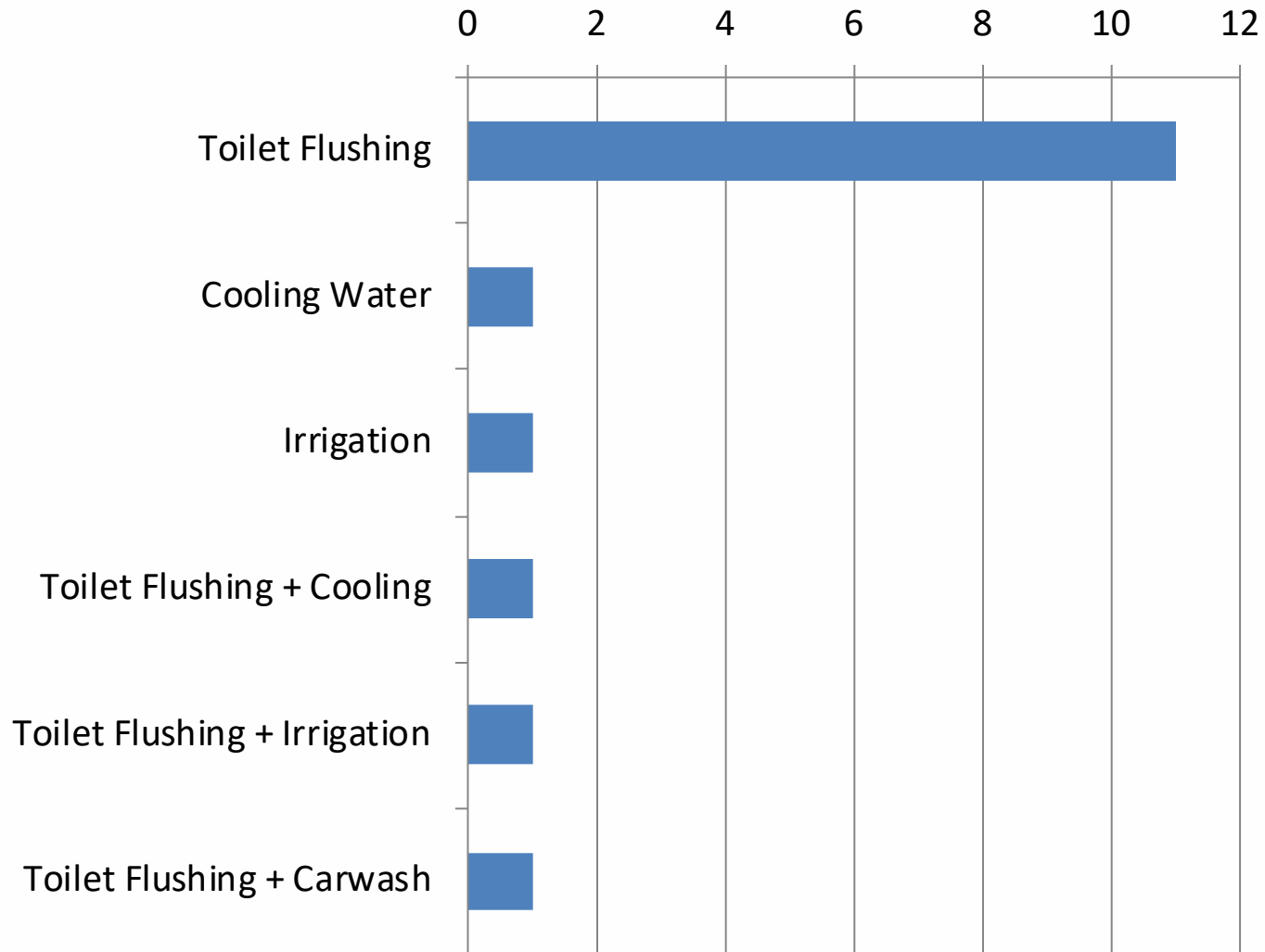


Note: Design flow for system #15 has not been confirmed.

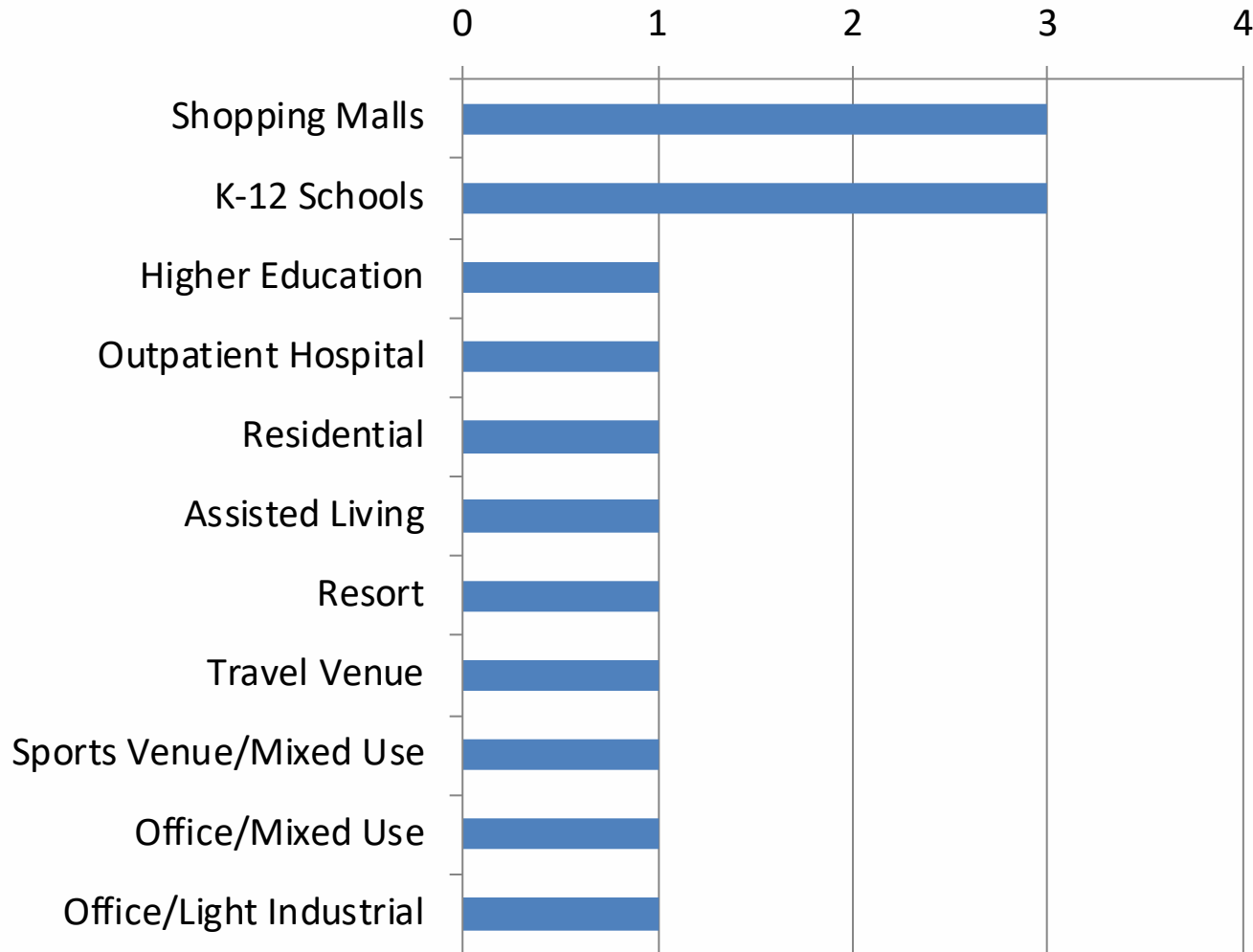
DECENTRALIZED NON-POTABLE WATER REUSE SYSTEM TYPES IN NEW ENGLAND



DISTRIBUTED NON-POTABLE REUSE WATER USES IN NEW ENGLAND



DECENTRALIZED NON-POTABLE REUSE WATER PROJECT TYPES IN NEW ENGLAND



NEW ENGLAND NON-POTABLE WATER REUSE SYSTEMS – SUMMARY OF PRELIMINARY CHARACTERIZATIONS

- AGE: 14 – 19 YEARS OLD
- DESIGN FLOWS – 5,000 TO 50,000 GPD
- TREATMENT TECHNOLOGY: MEMBRANE BIOREACTOR
- NON-POTABLE REUSE USE: TOILET FLUSHING
- PROJECT TYPES: RETAIL, EDUCATION & MANY OTHERS



NEW ENGLAND DECENTRALIZED NON-POTABLE WATER REUSE DRIVERS

- ONE/POSSIBLY TWO OF THESE SYSTEMS, OUT OF 16 WAS/WERE IMPLEMENTED FOR SUSTAINABILITY PURPOSES
- THE REST WERE DONE DUE TO NECESSITY:
 - SITE, SOIL, HYDROGEOLOGIC CONSTRAINTS ON WASTEWATER DISPERSAL
 - POTABLE WATER SUPPLY CAPACITY LIMITATIONS
 - COMBINATION OF ABOVE



CURRENT ONSITE WATER REUSE REGULATORY/ GUIDELINE LANDSCAPE IN NEW ENGLAND

State	Reuse Guidelines	Reuse Regulations	Onsite Reuse Systems
CT	No	No	Yes
RI	Yes	No	Yes
MA	No	Yes	Yes
VT	No	No	Yes
NH	No	No	No
ME	No	No	No

Onsite Water Reuse

2. WATER REUSE & THERMAL ENERGY RECOVERY CASE STUDY: BATTERY PARK CITY

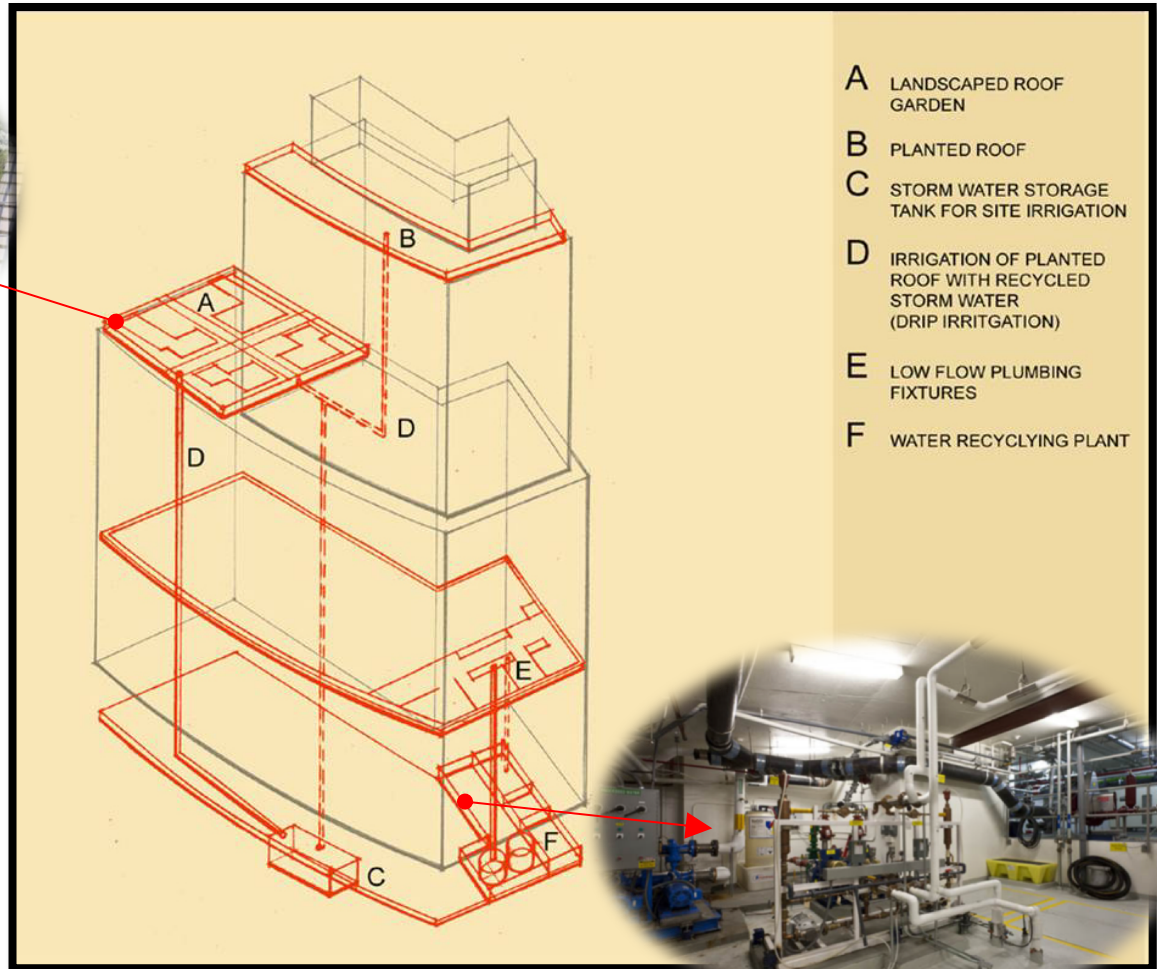
CASE STUDY: BATTERY PARK, NYC

IN BUILDING WATER REUSE & THERMAL ENERGY RECOVERY



Reuse Applications:

- Toilet Flushing
- Cooling Tower Make-Up Water
- Landscape Irrigation
- Laundry



- A LANDSCAPED ROOF GARDEN
- B PLANTED ROOF
- C STORM WATER STORAGE TANK FOR SITE IRRIGATION
- D IRRIGATION OF PLANTED ROOF WITH RECYCLED STORM WATER (DRIP IRRIGATION)
- E LOW FLOW PLUMBING FIXTURES
- F WATER RECYCLING PLANT



SYSTEM PERFORMANCE

PROVEN TECHNOLOGIES/SYSTEM OPERATIONS WITH PROVEN RESULTS

NYC Required Parameter	DOB Limit	Membrane Specs
BOD (mg/L)	<10	<2
TSS (mg/L)	<10	<2
Fecal Colliform (CFU/100mL)	<100	<10
Turbidity (NTU)	<2	<0.2
E. Coli Colony Count (#/100mL)	<2.2	N/A
pH	6.5-8.0	N/A

System Requirements

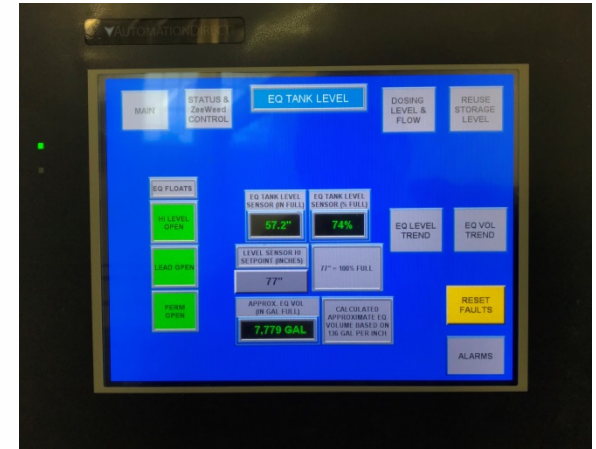
Actual Performance

Over 10 years of onsite in-building urban reuse system performance data consistently exceeding permit requirements with zero violations!

System Location	BOD, mg/l	TSS, mg/l	Turbidity NTU	Fecal Coliform #/100 ml	E. Coli #/ 100 ml
The Solaire (2003)	< 6	< 1	0.05 – 0.25	< 1	—
Millennium Tower Residences	< 6	< 1	0.15 – 0.45	< 1	—
The Visionaire	< 6	< 1	0.15 – 0.45	< 1 (Total coliform)	< 1
The Helena	< 6	< 1	0.05 -0.20	< 1	—

TECHNICAL ADVANCEMENTS IN PAST 20 YEARS

- TREATMENT PROCESS AUTOMATION
- OZONE AND ULTRAVIOLET DISINFECTION
- CONTINUOUS RECORDING SENSORS
 - TURBIDITY
 - COLOR
 - OXIDATION-REDUCTION POTENTIAL (ORP)
 - RESIDUAL OZONE
 - ULTRAVIOLET (UV) LIGHT ABSORBANCE/INTENSITY (UVA)
- SECURE REMOTE OPERATION & MONITORING



Onsite Water Reuse

3. WHAT IS THE FUTURE OF REUSE IN NEW ENGLAND?

RISK-BASED APPROACH TO PUBLIC HEALTH PROTECTION FOR NON-POTABLE WATER SYSTEMS



Final Report

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



(2017)



National Blue Ribbon Commission
for Onsite Non-potable Water Systems

A Guidebook for Developing and Implementing Regulations for Onsite Non-potable Water Systems



(2017)



RISK-BASED FRAMEWORK FOR PUBLIC HEALTH PROTECTION

- **RISK BASED APPROACH BASED ON:**

- **RISK OF EXPOSURE TO REFERENCE PATHOGENS**
- **SYSTEM COMPLEXITY**
- **MULTIPLE BARRIER DESIGN**
- **FIT FOR PURPOSE WATER**
- **LOG₁₀ REDUCTION TARGETS**
- **LOG₁₀ REDUCTION VALUES FOR UNIT PROCESSES**

- **KEY MONITORING & REPORTING CONSIDERATIONS**

- **VALIDATION**
- **MONITORING**
- **CONTROL & AUTOMATION**
- **ALARMS**
- **FIELD VERIFICATION**
- **CONTINUOUS PROCESS VERIFICATION**
- **DATA**
- **REPORTING**

EXAMPLE TREATMENT PROCESS LOG₁₀ REDUCTION CREDITS

Treatment Process	Log ₁₀ Reduction Credits (Virus/Protozoa/Pathogens)
Microfiltration or Ultrafiltration	0/4/0
Membrane Bioreactor	1.5/2/4
Reverse Osmosis	Up to 2/2/2
Ultraviolet Light Disinfection	Up to 6/6/6
Chlorine Disinfection	Up to 5/0/5
Ozone Disinfection	Up to 4/3/0

*Source: Adapted from Table 3 in A Guidebook for Developing and Implementing Regulations for Onsite Non-potable Water Systems

FUTURE OPPORTUNITIES FOR DISTRIBUTED REUSE IN NEW ENGLAND

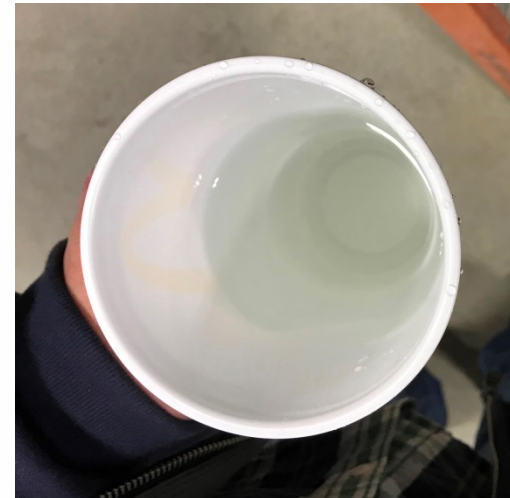
1. ONSITE WATER REUSE
2. SEWER MINING



NON-POTABLE REUSE WORKS!

Let's Work Together on
Decentralized Non-Potable
Reuse to:

- Increase Effectiveness of
Regulatory Programs
- Provide Cost-Effective
Resiliency and
Sustainability of Water
Infrastructure



NATURAL SYSTEMS UTILITIES

...A BETTER WAY



Thank you!

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Q&A

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